



PARKS CANADA AGENCY

# Technical Specifications for Kicking Horse and Monarch Campground Improvements

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Yoho National Park

**Issued For Tender**

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## **PART 1 GENERAL**

### **1.1 PRECEDENCE**

- .1 For Federal Government projects, Division 1 Sections take precedence over technical specification sections in other divisions of this specification

### **1.2 PROJECT DESCRIPTION**

- .1 Work of this Contract comprises the renovation and construction of facilities within the Kicking Horse and Monarch Campgrounds in Yoho National Park as listed below, and as detailed on the drawings and specifications:
  - .1 Monarch Campground:
    - .1 Improvements to the existing sanitary dump station.
  - .2 Kicking Horse Campgrounds:
    - .1 Removal and replacement of entry kiosk.
    - .2 Removal and replacement of washroom/shower building.
    - .3 Removal and replacement of playground structure.

### **1.3 WORK BY OTHERS**

- .1 Tree Pruning
  - .1 Parks Canada Agency will complete all required tree pruning internally.
  - .2 Contractor to advise Departmental Representative of any requirements for tree pruning.

### **1.4 CONTRACT METHOD**

- .1 Construct Work under construction management contract.
- .2 Employ qualified subcontractors for:
  - .1 Section 02 81 01 – Hazardous Materials
  - .2 Section 02 82 00.01 Asbestos Abatement
  - .3 Section 02 83 10 Lead – Base Paint Abatement
  - .4 Section 02 84 00 Polychlorinate Biphenyl Remediation
  - .5 Section 02 85 00.01 Mould Remediation

### **1.5 CONSTRUCTION SCHEDULE**

- .1 This project will be undertaken according to the following schedules:
  - .1 Commence – September 4, 2018
  - .2 Substantial Completion – June 30, 2019
- .2 The campgrounds will remain open according to the following schedule:
  - .1 Monarch: May 3 to October 8, 2018
  - .2 Kicking Horse: May 17 to October 8, 2018
- .3 No additional compensation will be provided to the Contractor for cold weather work or other weather-related delays or costs.
- .4 Within one week of contract award, the successful bidder will be required to provide a detailed project schedule to meet the above completion date for Departmental Representative's approval. When schedule has been approved by Departmental Representative, take necessary measures to complete work within scheduled time. No schedule changes will be permitted without Departmental Representative's approval.
- .5 Fire access/control shall be maintained during duration of construction.

**1.6 CONTRACTOR USE OF PREMISES**

- .1 Co-ordinate use of premises under direction of Departmental Representative.
- .2 Remove or alter existing work to prevent injury or damage to portions of existing work which remain.
- .3 Repair or replace portions of existing work which have been altered during construction operations to match existing or adjoining work, as directed by Departmental Representative.
- .4 At completion of operations condition of existing work: equal to or better than that which existed before new work started.

**1.7 NATIONAL PARK REGULATIONS**

- .1 Contractor and all sub-contractors shall ensure that all work is performed in accordance with ordinances, laws, rules and regulations set out in the National Park Act.
- .2 Contractor and all sub-contractors shall obtain business licenses from Parks Canada Administration Office prior to commencement of work.
- .3 Contractor and all sub-contractors shall comply with all laws and government regulations applicable to work under this contract.
- .4 All Contractor's and all sub-contractor's business and private vehicles are required to obtain vehicle passes from the Parks Canada Administration Office.
- .5 Contractor to equip all service vehicles and supervisory vehicles with Emergency Spill Kit DOT-E-10102 or equivalent.
- .6 Contractor is responsible to ensure all sub-contractors comply with the National Park Regulations in addition to the conditions of contract

**1.8 EXISTING SERVICES**

- .1 Carry out work at times and in a way as directed by Departmental Representative and governing authorities.
- .2 Establish location and extent of service lines in area of work before starting Work. Notify Departmental Representative of findings.
- .3 Where unknown services are encountered, immediately advise Departmental Representative and confirm findings in writing.
- .4 Protect, relocate or maintain existing active services. When inactive services are encountered, cap off in manner approved by authorities having jurisdiction.
- .5 Record locations of maintained, re-routed and abandoned service lines.
- .6 Construct barriers in accordance with Section 01 56 00- Temporary Barriers and Enclosures.

**1.9 DOCUMENTS REQUIRED**

- .1 Maintain at job site, one copy each document as follows:
  - .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 Health and Safety Plan and Other Safety Related Documents.
- .11 Other documents as specified.

**PART 2 PRODUCTS**

**2.1 NOT USED**

- .1 Not used.

**PART 3 EXECUTION**

**3.1 NOT USED**

- .1 Not used.

**END OF SECTION**



**PART 1 GENERAL**

**1.1 ACCESS AND EGRESS**

- .1 Design, construct and maintain temporary "access to" and "egress from" work areas, including stairs, runways, ramps or ladders and scaffolding, independent of finished surfaces and in accordance with relevant municipal, provincial and other regulations.

**1.2 USE OF SITE AND FACILITIES**

- .1 Execute work with least possible interference or disturbance to normal use of premises. Make arrangements with the Departmental Representative to facilitate work as stated.
- .2 Maintain existing services to building and provide for personnel and vehicle access.
- .3 Where security is reduced by work provide temporary means to maintain security.
- .4 Contractor is responsible for providing sanitary facilities, water and power.
- .5 Any damage to the Work Site caused by the contractor shall be repaired by the contractor at its expense.
- .6 Closures: protect work temporarily until permanent enclosures are completed.
- .7 The Contractor shall keep the Work Site clean and free from accumulation or waste materials and rubbish regardless of the source.

**1.3 EXISTING SERVICES**

- .1 Where Work involves breaking into or connecting to existing services, give the Departmental Representative 48 hours of notice.
- .2 Construct barriers in accordance with Section 01 56 00- Temporary Barriers and Enclosures.

**1.4 SPECIAL REQUIREMENTS**

- .1 Hours of work: 7 am to 7pm unless otherwise directed by Departmental Representative.
- .2 Ensure Contractor's personnel employed on site become familiar with and obey Parks Canada Agency regulations including safety, fire, traffic and security regulations.

**1.5 BUILDING SMOKING ENVIRONMENT**

- .1 Comply with smoking restrictions. Smoking is not permitted.

**PART 2 PRODUCTS**

**2.1 NOT USED**

- .1 Not Used.

**PART 3 EXECUTION**

**3.1 NOT USED**

- .1 Not Used.

**END OF SECTION**

## **PART 1        GENERAL**

### **1.1            REFERENCE STANDARDS**

- .1      Owner/Contractor Agreement.
- .2      Canadian Construction Documents Committee (CCDC)
  - .1      CCDC 2-1994, Stipulated Price Contract.

### **1.2            APPLICATIONS FOR PROGRESS PAYMENT**

- .1      Make applications for payment on account as monthly as Work progresses.
- .2      Date applications for payment last day of agreed monthly payment period and ensure amount claimed is for value, proportionate to amount of contract, of work performed and products delivered to place of work at that date.
- .3      Submit to Departmental Representative, at least 14 days before first application for payment, schedule of values for parts of Work, aggregating total amount of Contract Price, to facilitate evaluation of applications for payment.
- .4      Support claims for products delivered to Place of Work but not yet incorporated into Work by such evidence as Departmental Representative may reasonably require establishing value and delivery of products.

### **1.3            PREPARING SCHEDULE OF UNIT PRICE TABLE ITEMS**

- .1      Submit separate schedule of unit price items of Work requested in Bid form.
- .2      Ensure unit prices multiplied by quantities given equal material cost of that item in Schedule of Values.

### **1.4            SUBSTANTIAL PERFORMANCE OF WORK**

- .1      Prepare and submit to Departmental Representative a comprehensive list of items to be completed or corrected and apply for a review to establish Substantial Performance of Work or substantial performance of designated portion of Work when Work is substantially performed if permitted by lien legislation applicable to Place of Work designated portion which Departmental Representative agrees to accept separately is substantially performed. Failure to include items on list does not alter responsibility to complete Contract.
- .2      No later than 10 days after receipt of list and application, the Departmental Representative will review Work to verify validity of application, and no later than 7 days after completing review, will notify Contractor if Work or designated portion of Work is substantially performed.
- .3      Departmental Representative: state date of Substantial Performance of Work or designated portion of Work in certificate.
- .4      Immediately following issuance of certificate of Substantial Performance of Work, in consultation with the Departmental Representative, establish reasonable date for finishing Work.

### **1.5            PAYMENT OF HOLDBACK UPON SUBSTANTIAL PERFORMANCE OF WORK**

- .1      After issuance of certificate of Substantial Performance of Work:
  - .1      Submit application for payment of holdback amount.
  - .2      Submit sworn statement that accounts for labour, subcontracts, products, construction machinery and equipment, and other indebtedness which may have been incurred in Substantial Performance of Work and for which Owner might in be held responsible have been paid in full, except for amounts properly retained as holdback or as identified amount in dispute.

- .2 After receipt of application for payment and sworn statement, Departmental Representative will issue certificate for payment of holdback amount.
- .3 Amount authorized by certificate for payment of holdback amount is due and payable on day following expiration of holdback period stipulated in lien legislation applicable to Place of Work. Where lien legislation does not exist or apply, holdback amount is due and payable in accordance with other legislation, industry practice, or provisions which may be agreed to between parties. Owner may retain out of holdback amount sums required by law to satisfy liens against Work or, if permitted by lien legislation applicable to Place of Work, other third party monetary claims against Contractor which are enforceable against Owner.

#### **1.6 FINAL PAYMENT**

- .1 Refer to CCDC 2, GC 5.7.
- .2 Submit application for final payment when Work is completed.
- .3 Departmental Representative will, no later than 10 days after receipt of application for final payment, review Work to verify validity of application. Departmental Representative will give notification that application is valid or give reasons why it is not valid, no later than 7 days after reviewing Work.
- .4 Departmental Representative will issue final certificate for payment when application for final payment is found valid.

#### **PART 2 PRODUCTS**

##### **2.1 NOT USED**

- .1 Not Used.

#### **PART 3 EXECUTION**

##### **3.1 NOT USED**

- .1 Not Used.

**END OF SECTION**

## **PART 1 GENERAL**

### **1.1 GENERAL**

- .1 Contractor is responsible for providing third party material and laboratory testing services as required to provide the required quality control (QC).
  - .1 Requirements for quality control are specified within individual specification sections.
  - .2 Quality control and material testing is required to show conformance to the contract documents for concrete pours, sub grade and backfilling compaction, and as required and specified elsewhere in the contract documents.
- .2 Materials testing for purposes of Quality Control shall be paid through a cash allowance.
  - .1 Contractor shall submit copies of QC test reports to the Departmental Representative for review and approval of test results.
  - .2 Copies of QC test results shall be submitted with each application for progress payment.
- .3 The Departmental Representative will provide and pay for quality assurance (QA) testing.

### **1.2 APPOINTMENT AND PAYMENT**

- .1 Departmental Representative will appoint and pay for services of testing laboratory except follows:
  - .1 Inspection and testing required by laws, ordinances, rules, regulations or orders of public authorities.
  - .2 Inspection and testing required for Contractor's Quality Control.
  - .3 Testing, adjustment and balancing of conveying systems, mechanical and electrical equipment and systems.
  - .4 Mill tests and certificates of compliance.
  - .5 Tests specified to be carried out by Contractor under supervision of Departmental Representative.
- .2 Where tests or inspections by designated testing laboratory reveal Work not in accordance with contract requirements, pay costs for additional tests or inspections as required by Departmental Representative to verify acceptability of corrected work.

### **1.3 CONTRACTOR'S RESPONSIBILITIES**

- .1 Provide labour, equipment and facilities to:
  - .1 Provide access to Work for inspection and testing.
  - .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 48 hours minimum 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**

**2.1            NOT USED**

.1        Not Used.

**PART 3        EXECUTION**

**3.1            NOT USED**

.1        Not Used.

**END OF SECTION**

## **PART 1        GENERAL**

### **1.1            ADMINISTRATIVE**

- .1      Departmental Representative will administer the Pre-Construction Meeting.
- .2      Departmental Representative will give advance notice of meeting dates, times, and location to affected parties.
- .3      Ensure that all meetings are attended by at least the Contractor's Superintendent, the Contractor's Project Manager and senior representatives of major Sub-Contractors, if requested by Departmental Representative.
- .4      Ensure representatives of the Contractor, Sub-Contractor and Suppliers or Manufacturers attending the meetings are qualified and authorized to act on behalf of the party each represents.
- .5      Departmental Representative will chair the meetings and record discussions and decisions, and circulate the minutes. The Contractor is to circulate the minutes to Sub-Contractors, Suppliers and Manufacturers as required.
- .6      Notify Departmental Representative in writing of any discrepancies or inconsistencies within two (2) days of receipt of minutes for recording in the next meeting. Failure to notify Departmental Representative of discrepancies or inconsistencies within two (2) days of receipt of minutes will be deemed acceptance of the minutes as recorded.

### **1.2            PRECONSTRUCTION MEETING**

- .1      Within 7 days after award of Contract, Departmental Representative will schedule a meeting of parties in contract to discuss and resolve administrative procedures and responsibilities.
- .2      Departmental Representative, the Consultant, the Contractor's Superintendent, the Contractor's Project Manager, and senior representatives of major Subcontractors involved in the work, will be in attendance.
- .3      Agenda to include:
  - .1      Appointment of official representative of participants in the Work (Contractor's Superintendent, Contractor's Project Manager, Contractor's Safety Professional, Contractor's Scheduler and Quantity Surveyor, Contractor's Foreman, and Departmental Representative).
  - .2      Responsibilities of the Contractor and Departmental Representative.
  - .3      Site safety, site restrictions and hours of operation.
  - .4      Occupational health and safety relationships and responsibilities. Submittal of Site Safety Manual and implementation of Site orientation program.
  - .5      Schedule of Work and progress scheduling.
  - .6      Schedule of submission of shop drawings, samples, colour chips. Submit submittals in accordance with Section 01 33 00- Submittal Procedures.
  - .7      Delivery schedule of major and key equipment.
  - .8      Site security in accordance with Section 01 56 00- Temporary Barriers and Enclosures and arrangements for Departmental Representative access to the Site.
  - .9      Document Management Procedures (method of tracking and filing requests for information (RFIs), Change Orders, etc., procedures used for logging record drawing information, and other document related issues).
  - .10     Submittal procedures
  - .11     Change Order procedures
  - .12     Owner provided products.

- .13 Record drawings.
- .14 Maintenance manuals in accordance with Section 01 78 00- Closeout Submittals.
- .15 Take-over procedures, acceptance, warranties in accordance with Section 01 78 00- Closeout Submittals.
- .16 Monthly progress claims, administrative procedures, photographs, hold backs, protocols for communication, reporting, and inspection.
- .17 Appointment of inspection and testing agencies or firms.
- .18 Insurances, transcript of policies.
- .19 Ambiguities or questions of interpretation identified in the Contract Documents

### **1.3 PROGRESS MEETINGS**

- .1 The Departmental Representative, Contractor's Superintendent, Contractor's Project Manager and senior representatives of major Sub-Contractors involved in the Work to be in attendance.
- .2 The Progress Meetings are to be held at intervals of approximately two weeks, or more frequently if so decided by Departmental Representative.
- .3 Agenda to include the following:
  - .1 Review, approval of minutes of previous meeting.
  - .2 Review of Work progress since previous meeting.
  - .3 Occupational health and safety incidents, records and procedures.
  - .4 Field observations, problems, conflicts.
  - .5 Schedule
  - .6 Document Management Issues.
  - .7 Submittal status.
  - .8 Requests for information.
  - .9 Proposed Contract modifications.
  - .10 Change Order status.
  - .11 Site coordination.
  - .12 Quality control.
  - .13 Site cleanliness.
  - .14 Erosion and Sedimentation Control Measures.
  - .15 Construction Site Solid Waste Management Program.
  - .16 Other action items.
- .4 Submit for information only, in accordance with Section 01 33 00 Submittal Procedures, at each regularly scheduled progress meeting:
  - .1 Totals of all personnel currently on Site associated with the Contract, broken down by trade and Sub-Contractor including all staff.
  - .2 Totals of all major equipment currently on Site, over a two thousand dollar replacement value, broken down by type and Sub-Contractor.

### **1.4 SITE ADMINISTRATION / CONTRACT COORDINATION MEETINGS**

- .1 At monthly intervals, or more frequently as required, Departmental Representative will call a Site Administration / Contract Coordination Meeting. The purpose of this meeting will be to discuss and resolve issues relating to the interactions among the various ongoing works.
- .2 The Departmental Representative, Contractor's Superintendent and Contractor's Project Manager to be in attendance.

- .3 Agenda will include issues related to site administration or construction contract coordination.

## **1.5 SPECIAL MEETINGS**

- .1 Special meetings may be held at the request of Departmental Representative or the Contractor to discuss specific items. Arrange for attendance by parties requested by Departmental Representative.

## **PART 2 PRODUCTS**

### **2.1 NOT USED**

- .1 Not Used.

## **PART 3 EXECUTION**

### **3.1 NOT USED**

- .1 Not Used.

**END OF SECTION**



## **PART 1 GENERAL**

### **1.1 ADMINISTRATIVE**

- .1 Submit to the Departmental Representative submittals listed for review. Submit promptly and in orderly sequence to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension by reason of such default will be allowed.
- .2 Do not proceed with Work affected by submittal until review is complete.
- .3 Present shop drawings, product data, samples and mock-ups in SI Metric units.
- .4 Where items or information is not produced in SI Metric units converted values are acceptable.
- .5 Review submittals prior to submission to the Consultant. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and co-ordinated with requirements of Work and Contract Documents. Submittals not stamped, signed, dated and identified as to specific project will be returned without being examined and considered rejected.
- .6 Notify the Departmental Representative, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.
- .7 Verify field measurements and affected adjacent Work are co-ordinated.
- .8 Contractor's responsibility for errors and omissions in submission is not relieved by the Consultant's review of submittals.
- .9 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by the Consultant's review.
- .10 Keep one reviewed copy of each submission on site.

### **1.2 SHOP DRAWINGS AND PRODUCT DATA**

- .1 Refer to CCDC 2 GC 3.11.
- .2 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.
- .3 Submit drawings stamped and signed by a Professional Engineer registered or licensed in the province of British Columbia, Canada.
- .4 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 co-ordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.
- .5 Allow 7 days for the Departmental Representative's review of each submission.
- .6 Adjustments made on shop drawings by the Departmental Representative are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to the Departmental Representative prior to proceeding with Work.
- .7 Make changes in shop drawings as the Departmental Representative may require, consistent with Contract Documents. When resubmitting, notify the Departmental Representative in writing of revisions other than those requested.
- .8 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.
- .9 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.
- .10 After the Departmental Representative's review, distribute copies.
- .11 Submit PDF copies of shop drawings for each requirement requested in specification Sections and as the Departmental Representative may reasonably request.
- .12 Submit PDF copies of product data sheets or brochures for requirements requested in specification Sections and as requested by the Departmental Representative where shop drawings will not be prepared due to standardized manufacture of product.
- .13 Submit PDF copies of certificates for requirements requested in specification Sections and as requested by the 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.
- .14 Submit PDF copies of manufacturers' instructions for requirements requested in specification Sections and as requested by the Consultant and 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.
- .15 Submit PDF copies of Manufacturer's Field Reports for requirements requested in specification Sections and as requested by the Departmental Representative.
- .16 Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.

- .17 Submit PDF copies of Operation and Maintenance Data for requirements requested in specification Sections and as requested by the Departmental Representative.
- .18 Delete information not applicable to project.
- .19 Supplement standard information to provide details applicable to project.
- .20 If upon review by the Departmental Representative, no errors or omissions are discovered or if only minor corrections are made, 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.
- .21 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.

### **1.3 SAMPLES**

- .1 Submit for review samples in duplicate as requested in respective specification Sections. Label samples with origin and intended use.
- .2 Deliver samples prepaid to Departmental Representative's site office.
- .3 Notify Departmental Representative in writing, at time of submission of deviations in samples from requirements of Contract Documents.
- .4 Where colour, pattern or texture is criterion, submit full range of samples.
- .5 Adjustments made on samples by Departmental Representative are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Departmental Representative prior to proceeding with Work.
- .6 Make changes in samples which Departmental Representative may require, consistent with Contract Documents.
- .7 Reviewed and accepted samples will become standard of workmanship and material against which installed Work will be verified.

### **1.4 MOCK-UPS**

- .1 Erect mock-ups in accordance with 01 45 00- Quality Control.

### **1.5 PHOTOGRAPHIC DOCUMENTATION**

- .1 Submit electronic copy of colour digital photography in jpg standard resolution or PDF format.
- .2 Project identification: name and number of project and date of exposure indicated.
- .3 Take photographs of site conditions before, during, and after construction. Take photographs of any unique or unusual items.
- .4 Photographs to be submitted on USB Drive. All photographs to be labelled with meaningful titles.

**1.6 CERTIFICATES AND TRANSCRIPTS**

- .1 Immediately after award of Contract, submit Workers' Compensation Board status.
- .2 Submit transcription of insurance immediately after award of Contract.

**PART 2 PRODUCTS**

**2.1 NOT USED**

- .1 Not Used.

**PART 3 EXECUTION**

**3.1 NOT USED**

- .1 Not Used.

**END OF SECTION**

## **PART 1 GENERAL**

### **1.1 REFERENCE STANDARDS**

- .1 Canada Labour Code, Part 2, Canada Occupational Safety and Health Regulations
- .2 Province of British Columbia
  - .1 Workers Compensation Act, RSBC 1996 - Updated 2012.

### **1.2 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00- Submittal Procedures.
- .2 Submit site-specific Health and Safety Plan: Within 7 days after date of Notice to Proceed and prior to commencement of Work. Health and Safety Plan must include:
  - .1 Results of site specific safety hazard assessment.
  - .2 Results of safety and health risk or hazard analysis for site tasks and operation.
- .3 Submit 1 copy of Contractor's authorized representative's work site health and safety inspection reports to Departmental Representative weekly, including minutes of safety toolbox meetings.
- .4 Submit copies of reports or directions issued by Federal, Provincial and Territorial health and safety inspectors.
- .5 Submit copies of incident and accident reports.
- .6 Submit WHMIS MSDS - Material Safety Data Sheets.
- .7 Departmental Representative will review Contractor's site-specific Health and Safety Plan and provide comments to Contractor within 3 days after receipt of plan. Revise plan as appropriate and resubmit plan to Departmental Representative within 3 days after receipt of comments from Departmental Representative.
- .8 Departmental Representative's review of Contractor's final Health and Safety plan should not be construed as approval and does not reduce the Contractor's overall responsibility for construction Health and Safety.
- .9 Medical Surveillance: where prescribed by legislation, regulation or safety program, submit certification of medical surveillance for site personnel prior to commencement of Work, and submit additional certifications for any new site personnel to Departmental Representative.
- .10 On-site Contingency and Emergency Response Plan: address standard operating procedures to be implemented during emergency situations.
- .11 Emergencies: In the event of emergency call 911
  - .1 All other inquiries call Departmental Representative or Parks Canada Dispatch at 403-762-1470.
  - .2 All predator sightings to be reported to Departmental Representative or Parks Canada Dispatch.

### **1.3 FILING OF NOTICE**

- .1 File Notice of Project with Provincial authorities prior to beginning of Work.

### **1.4 SAFETY ASSESSMENT**

- .1 Perform site specific safety hazard assessment related to project.

### **1.5 MEETINGS**

- .1 Schedule and administer Health and Safety meeting with Departmental Representative prior to commencement of Work.

## **1.6 REGULATORY REQUIREMENTS**

- .1 Do Work in accordance with Section 01 41 00- Regulatory Requirements.

## **1.7 PROJECT/SITE CONDITIONS**

- .1 Work at site will involve contact with:
  - .1 Asbestos, Lead Paint and Mould. Refer to the Hazardous Materials Assessment Report in Appendix B.

## **1.8 GENERAL REQUIREMENTS**

- .1 Develop written site-specific Health and Safety Plan based on hazard assessment prior to beginning site Work and continue to implement, maintain, and enforce plan until final demobilization from site. Health and Safety Plan must address project specifications.
- .2 Departmental Representative may respond in writing, where deficiencies or concerns are noted and may request re-submission with correction of deficiencies or concerns.

## **1.9 RESPONSIBILITY**

- .1 Be responsible for health and safety of persons on site, safety of property on site and for protection of persons adjacent to site and environment to extent that they may be affected by conduct of Work.
- .2 Contractor will be responsible and assume the role Constructor as described in the Ontario Occupational Health and Safety Act and Regulations for Construction Projects.
- .3 Comply with and enforce compliance by employees with safety requirements of Contract Documents, applicable federal, provincial, territorial and local statutes, regulations, and ordinances, and with site-specific Health and Safety Plan.

## **1.10 COMPLIANCE REQUIREMENTS**

- .1 Comply with Workers Compensation Act, B.C. Reg. RSBC 1996.
- .2 Comply with Occupational Health and Safety Regulations, 1996.
- .3 Comply with Occupational Health and Safety Act, General Safety Regulations, O.I.C.
- .4 Comply with Canada Labour Code, Canada Occupational Safety and Health Regulations.

## **1.11 UNFORSEEN HAZARDS**

- .1 When unforeseen or peculiar safety-related factor, hazard, or condition occur during performance of Work, follow procedures in place for Employee's Right to Refuse Work in accordance with Acts and Regulations of the Province having jurisdiction and advise Departmental Representative verbally and in writing.
- .2 When unforeseen or peculiar safety-related factor, hazard, or condition occur during performance of Work, advise Departmental Representative and follow procedures in accordance with Acts and Regulations of the Province having jurisdiction.

## **1.12 POSTING OF DOCUMENTS**

- .1 Ensure applicable items, articles, notices and orders are posted in conspicuous location on site in accordance with Acts and Regulations of Province having jurisdiction, and in consultation with Departmental Representative.

## **1.13 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 may stop Work if non-compliance of health and safety regulations is not corrected.

**1.14 BLASTING**

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

**1.15 POWDER ACTUATED DEVICES**

- .1 Use powder actuated devices only after receipt of written permission from Departmental Representative.

**1.16 WORK STOPPAGE**

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

**PART 2 PRODUCTS**

**2.1 NOT USED**

- .1 Not used.

**PART 3 EXECUTION**

**3.1 NOT USED**

- .1 Not used.

**END OF SECTION**

## **PART 1 GENERAL**

### **1.1 NATIONAL PARKS ACT**

- .1 Perform work in accordance with the ordinances and laws set out in the National Parks Act and Regulations.

### **1.2 CANADIAN ENVIRONMENTAL ASSESSMENT ACT**

- .1 Execution of work is subject to provisions within the Canadian Environmental Assessment Act, 2012.
- .2 Failure to comply with or observe environmental protection measures, as identified in these specifications, may result in work being suspended pending rectification of problem(s).

### **1.3 REFERENCE STANDARDS**

- .1 Canadian Construction Documents Committee (CCDC)
  - .1 CCDC 2-2008 Stipulated Price Contract.

### **1.4 DEFINITIONS**

- .1 Environmental Pollution and Damage: presence of chemical, physical, biological elements or agents which adversely affect human health and welfare; unfavourably alter ecological balances of importance to human life; affect other species of importance to humans; or degrade environment aesthetically, culturally and/or historically.
- .2 Environmental Protection: prevention/control of pollution and habitat or environment disruption during construction.

### **1.5 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 as specified.
  - .2 Submit copies of WHMIS MSDS.
- .3 Before commencing construction activities or delivery of materials to site, submit Environmental Protection Plan for review and approval by Departmental Representative.
- .4 Environmental Protection Plan must include comprehensive overview of known or potential environmental issues to be addressed during construction.
- .5 Address topics at level of detail commensurate with environmental issue and required construction task[s].
- .6 Include in Environmental Protection Plan:
  - .1 Name[s] of person[s] responsible for ensuring adherence to Environmental Protection Plan.
  - .2 Name[s] and qualifications of person[s] responsible for manifesting hazardous waste to be removed from site.
  - .3 Name[s] and qualifications of person[s] responsible for training site personnel.
  - .4 Descriptions of environmental protection personnel training program.
  - .5 Erosion and sediment control plan identifying 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.



- .6 Drawings indicating 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 Work area plan showing proposed activity in each portion of area and identifying areas of limited use or non-use.
  - .1 Plan to include measures for marking limits of use areas and methods for protection of features to be preserved within authorized work areas.
- .8 Spill Control Plan to include procedures, instructions, and reports to be used in event of unforeseen spill of regulated substance.
- .9 Non-Hazardous solid waste disposal plan identifying methods and locations for solid waste disposal including clearing debris.
- .10 Air pollution control plan detailing provisions to assure that dust, debris, materials, and trash, are contained on project site.
- .11 Contaminant Prevention Plan identifying potentially hazardous substances to be used on job site; intended actions to prevent introduction of such materials into air, water, or ground; and detailing provisions for compliance with Federal, Provincial, and Municipal laws and regulations for storage and handling of these materials.
- .12 Waste Water Management Plan identifying methods and procedures for management 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.
- .13 Historical, archaeological, cultural resources biological resources and wetlands plan that defines procedures for identifying and protecting historical, archaeological, cultural resources, biological resources and wetlands.
- .14 Pesticide treatment plan to be included and updated, as required.

#### **1.6 MIGRATORY BIRDS ACT**

- .1 Avoid any construction activities which affect nesting birds.

#### **1.7 RELICS AND ANTIQUITIES**

- .1 Give immediate notice to Departmental Representative if evidence archaeological finds are encountered during construction, and await Departmental Representative's written instructions before proceeding with work in this area.
- .2 Relics, antiquities, items of historical or scientific interest such as cornerstones and contents, commemorative plaques, inscribed tablets, and similar objects found on site shall remain PCA's property. Protect such articles and request directives from Departmental Representative.
- .3 Provide 48 hours' notice to Departmental Representative prior to commencing any work that may interfere with or affect an identified historical or archaeological site. Commence work only upon written instructions from Departmental Representative.

#### **1.8 WILDLIFE**

- .1 Avoid or terminate activities on site that attract or harass wildlife.
- .2 Immediately notify Departmental Representative who will notify Parks Canada Environmental Surveillance Officer of any predator sightings. Bears, wolves, cougars activity or encounters on or around site. Other wildlife encounters should be reported within 24 hours.

## **1.9 FIRES**

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

## **1.10 DISPOSAL OF WASTE**

- .1 All garbage must be stored and handled in conformance with National Parks Garbage Regulations.
- .2 All domestic garbage should be stored over the short term in wildlife-proof dumpsters. Domestic recycling should be put in appropriate facilities. Contaminated materials are to be taken out of the Park.
- .3 Do not bury rubbish and waste materials on site.
- .4 Maintain the site in a tidy condition, free of waste material, debris and litter.
- .5 All waste must be removed from the Park within a reasonable time as directed by Departmental Representative

## **1.11 DRAINAGE**

- .1 Develop and submit erosion and Sediment Control Plan (ESC) identifying type and location of erosion and sediment controls provided. Plan to include 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.
- .2 Provide temporary drainage and pumping required to keep excavations and site free from water.
- .3 Dewatering of a construction site will require a special permit.
- .4 Do not pump water containing suspended materials into waterways, sewer or drainage systems.
- .1 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with Parks Canada requirements and in conformance with the Environmental Contaminants Act and applicable provincial regulations while observing the Code of Good Practice for Management of Hazardous and Toxic Wastes at Federal Establishments.

## **1.12 SITE CLEARING AND PLANT PROTECTION**

- .1 Protect trees and plants on site and adjacent properties.
  - .1 Locations of all trees existing on site to be surveyed prior to construction and final decisions on tree removal to be made on a case-by-case basis in the field by Departmental Representative.
  - .2 Trees identified as existing-to-remain within or adjacent to the limit of Work require a Tree Protection Zone (TPZ) during construction by means of a protective barrier or fencing by the contractor. Fencing may be standard chain-link construction fence 1830 mm (6') minimum height or equivalent to approval of Departmental Representative.
  - .3 Approval of TPZs by PCA is required prior to commencing work.
  - .4 Activities which are likely to injure or destroy the tree are not permitted within the TPZ including
    - .1 Parking of vehicles or machinery
    - .2 Travel or operation of vehicles or machinery
    - .3 Storage of equipment, materials, or stockpiles
  - .5 The Contractor is responsible for damages to trees or shrubs identified as existing-to-remain within the limits of Work. Damages may include the cost of repair, removal, and replacement (at the rate of three trees per tree removed) as

determined by assessment of damages by PCA. Species and installation locations for replacement trees to be approved by Departmental Representative.

- .2 Protect trees and shrubs adjacent to construction work, storage areas and trucking lanes, and encase with protective wood framework from grade level to height of 2 m minimum.
- .3 Protect roots of designated trees to dripline during excavation and site grading to prevent disturbance or damage.
  - .1 Avoid unnecessary traffic, dumping and storage of materials over root zones.
- .4 Minimize stripping of topsoil and vegetation.
- .5 Permits are required from Parks Canada Environmental Surveillance Officer if a tree is to be removed. Contact Departmental Representative and Parks Canada Environmental Surveillance Officer at (403) 762-1416.

#### **1.13 WORK ADJACENT TO WATERWAYS**

- .1 Construction equipment to be operated on land only.
- .2 Waterways to be kept free of excavated fill, waste material and debris.
- .3 Design and construct temporary crossings to minimize erosion to waterways.
- .4 Do not skid logs or construction materials across waterways.

#### **1.14 CONTRACTOR'S OPERATIONS**

- .1 Confine all operations to work limits as staked or designated by Departmental Representative. No activities of any kind may be carried out beyond those work limits without Departmental Representative's written permission.
- .2 Do not store or stockpile construction materials in trees bordering, or being preserved on site. Do not unreasonably encumber site with products.
- .3 Equipment maintenance shall only be carried out in designated areas or as approved by Departmental Representative and Parks Canada Environmental Surveillance Officer.
- .4 Used oil, filter and grease cartridges, lubrication containers and other products of equipment maintenance shall be collected and disposed of at nearest industrial waste facility.
- .5 Leave machinery running only while in use, except where extreme temperatures prohibit shutting machinery down.
- .6 Provide sufficient sanitary facilities and maintain in a clean condition.
- .7 Obtain permit from Parks Canada Environmental Surveillance Officer for storage of fuel or other inflammable liquids. Observe all restrictions and conditions imposed by permit regarding special protection and berming to control spills and tank damage; fire protection considerations; provisions for disposal of fouled material and used petroleum products
- .8 Refuelling. No refuelling is allowed within the project area.
- .9 All tree removal will be following Migratory Birds Act
- .10 Contractor will avoid any Ground Squirrels.
- .11 Conduct operations at all times in such a manner as to preserve natural features and vegetation in area. Cut and fill slopes shall be blended with adjoining topography. Material from fill slopes will not be permitted to slough or roll into surrounding tree cover or to bury any plant material designated to be retained.
- .12 When, in opinion of Departmental Representative, negligence on part of Contractor results in damage or destruction of vegetation, or other environmental or aesthetic features beyond staked or designated work areas, Contractor shall be responsible, at his expense, for complete restoration of trees including replacement of trees, shrubs, topsoil, grass, etc. to Departmental Representative's satisfaction.

- .13 As no non-native vegetation is allowed in Park, all construction equipment shall be thoroughly washed before entering Yoho National Park.

#### **1.15 CONTRACTOR'S EMPLOYEE BRIEFING**

- .1 Conduct briefing sessions for all employees and sub-contractor employees highlighting requirements of this section, including operation of equipment strictly.
- .2 Pre-construction meeting with Contractor and Departmental Representative will occur prior to construction commencing.
- .3 Contract documents have been developed in accordance with Canadian Environmental Assessment Act screening requirements. Construction methods which are directly affected by CEAA screening will be reviewed at initial site meeting. Contractor will be expected to comply with and ensure construction practices meet the CEAA Standards. Failure to comply may lead to cessation of work.

#### **1.16 COMPLIANCE WITH PARKS CANADA DEVELOPMENT PERMIT**

- .1 Read, understand and comply with Parks Canada Building Permit and all stipulations provided therein.

#### **1.17 NOTIFICATION**

- .1 Departmental Representative will notify the Contractor in writing of observed noncompliance with Federal, Provincial or Municipal environmental laws or regulations, permits, and other elements of Contractor's Environmental Protection plan.
- .2 Contractor: after receipt of such notice, inform Departmental Representative of proposed corrective action and take such action for approval by Departmental Representative.
  - .1 Take action only after receipt of written approval by Departmental Representative.
- .3 Departmental Representative will issue stop order of work until satisfactory corrective action has been taken.
- .4 No time extensions granted or equitable adjustments allowed to Contractor for such suspensions.

### **PART 2 PRODUCTS**

#### **2.1 NOT USED**

- .1 Not Used.

### **PART 3 EXECUTION**

#### **3.1 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11- Cleaning.
  - .1 Leave Work area clean at end of each day.
- .2 Ensure public waterways, storm and sanitary sewers remain free of waste and volatile materials disposal.
- .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 recycling or reuse in accordance with Section 01 74 21- Construction/Demolition Waste Management and Disposal and drawings.

- .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

### **3.2 CONCRETE MANAGEMENT**

- .1 Where concrete work is to take place, the EPP must include the following concrete management elements:
  - .1 Concrete mixer truck washout must be contained in an approved facility with wash products.

**END OF SECTION**

**PART 1 GENERAL**

**1.1 REFERENCES AND CODES**

- .1 Perform Work in accordance with National Building Code of Canada (NBC) including amendments up to tender closing date and other codes of provincial or local application provided that in case of conflict or discrepancy, more stringent requirements apply.
- .2 Meet or exceed requirements of:
  - .1 Contract documents.
  - .2 Specified standards, codes and referenced documents.

**1.2 WHMIS**

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

**1.3 NATIONAL PARKS ACT**

- .1 Perform Work in accordance with National Parks Act when projects are located within boundaries of National Park.

**1.4 MIGRATORY BIRDS CONVENTION ACT**

- .1 If tree removal is required, perform in accordance with Migratory Birds Convention Act.

**1.5 PERMITTING**

- .1 All permitting is the responsibility of Parks Canada, including electrical permitting.

**PART 2 PRODUCTS**

**2.1 NOT USED**

- .1 Not Used.

**PART 3 EXECUTION**

**3.1 NOT USED**

- .1 Not Used.

**END OF SECTION**

## **PART 1 GENERAL**

### **1.1 REFERENCE STANDARDS**

- .1 Canadian Construction Documents Committee (CCDC)
  - .1 CCDC 2-94, Stipulated Price Contract.

### **1.2 CONTRACTOR'S RESPONSIBILITIES**

- .1 The Contractor is totally responsible for quality of Material and Product which he provides for the Work.
- .2 The Contractor is responsible for quality control testing and shall perform such inspections and tests as are necessary to ensure that the Work conforms to the requirements of the Contract Documents.
- .3 During the progress of the Work, a sufficient number of tests shall be performed by the Contractor to determine that Material, Product and installation meet the specifications and standards requirements.
- .4 Minimum requirements regarding quality control are specified in various sections of the specifications, however, the Contractor shall perform as many inspections and tests as are necessary to ensure that the Work conforms to the requirements of the Contract Documents.
- .5 Testing shall be in accordance with pertinent codes and regulations and with selected standards of the American Society for Testing Materials (ASTM) and Canadian Standards Association (CSA).
- .6 Product testing, mill test and laboratory reports to demonstrate that Product and Material supplied by the Contractor meet the specifications are specified under various sections of the Contract Documents.

### **1.3 QUALITY CONTROL TESTING BY THE CONTRACTOR**

- .1 The Contractor shall retain the services of a licenced independent testing agency under supervision of a registered professional Engineer, and pay for the cost of testing services for quality control including, but not limited to, the following:
  - .1 Sieve analysis of sands and aggregates to be supplied to the Work.
  - .2 Concrete Testing
  - .3 Asphalt Testing
  - .4 Backfill, subgrade, base course and asphalt concrete paving
  - .5 Any product testing that is required and is specified under various sections of the specifications
- .2 The Contractor shall promptly process and distribute all required copies of test reports and test information and related instructions to all of his Subcontractors and Suppliers to ensure that all necessary retesting and replacement of construction can proceed without delay.

### **1.4 INSPECTION**

- .1 Allow Departmental Representative access to Work. If part of Work is in preparation at locations other than Place of Work, allow access to such Work whenever it is in progress.
- .2 Give written notice minimum one week in advance of operations requesting inspection if Work is designated for special tests, inspections or approvals by Departmental Representative instructions, or law of Place of Work.
- .3 If Contractor covers or permits to be covered Work that has been designated for special tests, inspections or approvals before such is made, uncover such Work, have inspections or tests satisfactorily completed and make good such Work.

- .4 Departmental Representative will order part of Work to be examined if Work is suspected to be not in accordance with Contract Documents. If, upon examination such work is found not in accordance with Contract Documents, correct such Work and pay cost of examination and correction. If such Work is found in accordance with Contract Documents, Departmental Representative shall pay cost of examination and replacement.

## **1.5 ACCESS TO WORK**

- .1 Allow inspection/testing agencies access to Work, off site manufacturing and fabrication plants.
- .2 Co-operate to provide reasonable facilities for such access.

## **1.6 PROCEDURES**

- .1 Notify Departmental Representative in advance of requirement for tests, in order that attendance arrangements can be made.
- .2 Submit samples and/or materials required for testing, as specifically requested in specifications. Submit with reasonable promptness and in orderly sequence to not cause delays in Work.
- .3 Provide labour and facilities to obtain and handle samples and materials on site. Provide sufficient space to store and cure test samples.

## **1.7 REJECTED WORK**

- .1 Remove defective Work, whether result of poor workmanship, use of defective products or damage and whether incorporated in Work or not, which has been rejected by Departmental Representative as failing to conform to Contract Documents. Replace or re-execute in accordance with Contract Documents.
- .2 Make good other Contractor's work damaged by such removals or replacements promptly.
- .3 If in opinion of Departmental Representative it is not expedient to correct defective Work or Work not performed in accordance with Contract Documents, Owner will deduct from Contract Price difference in value between Work performed and that called for by Contract Documents, amount of which will be determined by Departmental Representative.

## **1.8 REPORTS**

- .1 Submit 1 copy of inspection and test reports to Departmental Representative.

## **1.9 TESTS AND MIX DESIGNS**

- .1 Furnish test results and mix designs as requested.
- .2 Cost of tests and mix designs beyond those called for in Contract Documents or beyond those required by law of Place of Work will be appraised by Departmental Representative and may be authorized as recoverable.

## **1.10 MOCK-UPS**

- .1 Prepare mock-ups for Work specifically requested in specifications. Include for Work of Sections required to provide mock-ups.
- .2 Prepare mock-ups for Departmental Representative's review with reasonable promptness and in orderly sequence, to not cause delays in Work.
- .3 Failure to prepare mock-ups in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension by reason of such default will be allowed.



- .4 If requested, Departmental Representative will assist in preparing schedule fixing dates for preparation.
- .5 Remove mock-up at conclusion of Work or when acceptable to Departmental Representative.
- .6 Mock-ups may remain as part of Work.
- .7 Specification section identifies whether mock-up may remain as part of Work or if it is to be removed and when.

**1.11 MILL TESTS**

- .1 Submit mill test certificates as required by specification Sections.

**1.12 EQUIPMENT AND SYSTEMS**

- .1 Submit adjustment and balancing reports for mechanical, electrical systems.

**PART 2 PRODUCTS**

**2.1 NOT USED**

- .1 Not Used.

**PART 3 EXECUTION**

**3.1 NOT USED**

- .1 Not Used.

**END OF SECTION**

## **PART 1 GENERAL**

### **1.1 REFERENCE STANDARDS**

- .1 Canadian General Standards Board (CGSB)
  - .1 CGSB 1.59-97, Alkyd Exterior Gloss Enamel.
  - .2 CAN/CGSB 1.189-00, Exterior Alkyd Primer for Wood.
- .2 Canadian Standards Association (CSA International)
  - .1 CSA-O121-M1978(R2003), Douglas Fir Plywood.
- .3 Public Works Government Services Canada (PSPC) Standard Acquisition Clauses and Conditions (SACC)-ID: R0202D, Title: General Conditions 'C', In Effect as Of: May 14, 2004.
- .4 Canadian Standards Association (CSA International)
  - .1 CSA-A23.1-04/A23.2-04, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
  - .2 CAN/CSA-S269.3 (R2003), Concrete Formwork, National Standard of Canada

### **1.2 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit shop drawings for formwork and falsework.
  - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of British Columbia, Canada.
- .3 Indicate method and schedule of construction, shoring, stripping and re-shoring procedures, materials, arrangement of joints, ties, liners, and locations of temporary embedded parts. Comply with CAN/CSA-S269.3 for formwork drawings.

### **1.3 INSTALLATION AND REMOVAL**

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

### **1.4 HOARDING**

- .1 Erect temporary site enclosure using new 1.2 m high snow fence wired to rolled steel "T" bar fence posts spaced at 2.4 m on centre. Maintain fence in good repair.
- .2 Provide barriers around trees and plants designated to remain. Protect from damage by equipment and construction procedures.

### **1.5 GUARD RAILS AND BARRICADES**

- .1 Provide secure, rigid guard rails and barricades around deep excavations, open shafts, open stair wells, open edges of floors and roofs, and in other areas as required.
- .2 Provide as required by governing authorities.

### **1.6 WEATHER ENCLOSURES**

- .1 Provide weather tight closures to unfinished door and window openings, tops of shafts and other openings in floors and roofs.
- .2 Close off floor areas where walls are not finished; seal off other openings; enclose building interior work for temporary heat.
- .3 Design enclosures to withstand wind pressure and snow loading.

## **1.7 ACCESS TO SITE**

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

## **1.8 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 public.

## **1.9 FIRE ROUTES**

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

## **1.10 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.

## **1.11 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.

## **1.12 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate waste materials for reuse in accordance with Section 01 74 21- Construction/Demolition Waste Management And Disposal.

# **PART 2 PRODUCTS**

## **2.1 MATERIALS**

- .1 Formwork materials:
  - .1 For concrete without special architectural features, use wood and wood product formwork materials to CSA-O121 CAN/CSA-O86 CSA O437 Series CSA-O153.
- .2 Form ties:
  - .1 For concrete not designated 'Architectural', use removable or snap-off metal ties, fixed or adjustable length, free of devices leaving holes larger than 25 mm diameter in concrete surface.
- .3 Forms for Exposed Surfaces:
  - .1 Use 18 mm coated Formply consisting of Douglas Fir substrate with resin-impregnated paper overlay and factory treated chemically active release agent.
  - .2 Use full sized sheets as practical.
  - .3 Obtain approval of Departmental Representative prior to the reuse of any form.
  - .4 Support pours less than 1.5 m height at 300 mm maximum on centres.
  - .5 Support pours greater than 1.5 m height at 200 mm maximum on centre.

- .6 Use strong-backs or walers placed perpendicular to supports to ensure straightness of form.
- .7 Construct metal bolts or anchorages within the form so as to allow their removal to a depth of at least 20 mm from the concrete surface.
- .8 Remove plastic sleeves for a distance of 100 mm from the face of the concrete and fill cavity with a non-shrink grout approved by the Departmental Representative to 75 mm from the surface. Fill remaining 75 mm with approved concrete patching material.
- .4 Forms for unexposed surfaces:
  - .1 Use 15 mm plywood supported at 400 mm maximum on centre

### **PART 3 EXECUTION**

#### **3.1 NOT USED**

- .1 Not Used.

**END OF SECTION**

## **PART 1 GENERAL**

### **1.1 REFERENCE STANDARDS**

- .1 Canadian Construction Documents Committee (CCDC)
  - .1 CCDC 2-94, Stipulated Price Contract.
- .2 Within text of each specifications section, reference may be made to reference standards. Conform to these reference standards, in whole or in part as specifically requested in specifications.
- .3 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.
- .4 Cost for such testing will be born 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. Slope to shed moisture.
- .7 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.
- .8 Remove and replace damaged products at own expense and to satisfaction of Departmental Representative.
- .9 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 TRANSPORTATION**

- .1 Pay costs of transportation of products required in performance of Work.

## **1.6 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.

## **1.7 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.

## **1.8 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.

## **1.9 CONCEALMENT**

- .1 In finished areas conceal pipes, ducts and wiring in floors, walls and ceilings, except where indicated otherwise.

- .2 Before installation inform Departmental Representative if there is interference. Install as directed by Departmental Representative.

#### **1.10 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.

#### **1.11 LOCATION OF FIXTURES**

- .1 Consider location of fixtures, outlets, and mechanical and electrical items indicated as approximate.
- .2 Inform Departmental Representative of conflicting installation. Install as directed.

#### **1.12 FASTENINGS**

- .1 Provide metal fastenings and accessories in same texture, colour and finish as adjacent materials, unless indicated otherwise.
- .2 Prevent electrolytic action between dissimilar metals and materials.
- .3 Use non-corrosive hot dip galvanized steel fasteners and anchors for securing exterior work, unless stainless steel or other material is specifically requested in affected specification Section.
- .4 Space anchors within individual load limit or shear capacity and ensure they provide positive permanent anchorage. Wood, or any other organic material plugs are not acceptable.
- .5 Keep exposed fastenings to a minimum, space evenly and install neatly.
- .6 Fastenings which cause spalling or cracking of material to which anchorage is made are not acceptable.

#### **1.13 FASTENINGS - EQUIPMENT**

- .1 Use fastenings of standard commercial sizes and patterns with material and finish suitable for service.
- .2 Use heavy hexagon heads, semi-finished unless otherwise specified. Use No. 304 stainless steel for exterior areas.
- .3 Bolts may not project more than one diameter beyond nuts.
- .4 Use plain type washers on equipment, sheet metal and soft gasket lock type washers where vibrations occur. Use resilient washers with stainless steel.

#### **1.14 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.

#### **1.15 EXISTING UTILITIES**

- .1 When breaking into or connecting to existing services or utilities, execute Work at times directed by Departmental Representative, with minimum of disturbance to Work.
- .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**

**2.1            NOT USED**

.1        Not Used.

**PART 3        EXECUTION**

**3.1            NOT USED**

.1        Not Used.

**END OF SECTION**



## **PART 1        GENERAL**

### **1.1            REFERENCE STANDARDS**

- .1 Canadian Construction Documents Committee (CCDC)
  - .1 CCDC 2-94, Stipulated Price Contract.

### **1.2            PROJECT CLEANLINESS**

- .1 Maintain Work in tidy condition, free from accumulation of waste products and debris.
- .2 Remove waste materials from site at daily regularly scheduled times or dispose of as directed by Departmental Representative. Do not burn waste materials on site.
- .3 Clear snow and ice as required.
- .4 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .5 Provide and use marked separate bins for recycling. Refer to Section 01 74 21- Construction/Demolition Waste Management and Disposal.
- .6 Dispose of waste materials and debris off site.
- .7 Clean interior areas prior to start of finishing work, and maintain areas free of dust and other contaminants during finishing operations.
- .8 Store volatile waste in covered metal containers, and remove from premises at end of each working day.
- .9 Provide adequate ventilation during use of volatile or noxious substances. Use of building ventilation systems is not permitted for this purpose.
- .10 Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.
- .11 Schedule cleaning operations so that resulting dust, debris and other contaminants will not fall on wet, newly painted surfaces nor contaminate building systems.

### **1.3            FINAL CLEANING**

- .1 Refer to CCDC 2, GC 3.14.
- .2 When Work is Substantially Performed remove surplus products, tools, construction machinery and equipment not required for performance of remaining Work.
- .3 Remove waste products and debris other than that caused by others, and leave Work clean and suitable for occupancy.
- .4 Prior to final review remove surplus products, tools, construction machinery and equipment.
- .5 Clean and polish glass, mirrors, hardware, wall tile, stainless steel, chrome, porcelain enamel, baked enamel, plastic laminate, and mechanical and electrical fixtures. Replace broken, scratched or disfigured glass.
- .6 Remove stains, spots, marks and dirt from decorative work, electrical and mechanical fixtures, furniture fitments, walls and floors.
- .7 Clean lighting reflectors, lenses, and other lighting surfaces.
- .8 Vacuum clean and dust building interiors, behind grilles, louvres and screens.
- .9 Wax, seal, shampoo or prepare floor finishes, as recommended by manufacturer.
- .10 Inspect finishes, fitments and equipment and ensure specified workmanship and operation.
- .11 Broom clean and wash exterior walks, steps and surfaces; rake clean other surfaces of grounds.
- .12 Remove dirt and other disfiguration from exterior surfaces.

- .13 Clean and sweep roofs, gutters, areaways, and sunken wells.
- .14 Sweep and wash clean paved areas.
- .15 Clean equipment and fixtures to sanitary condition; clean or replace filters of mechanical equipment.
- .16 Clean roofs, downspouts, and drainage systems.
- .17 Remove debris and surplus materials from crawl areas and other accessible concealed spaces.
- .18 Remove snow and ice from access to building.

**1.4 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate waste materials for recycling in accordance with Section 01 74 21- Construction/Demolition Waste Management And Disposal.

**PART 2 PRODUCTS**

**2.1 NOT USED**

- .1 Not Used.

**PART 3 EXECUTION**

**3.1 NOT USED**

- .1 Not Used.

**END OF SECTION**

## **PART 1 GENERAL**

### **1.1 SECTION INCLUDES**

- .1 This schedules and procedures for systematic Waste Management Program for construction, deconstruction, demolition, and renovation projects, including:
  - .1 Diversion of Materials.
  - .2 Waste Audit (WA) - Schedule A.
  - .3 Waste Reduction Workplan (WRW) - Schedule B.
  - .4 Demolition Waste Audit (DWA) - Schedule C.
  - .5 Cost/Revenue Analysis Workplan (CRAW) - Schedule D.
  - .6 Materials Source Separation Program (MSSP).
  - .7 Canadian Governmental Responsibility for the Environment Resources - Schedule E.

### **1.2 DEFINITIONS**

- .1 Approved/Authorized recycling facility: waste recycler approved by applicable provincial authority or other users of material for recycling approved by the Departmental Representative.
- .2 Class III: non-hazardous waste - construction renovation and demolition waste.
- .3 Construction, Renovation and/or Demolition (CRD) Waste: Class III solid, non-hazardous waste materials generated during construction, demolition, and/or renovation activities
- .4 Cost/Revenue Analysis Workplan (CRAW): based on information from Waste Reduction Workplan, and intended as financial tracking tool for determining economic status of waste management practices (Schedule E).
- .5 Inert Fill: inert waste - exclusively asphalt and concrete.
- .6 Waste Source Separation Program (WSSP): implementation and co-ordination of ongoing activities to ensure designated waste materials will be sorted into pre-defined categories and sent for recycling and reuse, maximizing diversion and potential to reduce disposal costs.
- .7 Recyclable: ability of product or material to be recovered at end of its life cycle and re-manufactured into new product for reuse.
- .8 Recycle: process by which waste and recyclable materials are transformed or collected for purpose of being transferred into new products.
- .9 Recycling: process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for purpose of using in altered form. Recycling does not include burning, incinerating, or thermally destroying waste.
- .10 Reuse: repeated use of product in same form but not necessarily for same purpose. Reuse includes:
  - .1 Salvaging reusable materials from re-modelling projects, before demolition stage, for resale, reuse on current project or for storage for use on future projects.
  - .2 Returning reusable items including pallets or unused products to vendors.
- .11 Salvage: removal of structural and non-structural materials from deconstruction/disassembly projects for purpose of reuse or recycling.
- .12 Separate Condition: refers to waste sorted into individual types.
- .13 Source Separation: act of keeping different types of waste materials separate beginning from the point they became waste.
- .14 Waste Audit (WA): detailed inventory of estimated quantities of waste materials that will be generated during construction, demolition, deconstruction and/or renovation. Involves

quantifying by volume/weight amounts of materials and wastes that will be reused, recycled or landfilled. Refer to Schedule A.

- .15 Waste Diversion Report: detailed report of final results, quantifying cumulative weights and percentages of waste materials reused, recycled and landfilled over course of project. Measures success against Waste Reduction Workplan (WRW) goals and identifies lessons learned.
- .16 Waste Management Co-ordinator (WMC): contractor representative responsible for supervising waste management activities as well as co-ordinating required submittal and reporting requirements.
- .17 Waste Reduction Workplan (WRW): written report which addresses opportunities for reduction, reuse, or recycling of materials generated by project. Specifies diversion goals, implementation and reporting procedures, anticipated results and responsibilities. Waste Reduction Workplan (Schedule B) information acquired from Waste Audit.

### 1.3 DOCUMENTS

- .1 Post and maintain in visible and accessible area at job site, one copy of following documents:
  - .1 Waste Audit (Schedule A).
  - .2 Waste Reduction Workplan (Schedule B).
  - .3 Material Source Separation Program (MSSP).

### 1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section [01 33 00- Submittal Procedures].
- .2 Prepare and submit following prior to project start-up:
  - .1 1 electronic copy of completed Waste Audit (WA): Schedule A.
  - .2 1 electronic copy of completed Waste Reduction Workplan (WRW): Schedule B.
  - .3 1 electronic copy of Cost/Revenue Analysis Workplan (CRAW): Schedule E.
  - .4 1 electronic copy of Waste Source Separation Program (WSSP).
- .3 Prepare and submit on monthly basis, throughout project or at intervals agreed to by Departmental Representative the following:
  - .1 Receipts, scale tickets, waybills, and/or waste disposal receipts that show quantities and types of materials reused, recycled, or disposed of.
  - .2 Updated Waste Materials Tracking form (Schedule D).
- .4 Submit prior to final payment the following:
  - .1 Waste Diversion Report, indicating final quantities [in tonnes] by material types salvaged for reuse, recycling or disposal in landfill and recycling centres, re-use depots, landfills and other waste processors that received waste materials (See Schedule C).
  - .2 Provide receipts, scale tickets, waybills, waste disposal receipts that confirm quantities and types of materials reused, recycled or disposed of and destination.

### 1.5 WASTE REDUCTION WORKPLAN (WRW)

- .1 Prepare and submit WRW (Schedule B) at least 10 days prior to project start-up.
- .2 WRW identifies strategies to optimize diversion through reduction, reuse, and recycling of materials and comply with applicable regulations, based on information acquired from WA.
- .3 WRW should include but not limited to:
  - .1 Applicable regulations.

- .2 Specific goals for waste reduction, identify existing barriers and develop strategies to overcome them.
- .3 Destination of materials identified.
- .4 Deconstruction/disassembly techniques and schedules.
- .5 Methods to collect, separate, and reduce generated wastes.
- .6 Location of waste bins on-site.
- .7 Security of on-site stock piles and waste bins.
- .8 Protection of personnel, sub-contractors.
- .9 Clear labelling of storage areas.
- .10 Training plan for contractor and sub-contractors.
- .11 Methods to track and report results reliably (Schedule D).
- .12 Details on materials handling and removal procedures.
- .13 Recycler and reclaimer requirements.
- .14 Quantities of materials to be salvaged for reuse or recycled and materials sent to landfill.
- .15 Requirements for monitoring on-site wastes management activities.
- .4 Structure WRW to prioritize actions and follow 3R's hierarchy, with Reduction as first priority, followed by Reuse, then Recycle.
- .5 Post WRW or summary where workers at site are able to review content.
- .6 Monitor and report on waste reduction by documenting total volume (in tonnes) and cost of actual waste removed from project (Schedule D).

#### **1.6 COST/REVENUE ANALYSIS WORKPLAN (CRAW)**

- .1 Prepare CRAW (see Schedule E) and include the following:
  - .1 Cost of current waste management practices.
  - .2 Implementation cost of waste diversion program.
  - .3 Savings and benefits resulting from waste diversion program.

#### **1.7 WASTE SOURCE SEPARATION PROGRAM (WSSP)**

- .1 As part of Waste Reduction Workplan, prepare WSSP prior to project start-up.
- .2 WSSP will detail methodology and planned on-site activities for separation of reusable and recyclable materials from waste intended for landfill.
- .3 Provide list and drawings of locations that will be made available for sorting, collection, handling and storage of anticipated quantities of reusable and recyclable materials.
- .4 Provide sufficient on-site facilities and containers for collection, handling, and storage of anticipated quantities of reusable and recyclable materials.
- .5 Locate containers to facilitate deposit of materials without hindering daily operations.
- .6 Provide training for workers and sub-contractors in handling and separation of materials for reuse and/or recycling.
- .7 Locate separated materials in areas which minimizes material damage.
- .8 Clearly and securely label containers to identify types/conditions of materials accepted and assist sub-contractors and workers in separating materials accordingly.
- .9 On-site sale of salvaged materials is not permitted unless authorized in writing by Departmental Representative and provided that site safety regulations and security requirements are adhered to.

## **1.8 USE OF SITE AND FACILITIES**

- .1 Execute Work with minimal interference and disturbance to normal use of premises.
- .2 Maintain security measures established by facility provide temporary security measures approved by Departmental Representative.

## **1.9 WASTE PROCESSING SITES**

- .1 Contractor is responsible to research and locate waste diversion resources and service providers. Salvaged materials are to be transported off site to approved and/or authorized recycling facilities or to users of material for recycling.
- .2 Province of: British Columbia
  - .1 Name: Golden Landfill class III landfill and recycling facility.

## **1.10 STORAGE, HANDLING AND PROTECTION**

- .1 Store, materials to be reused, recycled and salvaged in locations as directed by Departmental Representative.
- .2 Unless specified otherwise, materials for removal become Contractor's property.
- .3 Protect, stockpile, store and catalogue salvaged items.
- .4 Separate non-salvageable materials from salvaged items. Transport and deliver non-salvageable items to licensed disposal facility.
- .5 Protect structural components not removed and salvaged materials from movement or damage.
- .6 Support affected structures. If safety of building is endangered, cease operations and immediately notify Departmental Representative.
- .7 Protect surface drainage, mechanical and electrical from damage and blockage.
- .8 Provide on-site facilities and containers for collection and storage of reusable and recyclable materials.
- .9 Separate and store materials produced during project in designated areas.
- .10 Prevent contamination of materials to be salvaged and recycled and handle materials in accordance with requirements for acceptance by designated processing facilities.
  - .1 On-site source separation is recommended.
  - .2 Remove co-mingled materials to off site processing facility for separation.
  - .3 Obtain waybills, receipts and/or scale tickets for separated materials removed from site.
  - .4 Materials reused on-site are considered to be diverted from landfill and as such are to be included in all reporting.

## **1.11 DISPOSAL OF WASTES**

- .1 Do not bury rubbish or waste materials.
- .2 Do not dispose of any waste into waterways, storm, or sanitary sewers.
- .3 Keep records of construction waste including:
  - .1 Number and size of bins.
  - .2 Waste type of each bin.
  - .3 Total tonnage generated.
  - .4 Tonnage reused or recycled.
  - .5 Reused or recycled waste destination.
- .4 Remove materials on-site as Work progresses.

- .5 Prepare project summary to verify destination and quantities on a material-by-material basis as identified in the waste audit.

## 1.12 SCHEDULING

- .1 Co-ordinate Work with other activities at site to ensure timely and orderly progress of Work.

## PART 2 PRODUCTS

### 2.1 NOT USED

- .1 Not Used.

## PART 3 EXECUTION

### 3.1 APPLICATION

- .1 Do Work in compliance with WRW and WSSP.
- .2 Handle waste materials not reused, salvaged, or recycled in accordance with appropriate regulations and codes.

### 3.2 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.

### 3.3 DIVERSION OF MATERIALS

- .1 From following list, separate materials from general waste stream and stockpile in separate piles or containers, as reviewed by Departmental Representative, and consistent with applicable fire regulations.
  - .1 Mark containers or stockpile areas.
  - .2 Provide instruction on disposal practices.
- .2 On-site sale or distribution of salvaged materials to third parties is not permitted.

### 3.4 WASTE AUDIT (WA)

- .1 Schedule A - Waste Audit (WA)

(1) Material Category	(2) Material Quantity Unit	(3) Estimated Waste %	(4) Total Quantity of Waste (unit)	(5) Generation Point	(6) % Recycled	(7) % Reused
Wood and Plastics Material Description						
Off-cuts						
Warped Pallet Forms						
Plastic Packaging						
Cardboard Packaging						
Other						

(1) Material Category	(2) Material Quantity Unit	(3) Estimated Waste %	(4) Total Quantity of Waste (unit)	(5) Generation Point	(6) % Recycled	(7) % Reused
Doors and Windows Material Description						
Painted Frames						
Glass						
Wood						
Metal						
Other						

### 3.5 WASTE REDUCTION WORKPLAN (WRW)

#### .1 Schedule B

(1) Material Category	(2) Person(s) Responsible	(3) Total Quantity of Waste (unit)	(4) Reused Amount (units) Projected	Actual	(5) Recycled Amount (unit) Projected	Actual	(6) Material(s) Destination
Wood and Plastics Material Description							
Chutes							
Warped Pallet Forms							
Plastic Packaging							
Card-board Packaging							
Other							
Doors and Windows Material Description							
Painted Frames							
Glass							
Wood							
Metal							
Other							

### 3.6 COST/REVENUE ANALYSIS WORKPLAN (CRAW)

#### .1 Schedule E - Cost/Revenue Analysis Workplan (CRAW)

(1) Material Description	(2) Total Quantity (unit)	(3) Volume (cum)	(4) Weight (cum)	(5) Disposal Cost/Credit \$(+/-)	(6) Category Sub-Total \$(+/-)
Wood					
Wood Stud					
Plywood					
Baseboard - Wood					
Door Trim -					



Wood					
Cabinet					\$
Doors and Windows					
Panel Regular					
Slab Regular					
Wood Laminate	晉				
Byfold - Closet					
Glazing					\$
		(7) Cost (-) / Revenue (+)			\$

### 3.7 CANADIAN GOVERNMENTAL DEPARTMENTS CHIEF RESPONSIBILITY FOR THE ENVIRONMENT

#### .1 Schedule G - Government Chief Responsibility for the Environment:

Province	Address	General Inquires	Fax
British Columbia	Ministry of Environment Lands and Parks 810 Blanshard Street, 4thFloor Victoria BC V8V 1X4	604-387-1161	604-356-6464
	Waste Reduction Commission Soils and Hazardous Waste 770 South Pacific Blvd, Suite 303 Vancouver BC V6B 5E7	604-660-9550	604-660-9596

### 3.8 SCHEDULES

#### .1 Following Schedules are attached to this Specification:

- .1 Waste Audit - Schedule A.
- .2 Waste Reduction Workplan Form - Schedule B.
- .3 Waste Diversion Report Form - Schedule C.
- .4 Waste Materials Tracking Form - Schedule D.
- .5 Cost/Revenue Analysis Workplan - Schedule E.
- .6 Market Research Report - Schedule F (When Available).

**END OF SECTION**

## **PART 1        GENERAL**

### **1.1        REFERENCE STANDARDS**

- .1 Canadian Construction Documents Committee (CCDC)
  - .1 CCDC 2-2008, Stipulated Price Contract.
  - .2 DOC 14-2000, Design-Build Stipulated Price Contract.
  - .3 DOC 15-2000, Design-Builder/ Consultant Contract.
- .2 Canadian Environmental Protection Act (CEPA)
  - .1 SOR/2008-197, Storage Tank Systems for Petroleum Products and Allied Petroleum Products Regulations.

### **1.2        ADMINISTRATIVE REQUIREMENTS**

- .1 Acceptance of Work Procedures:
  - .1 Contractor's Inspection: Contractor: 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 submit verification that corrections have been made.
    - .2 Request Departmental Representative's inspection.
  - .2 Departmental Representative's Inspection:
    - .1 Departmental Representative and Contractor to inspect Work and identify defects and deficiencies.
    - .2 Contractor to correct Work as directed.
  - .3 Completion Tasks: submit written certificates in English that tasks have been performed as follows:
    - .1 Work: completed and inspected for compliance with Contract Documents.
    - .2 Defects: corrected and deficiencies completed.
    - .3 Equipment and systems: tested, balanced, adjusted and fully operational.
    - .4 Operation of systems: demonstrated to Owner's personnel.
    - .5 Commissioning of mechanical systems: completed in accordance with specifications.
    - .6 Aboveground storage tank inspection documentation, registration, forms, decommissioning and removal in accordance with CEPA SOR/2008-197.
    - .7 Work: complete and ready for final inspection.
  - .4 Final Inspection:
    - .1 When completion tasks are done, request final inspection of Work by Departmental Representative, and Contractor.
    - .2 When Work incomplete according to Departmental Representative, complete outstanding items and request re-inspection.
- .5 Declaration of Substantial Performance: when Departmental Representative considers deficiencies and defects corrected and requirements of Contract substantially performed, make application for Certificate of Substantial Performance.
- .6 Commencement of Lien and Warranty Periods: date of Owner's acceptance of submitted declaration of Substantial Performance to be date for commencement

for warranty period and commencement of lien period unless required otherwise by lien statute of Place of Work.

.7 Final Payment:

.1 When Departmental Representative considers final deficiencies and defects corrected and requirements of Contract met, make application for final payment.

.8 Payment of Holdback: after issuance of Certificate of Substantial Performance of Work, submit application for payment of holdback amount in accordance with contractual agreement.

**1.3 FINAL CLEANING**

.1 Clean in accordance with Section 01 74 11- Cleaning.

.1 Remove surplus materials, excess materials, rubbish, tools and equipment.

.2 Waste Management: separate waste materials for recycling or reuse in accordance with Section 01 74 21- Construction/Demolition Waste Management and Disposal.

**PART 2 PRODUCTS**

**2.1 NOT USED**

.1 Not Used.

**PART 3 EXECUTION**

**3.1 NOT USED**

.1 Not Used.

**END OF SECTION**

**PART 1 GENERAL**

**1.1 REFERENCE STANDARDS**

- .1 Canadian Environmental Protection Act (CEPA)
  - .1 SOR/2008-197, Storage Tank Systems for Petroleum Products and Allied Petroleum Products Regulations.

**1.2 ADMINISTRATIVE REQUIREMENTS**

- .1 Pre-warranty Meeting:
  - .1 Convene meeting one week prior to contract completion with Departmental Representative to:
    - .1 Verify Project requirements.
    - .2 Review warranty requirements.
  - .2 Departmental Representative to establish communication procedures for:
    - .1 Notifying construction warranty defects.
    - .2 Determine priorities for type of defects.
    - .3 Determine reasonable response time.
  - .3 Contact information for bonded and licensed company for warranty work action: provide name, telephone number and address of company authorized for construction warranty work action.
  - .4 Ensure contact is located within local service area of warranted construction, is continuously available, and is responsive to inquiries for warranty work action.

**1.3 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00- Submittal Procedures.
- .2 One weeks prior to Substantial Performance of the Work, submit to Departmental Representative, two final copies of operating and maintenance manuals in English.
- .3 Provide spare parts, maintenance materials and special tools of same quality and manufacture as products provided in Work.
- .4 Provide evidence, if requested, for type, source and quality of products supplied.

**1.4 FORMAT**

- .1 Organize data as 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.
  - .1 Identify contents of each binder on spine.
- .4 Cover: identify each binder with type or printed title 'Project Record Documents'; list title of project and identify subject matter of contents.
- .5 Arrange content by under Section numbers and sequence of Table of Contents.
- .6 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.
- .7 Text: manufacturer's printed data, or typewritten data.
- .8 Drawings: provide with reinforced punched binder tab.
  - .1 Bind in with text; fold larger drawings to size of text pages.
- .9 Provide 1:1 scaled CAD files in dwg format on USB.

## **1.5 AS -BUILT DOCUMENTS AND SAMPLES**

- .1 Maintain, in addition to requirements in General Conditions, at site for Departmental Representative one record copy of:
  - .1 Contract Drawings.
  - .2 Specifications.
  - .3 Addenda.
  - .4 Change Orders and other modifications to 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.
  - .1 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.
  - .1 Label each document "PROJECT RECORD" in neat, large, printed letters.
- .4 Maintain record documents in clean, dry and legible condition.
  - .1 Do not use record documents for construction purposes.
- .5 Keep record documents and samples available for inspection by Departmental Representative.

## **1.6 RECORDING INFORMATION ON PROJECT RECORD DOCUMENTS**

- .1 Record information on set of drawings provided by Departmental Representative.
- .2 Use felt tip marking pens, maintaining separate colours for each major system, for recording information.
- .3 Record information concurrently with construction progress.
  - .1 Do not conceal Work until required information is recorded.
- .4 Contract Drawings and shop drawings: mark each item to record actual construction, including:
  - .1 Measured depths of elements of foundation in relation to finish first floor datum.
  - .2 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
  - .3 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.
  - .4 Field changes of dimension and detail.
  - .5 Changes made by change orders.
  - .6 Details not on original Contract Drawings.
  - .7 Referenced Standards to related shop drawings and modifications.
- .5 Specifications: 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.
- .6 Other Documents: maintain inspection certifications, field test records, manufacturer's certifications, required by individual specifications sections.
- .7 Provide digital photos, if requested, for site records.

## **1.7 FINAL SURVEY**

- .1 Submit final site survey certificate in accordance with Section 01 71 00- Examination and Preparation, certifying that elevations and locations of completed Work are in conformance, or non-conformance with Contract Documents.

## **1.8 EQUIPMENT AND SYSTEMS**

- .1 For each item of equipment and each system include description of unit or system, and component parts.
  - .1 Give function, normal operation characteristics and limiting conditions.
  - .2 Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.
- .2 Panel board circuit directories: provide electrical service characteristics, controls, and communications.
- .3 Include installed colour coded wiring diagrams.
- .4 Operating Procedures: include start-up, break-in, and routine normal operating instructions and sequences.
  - .1 Include regulation, control, stopping, shut-down, and emergency instructions.
  - .2 Include summer, winter, and any special operating instructions.
- .5 Maintenance Requirements: include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- .6 Provide servicing and lubrication schedule, and list of lubricants required.
- .7 Include manufacturer's printed operation and maintenance instructions.
- .8 Include sequence of operation by controls manufacturer.
- .9 Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- .10 Provide installed control diagrams by controls manufacturer.
- .11 Provide Contractor's co-ordination drawings, with installed colour coded piping diagrams.
- .12 Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
- .13 Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
- .14 Include test and balancing reports as specified in Section 01 45 00- Quality Control and as required per other technical specifications.
- .15 Aboveground storage tank inspection documentation, registration, forms, decommissioning and removal in accordance with CEPA SOR/2008-197.
- .16 Additional requirements: as specified in individual specification sections.

## **1.9 MATERIALS AND FINISHES**

- .1 Building products, applied materials, and finishes: include product data, with catalogue number, size, composition, and colour and texture designations.
  - .1 Provide information for re-ordering custom manufactured products.
- .2 Instructions for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
- .3 Moisture-protection and weather-exposed products: include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
- .4 Additional requirements: as specified in individual specifications sections.

## **1.10 MAINTENANCE MATERIALS**

- .1 Spare Parts:
  - .1 Provide spare parts, in quantities specified in individual specification sections.
  - .2 Provide items of same manufacture and quality as items in Work.
  - .3 Deliver to site in location as directed; place and store.
  - .4 Receive and catalogue items.
    - .1 Submit inventory listing to Departmental Representative.
    - .2 Include approved listings in Maintenance Manual.
  - .5 Obtain receipt for delivered products and submit prior to final payment.
- .2 Extra Stock Materials:
  - .1 Provide maintenance and extra materials, in quantities specified in individual specification sections.
  - .2 Provide items of same manufacture and quality as items in Work.
  - .3 Deliver to site in location as directed; place and store.
  - .4 Receive and catalogue items.
    - .1 Submit inventory listing to Departmental Representative.
    - .2 Include approved listings in Maintenance Manual.
  - .5 Obtain receipt for delivered products and submit prior to final payment.
- .3 Special Tools:
  - .1 Provide special tools, in quantities specified in individual specification section.
  - .2 Provide items with tags identifying their associated function and equipment.
  - .3 Deliver to site in location as directed; place and store.
  - .4 Receive and catalogue items.
    - .1 Submit inventory listing to Departmental Representative.
    - .2 Include approved listings in Maintenance Manual.

## **1.11 DELIVERY, STORAGE AND HANDLING**

- .1 Store spare parts, maintenance materials, and special tools in manner to prevent damage or deterioration.
- .2 Store in original and undamaged condition with manufacturer's seal and labels intact.
- .3 Store components subject to damage from weather in weatherproof enclosures.
- .4 Store paints and freezable materials in a heated and ventilated room.
- .5 Remove and replace damaged products at own expense and for review by Departmental Representative.

## **1.12 WARRANTIES AND BONDS**

- .1 Develop warranty management plan to contain information relevant to Warranties.
- .2 Submit warranty management plan, 30 days before planned pre-warranty conference, to Departmental Representative for review and approval.
- .3 Warranty management plan to include required actions and documents to assure that Departmental Representative receives warranties to which it is entitled.
- .4 Provide plan in narrative form and contain sufficient detail to make it suitable for use by future maintenance and repair personnel.
- .5 Submit, warranty information made available during construction phase, to Departmental Representative for approval prior to each monthly pay estimate.

- .6 Assemble approved information in binder, submit upon acceptance of work and organize binder as follows:
  - .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 applicable item of work.
  - .4 Verify that documents are in proper form, contain full information, and are notarized.
  - .5 Co-execute submittals when required.
  - .6 Retain warranties and bonds until time specified for submittal.
- .7 Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial Performance is determined.
- .8 Conduct joint 4 month and 9 month warranty inspection, measured from time of acceptance, by Departmental Representative.
- .9 Include information contained in warranty management plan as follows:
  - .1 Roles and responsibilities of personnel associated with warranty process, including points of contact and telephone numbers within the organizations of Contractors, subcontractors, manufacturers or suppliers involved.
  - .2 Listing and status of delivery of Certificates of Warranty for extended warranty items, to include motors, HVAC balancing, roofs, pumps, and fire protection.
  - .3 Provide list for each warranted equipment, item, feature of construction or system indicating:
    - .1 Name of item.
    - .2 Model and serial numbers.
    - .3 Location where installed.
    - .4 Name and phone numbers of manufacturers or suppliers.
    - .5 Names, addresses and telephone numbers of sources of spare parts.
    - .6 Warranties and terms of warranty: include one-year overall warranty of construction. Indicate items that have extended warranties and show separate warranty expiration dates.
    - .7 Cross-reference to warranty certificates as applicable.
    - .8 Starting point and duration of warranty period.
    - .9 Summary of maintenance procedures required to continue warranty in force.
    - .10 Cross-Reference to specific pertinent Operation and Maintenance manuals.
    - .11 Organization, names and phone numbers of persons to call for warranty service.
    - .12 Typical response time and repair time expected for various warranted equipment.
  - .4 Procedure and status of tagging of equipment covered by extended warranties.
  - .5 Post copies of instructions near selected pieces of equipment where operation is critical for warranty and/or safety reasons.
- .10 Respond in timely manner to oral or written notification of required construction warranty repair work.
- .11 Written verification to follow oral instructions.



- .1 Failure to respond will be cause for the Departmental Representative to proceed with action against Contractor.

#### **1.13 WARRANTY TAGS**

- .1 Tag, at time of installation, each warranted item. Provide durable, oil and water resistant tag approved by Departmental Representative.
- .2 Attach tags with copper wire and spray with waterproof silicone coating.
- .3 Leave date of acceptance until project is accepted for occupancy.
- .4 Indicate following information on tag:
  - .1 Type of product/material.
  - .2 Model number.
  - .3 Serial number.
  - .4 Contract number.
  - .5 Warranty period.
  - .6 Inspector's signature.
  - .7 Construction Contractor.

#### **PART 2 PRODUCTS**

##### **2.1 NOT USED**

- .1 Not Used.

#### **PART 3 EXECUTION**

##### **3.1 NOT USED**

- .1 Not Used.

**END OF SECTION**

## **PART 1 GENERAL**

### **1.1 ADMINISTRATIVE REQUIREMENTS**

- .1 Demonstrate operation and maintenance of equipment and systems to Owner's personnel two weeks prior to date of substantial performance.
- .2 Owner: provide list of personnel to receive instructions, and co-ordinate their attendance at agreed-upon times.
- .3 Preparation:
  - .1 Verify conditions for demonstration and instructions comply with requirements.
  - .2 Verify designated personnel are present.
  - .3 Ensure equipment has been inspected and put into operation.
  - .4 Ensure testing, adjusting, and balancing has been performed and equipment and systems are fully operational.
- .4 Demonstration and Instructions:
  - .1 Demonstrate start-up, operation, control, adjustment, trouble-shooting, and maintenance of all equipment.
  - .2 Instruct personnel in phases of operation and maintenance using operation and maintenance manuals as basis of instruction.
  - .3 Review contents of manual in detail to explain aspects of operation and maintenance.
  - .4 Prepare and insert additional data in operations and maintenance manuals when needed during instructions.

### **1.2 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00- Submittal Procedures.
- .2 Submit schedule of time and date for demonstration of each item of equipment and each system two weeks prior to designated dates, for Departmental Representative's approval.
- .3 Submit reports within one week after completion of demonstration, that demonstration and instructions have been satisfactorily completed.
- .4 Give time and date of each demonstration, with list of persons present.
- .5 Provide copies of completed operation and maintenance manuals for use in demonstrations and instructions.

### **1.3 QUALITY ASSURANCE**

- .1 When specified in individual Sections requiring manufacturer to provide authorized representative to demonstrate operation of equipment and systems:
  - .1 Instruct Owner's personnel.
  - .2 Provide written report that demonstration and instructions have been completed.

## **PART 2 PRODUCTS**

### **2.1 NOT USED**

- .1 Not Used.

**PART 3        EXECUTION**

**3.1            NOT USED**

.1        Not Used.

**END OF SECTION**

**PART 1 GENERAL**

**1.1 DESCRIPTION**

- .1 Protecting existing underground utilities.
  - .1 Removing and plugging abandoned lines.
  - .2 Compaction.
  - .3 Alternative support methods.
  - .4 Protecting thrust blocks.

**1.2 REFERENCES**

- .1 ASTM International (ASTM):
  - .1 C425: Standard Specification for Compression Joints for Vitrified Clay Pipe and Fittings.
  - .2 C700: Standard Specification for Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated.

**1.3 DEFINITIONS**

- .1 Controlled Low Strength Unshrinkable Backfill: Refer to Section 03 30 00 – Cast-in-place Concrete.
- .2 Class C Concrete: Refer to Section 03 30 00.

**1.4 SUBMITTALS**

- .1 Submit the following shop drawings in accordance with Section 01 33 00 – Submittal Procedures.
  - .1 Record drawings to include record survey coordinates and elevations.
  - .2 Proposed locations for test pits.

**1.5 QUALITY ASSURANCE**

- .1 Comply with the requirements specified in Section 01 45 00.

**1.6 PROJECT/SITE CONDITIONS**

- .1 Pipelines may be indicated on the drawings, but the right is reserved by the Departmental Representative, to make such modifications in location as may be found desirable to avoid interference with existing utilities.

**PART 2 PRODUCTS**

**2.1 MATERIALS**

- .1 Except as indicated, or as specifically authorized by the Departmental Representative, where existing utilities to remain must be removed, reconstruct utilities with new material of the same size, type, and quality as that removed.

- .2      Vitrified Clay Sewer Pipe and Couplings: For pipe 200 mm or less in diameter, replace with plain-end pipe conforming to ASTM C700.
- .1      Compression Coupling: ASTM C425, compression couplings. Use at least two lengths of pipe in crossing the trench section.

### **PART 3      EXECUTION**

#### **3.1      EXAMINATION**

- .1      British Columbia One Call locates to be completed by Contractor prior to underground digging.
- .2      Test Pits: Excavate test pits to field verify the locations, depth of bury, diameter, and pipe material of existing underground utilities at crossings and at tie-in points before ordering materials or commencing excavation. Immediately notify the Departmental Representative if conflicts are encountered.

#### **3.2      PREPARATION**

- .1      Where utilities are parallel to or cross work, but do not conflict with work, notify the utility owner at least 48 hours in advance of construction at the crossing. Coordinate the construction schedule with the utility owner.

#### **3.3      PROCEDURES**

- .1      Protect in Place: Protect utilities in place, unless abandoned, and maintain the utility in service, unless otherwise indicated or specified.
- .2      Damage to Utilities to Remain: If existing utilities to remain are damaged, immediately notify utility owner, and repair to owner's satisfaction.

#### **3.4      COMPACTION**

- .1      Protecting Existing Utilities:
  - .1      Backfill and compact under and around utilities. Compaction shall conform to Section 31 23 33.01 – Excavation, Trenching and Backfilling.
  - .2      Where compaction cannot adequately be performed around utility due to the presence of encroaching existing utilities, utilize controlled low strength fill.

#### **3.5      PROTECTION OF THRUST BLOCKS**

- .1      Protect thrust blocks on existing waterlines or sewer force mains in place or shore to resist the thrust by a means accepted by the Departmental Representative, and reconstruct. If the thrust blocks are exposed or rendered to be ineffective in the opinion of the Departmental Representative, reconstruct them to bear against firm unexcavated or backfill material.
  - .1      Provide firm support by backfilling affected portion of the trench for a distance of 600 mm on each side of the thrust block to be reconstructed from the pipe bedding to the pavement subgrade with either:
    - .1      Controlled low strength fill; or,
    - .2      Native material compacted to a relative compaction of 95 percent. See Section 31 23 33.01 for compaction requirements.

- .2 Excavate the backfill material for construction of the thrust block.
- .3 Test compaction of the backfill material before pouring any concrete thrust block.  
Concrete shall conform to Section 03 30 00.

**3.6 CLOSEOUT ACTIVITIES**

- .1 Provide in accordance with Section 01 78 00 – Closeout Submittals.

**END OF SECTION**

**PART 1 GENERAL**

**1.1 DESCRIPTION:**

- .1 Provide demolition and alterations of existing conditions as indicated and in compliance with Contract Documents.

**1.2 REFERENCES:**

- .1 Canadian Standards Association (CSA):
  - .1 S350M: Code of Practice for Safety in Demolition of Structures.
- .2 United States Environmental Protection Agency (USEPA):
  - .1 832: Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

**1.3 SUBMITTALS:**

- .1 Submit the following in accordance with Section 01 33 00.
  - .1 Demolition Plan.
  - .2 Sustainable Design Submittals.

**1.4 QUALITY ASSURANCE:**

- .1 Comply with the requirements specified in Section 01 45 00.
- .2 Demolition Plan: Provide description of sequence, methods, and equipment used for demolition (including disposal).

**1.5 DELIVERY STORAGE AND HANDLING:**

- .1 Comply with the requirements specified in Section 01 66 00 – Common Product Requirements.

**PART 2 PRODUCTS**

**2.1 NOT USED**

- .1 (Not Used)

**PART 3 EXECUTION**

**3.1 PREPARATION:**

- .1 Survey Markers and Monuments:
  - .1 Provide three reference points, established by a licensed land surveyor, for each survey marker or monument temporarily removed. Record locations and designations of survey markers and monuments prior to removal.
  - .2 Store removed markers and monuments during demolition work, and replace upon completion of work. Re-establish survey markers and monuments in conformance with recorded reference points. Forward letter to Departmental Representative,

signed by a licensed land surveyor, verifying reestablishment of survey markers and monuments.

- .2 Burning of demolition debris is prohibited.
- .3 Protect existing structures, equipment, and appurtenances to remain.
- .4 Obtain permission from Departmental Representative before abandoning or removing existing structures, materials, equipment and appurtenances.
- .5 Provide fire extinguishers in areas where demolition work is performed by use of an open flame. Exercise necessary precautions for fire prevention.
- .6 Maintain circulation of traffic within area at all times during demolition operations.
- .7 Make necessary arrangements with and perform work required by utility companies and municipal departments for discontinuance or interruption of utility services due to demolition work.
- .8 Confine apparatus, storage of materials, demolition work, new construction, and operations of workmen to areas that will not interfere with continued use and operation of entire facility. Provide and maintain lights, barriers, and temporary passageways for free and safe access.
- .9 Provide shoring or bracing where necessary to prevent settlement or displacement of existing or new structures. Do not overload floors.

### **3.2 DEMOLITION:**

- .1 Demolish and remove existing construction, utilities, equipment, and appurtenances.
- .2 Provide maximum practicable protection from inclement weather for materials, equipment, and personnel located in partially dismantled structures.
- .3 Protect persons and property throughout progress of work. Provide safe working conditions for personnel.
- .4 Wet down work during demolition operations to prevent dust from arising. Minimize spread of dust and airborne particles.
- .5 Complete demolition work on upper levels before disturbing supporting members on lower levels.
- .6 Demolish foundation walls to a depth of not less than two-feet below existing ground level. Break cellar and tank floors into pieces having area not more than four-square feet with well-defined cracks through full depth of floor. Provide holes having area at least one-square foot through floors at intervals of ten-feet lengthwise and crosswise.
- .7 Cap or plug with concrete, pipes and other conduits which are abandoned in place.
- .8 Removed materials, equipment, and appurtenances, not designated for relocation, become property of Contractor and shall be disposed of offsite.

### **3.3 SALVAGE:**

- .1 Store equipment to be salvaged or relocated as directed by Departmental Representative. Protect salvaged items from damage during work.

### **3.4 REPAIR/RESTORATION:**

- .1 Repair or remove items that are damaged. Repair and install damaged items to condition at least equal to that which existed prior to start of work.



**3.5 CLOSEOUT ACTIVITIES:**

- .1 Provide in accordance with Section 01 77 00.

**END OF SECTION**

**PART 1 GENERAL**

**1.1 MEASUREMENT AND PAYMENT**

- .1 Removal of existing asphalt pavement will be measured in square metres of surface actually removed.
- .2 Payment under this item will include operations involved in removing, hauling and stockpiling and disposing of designated pavement.

**PART 2 PRODUCTS**

**2.1 EQUIPMENT**

- .1 Use cold milling, planning or grinding equipment with automatic grade controls capable of operating from stringline, and capable of removing part of pavement surface to depths or grades indicated.

**PART 3 EXECUTION**

**3.1 PREPARATION**

- .1 Prior to beginning removal operation, inspect and verify with Departmental Representative areas, depths and lines of asphalt pavement to be removed.
- .2 Protection: protect existing pavement not designated for removal, light units and structures from damage. In event of damage, immediately replace or make repairs to approval of Departmental Representative at no additional cost.

**3.2 REMOVAL**

- .1 Remove existing asphalt pavement to lines and grades as indicated in drawings and approved by Departmental Representative.
- .2 Use equipment and methods of removal and hauling which do not damage or disturb underlying pavement.
- .3 Prevent contamination of removed asphalt pavement by topsoil, underlying gravel or other materials.
- .4 Suppress dust generated by removal process.

**3.3 FINISH TOLERANCES**

- .1 Finished surfaces in areas where asphalt pavement has been removed to be within +/-5 mm of grade specified but not uniformly high or low.

**3.4 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 Sweep remaining asphalt pavement surfaces clean of debris resulting from removal operations using rotary power brooms and hand brooming as required.

**END OF SECTION**

## **PART 1        GENERAL**

### **1.1        RELATED REQUIREMENTS**

- .1        Section 02 42 13        Deconstruction of Structures
- .2        Section 02 82 00        Asbestos Abatement
- .3        Section 02 83 10        Lead-Base Paint Abatement
- .4        Section 01 74 21        Construction/Demolition Waste Management Disposal

### **1.2        REFERENCE STANDARDS**

- .1        Canadian Environmental Protection Act (CEPA)
  - .1        CCME PN 1326-2008, Environmental Code of Practice for Aboveground and Underground Storage Tank Systems for Petroleum Products and Allied Petroleum Products.
- .2        Canada Green Building Council (CaGBC)
  - .1        LEED Canada-NC Version 1.0-2004, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Package For New Construction and Major Renovations (including Addendum 2007).
  - .2        LEED Canada-CI Version 1.0-2007, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Guide For Commercial Interiors.
- .3        CSA International
  - .1        CSA S350-M1980(R2003), Code of Practice for Safety in Demolition of Structures.
- .4        Department of Justice Canada (Jus)
  - .1        Canadian Environmental Assessment Act (CEAA), 1995, c. 37.
  - .2        Canadian Environmental Protection Act (CEPA), 1999, c. 33.
    - .1        SOR/2003-2, On-Road Vehicle and Engine Emission Regulations.
    - .2        SOR/2006-268, Regulations Amending the On-Road Vehicle and Engine Emission Regulations.
    - .3        Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.
- .5        Underwriters' Laboratories of Canada (ULC)
  - .1        CAN/ULC-S660-08, Standard for Nonmetallic Underground Piping for Flammable and Combustible Liquids.
  - .2        ULC/ORD-C58.15-1992, Overfill Protection Devices for Flammable Liquid Storage Tanks.
  - .3        ULC/ORD-C58.19-1992, Spill Containment Devices for Underground Flammable Liquid Storage Tanks.
- .6        U.S. Environmental Protection Agency (EPA)
  - .1        EPA CFR 86.098-10, Emission standards for 1998 and later model year Otto-cycle heavy-duty engines and vehicles.
  - .2        EPA CFR 86.098-11, Emission standards for 1998 and later model year diesel heavy-duty engines and vehicles.
  - .3        EPA 832/R-92-005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

### **1.3        DEFINITIONS**

- .1        Hazardous Materials: dangerous substances, dangerous goods, hazardous commodities and hazardous products, include but not limited to: poisons, corrosive agents, flammable

substances, ammunition, explosives, radioactive substances, or materials that endanger human health or environment if handled improperly.

- .2 Waste Management Co-ordinator (WMC): contractor representative responsible for supervising waste management activities as well as co-ordinating related, required submittal and reporting requirements.
- .3 Waste Audit (WA): detailed inventory of materials in building. Involves quantifying by volume/weight amounts of materials and wastes generated during construction, demolition, deconstruction, or renovation project. Indicates quantities of reuse, recycling and landfill.
- .4 Waste Reduction Workplan (WRW): written report which addresses opportunities for reduction, reuse, or recycling of materials. WRW is based on information acquired from WA.

#### **1.4 ADMINISTRATIVE REQUIREMENTS**

- .1 Pre-Installation Meetings:
  - .1 Convene pre-installation meeting 1 week prior to beginning work of this Section, with Departmental Representative in accordance with Section 01 31 19- Project Meetings to:
    - .1 Verify project requirements.
    - .2 Verify existing site conditions adjacent to demolition work.
    - .3 Co-ordination with other construction subtrades.
  - .2 Hold project meetings every week.
  - .3 Ensure project manager attend.
  - .4 WMC must provide written report on status of waste diversion activity at each meeting.
  - .5 Departmental Representative will provide written notification of change to meeting schedule established upon contract award 24 hours prior to scheduled meeting.
- .2 Scheduling:
  - .1 Employ necessary means to meet project time lines without compromising specified minimum rates of material diversion.
    - .1 In event of unforeseen delay notify in writing Departmental Representative.

#### **1.5 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00- Submittal Procedures Section 01 74 21- Construction/Demolition Waste Management Disposal.
- .2 WMC is responsible for fulfilment of reporting requirements.
- .3 Prior to beginning of Work on site submit detailed Waste Reduction Workplan in accordance with Section 01 74 21- Construction/Demolition Waste Management And Disposal and indicate:
  - .1 Descriptions of and anticipated quantities in percentages of materials to be salvaged reused, recycled and landfilled.
  - .2 Schedule of selective demolition.
  - .3 Number and location of dumpsters.
  - .4 Anticipated frequency of tippage.
  - .5 Name and address of waste receiving organizations.

- .4 Submit copies of certified weigh bills from authorized disposal sites and reuse and recycling facilities for material removed from site upon request of Departmental Representative on a weekly basis.
  - .1 Written authorization from Departmental Representative is required to deviate from receiving organizations listed in Waste Reduction Workplan.
- .5 Shop Drawings:
  - .1 Submit for review and approval demolition drawings, diagrams or details showing sequence of demolition work and supporting structures and underpinning.
  - .2 Submit demolition drawings stamped and signed by professional engineer registered or licensed in Province, Canada.
- .6 Sustainable Design Submittals:
  - .1 LEED Canada-CI Version 1.0 Submittals: in accordance with Section 01 35 43- Environmental Procedures.
  - .2 Erosion and Sedimentation Control: submit erosion and sedimentation control plan in accordance with authorities having jurisdiction and Section 01 35 43- Environmental Procedures.
  - .3 Construction Waste Management:
    - .1 Submit project Waste Reduction Workplan highlighting recycling and salvage requirements.
    - .2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating that 75% of construction wastes were recycled or salvaged.

## **1.6 QUALITY ASSURANCE**

- .1 Regulatory Requirements: Ensure Work is performed in compliance with TDGA, CEAA, CEPA, applicable Provincial/Territorial and Municipal regulations.

## **1.7 SITE CONDITIONS**

- .1 Environmental protection:
  - .1 Ensure Work is done in accordance with Section 01 35 43- Environmental Procedures.
  - .2 Ensure Work does not adversely affect adjacent watercourses, groundwater and wildlife, or contribute to excess air and noise pollution.
  - .3 Fires and burning of waste or materials is not permitted on site.
  - .4 Do not bury rubbish waste materials.
  - .5 Do not dispose of waste or volatile materials including but not limited to: mineral spirits, oil, petroleum based lubricants, or toxic cleaning solutions into watercourses, storm or sanitary sewers.
    - .1 Ensure proper disposal procedures are maintained throughout project.
  - .6 Do not pump water containing suspended materials into watercourses, storm or sanitary sewers, or onto adjacent properties.
  - .7 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with authorities having jurisdiction and as directed by Departmental Representative.
  - .8 Protect trees, plants and foliage on site and adjacent properties where indicated.
  - .9 Prevent extraneous materials from contaminating air beyond application area, by providing temporary enclosures during demolition work.
  - .10 Cover or wet down dry materials and waste to prevent blowing dust and debris. Control dust on all temporary roads.

## **1.8 EXISTING CONDITIONS**

- .1 If material resembling spray or trowel applied asbestos or other designated substance listed as hazardous be encountered in course of demolition, stop work, take preventative measures, and notify Departmental Representative immediately. Proceed only after receipt of written instructions have been received from Departmental Representative.
- .2 Structures to be demolished are based on their condition at time of examination prior to tendering.
  - .1 Remove, protect and store salvaged items as directed by Departmental Representative. Salvage items as identified by Departmental Representative. Deliver to Departmental Representative as directed.

## **PART 2 PRODUCTS**

### **2.1 EQUIPMENT**

- .1 Equipment and heavy machinery:
  - .1 On-road vehicles to: CEPA-SOR/2003-2, On-Road Vehicle and Engine Emission Regulations.
  - .2 Off-road vehicles to: EPA CFR 86.098-11.
- .2 Leave machinery running only while in use, except where extreme temperatures prohibit shutting machinery down.

## **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: 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 demolition.
  - .3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal after completion of demolition work.
- .2 Protection of in-place conditions:
  - .1 Work in accordance with Section 01 35 43- Environmental Procedures and Erosion and Sedimentation Control Plan.
  - .2 Prevent movement, settlement or damage of adjacent landscaping, paving, walks, structures, adjacent grades, services, and trees.
    - .1 Provide bracing, shoring and underpinning as required.
    - .2 Repair damage caused by demolition as directed by Departmental Representative.
  - .3 Support affected structures and, if safety of structure being demolished or services or adjacent structures appears to be endangered, take preventative measures, stop Work and immediately notify Departmental Representative.
  - .4 Prevent debris from blocking surface drainage system, elevators, mechanical and electrical systems which must remain in operation.

- .3 Surface Preparation:
  - .1 Disconnect and re-route electrical and telephone service lines entering buildings to be demolished.
    - .1 Post warning signs on electrical lines and equipment which must remain energized to serve other properties during period of demolition.
  - .2 Disconnect and cap designated mechanical services.
    - .1 Natural gas supply lines: remove in accordance with gas company requirements.
    - .2 Sewer and water lines: remove to property line in accordance with authority having jurisdiction.
    - .3 Other underground services: remove and dispose of as directed by Departmental Representative in accordance with Section 33 71 73.02- Underground Electrical Service.
  - .3 Septic Tanks:
    - .1 Pump out buried septic tanks, left in place. Fill with sand.
    - .2 Remove tanks within area of new construction or under paved areas and slabs.
    - .3 Removal in accordance with CCME, Code of Practice PN 1326.
  - .4 Underground storage tanks and piping: remove and dispose in accordance with Section ULC/ORD-C58.15 and as directed.
  - .5 Do not disrupt active or energized utilities designated to remain undisturbed.
  - .6 Remove rodent and vermin as required by Departmental Representative.

### 3.2 DEMOLITION

- .1 Blasting operations not permitted during demolition.
- .2 Do blasting operations in accordance with CSA S350.
- .3 Remove contaminated or dangerous materials as defined by authorities having jurisdiction, relating to environmental protection, from site and dispose of in safe manner to minimize danger at site or during disposal.
- .4 Prior to start of Work remove contaminated or hazardous materials as defined by authorities having jurisdiction from site and dispose of at designated disposal facilities in safe manner and in accordance with Section 02 81 01- Hazardous Materials. Refer Existing Conditions in PART 1.
- .5 Demolish structure.
- .6 To permit as indicated.
- .7 Crush concrete generated due to demolition of foundations to size suitable for recycling.
  - .1 Where possible identify markets which will accept crushed material as aggregate.
  - .2 For further information regarding acceptable uses contact Provincial / Territorial aggregate producers associations.
- .8 Demolish foundation walls to minimum of beyond area of new construction.
- .9 Demolish foundation walls and footings, within areas of new construction.
- .10 Break 114mm holes in concrete slabs which are not to be removed, to prevent accumulation of water.
  - .1 Keep floor drains open if permanent drainage still connected.
- .11 Removal of pavements, curbs, and gutters:
  - .1 Remove items as indicated in drawings.
  - .2 Square up adjacent surfaces to remain in place by saw cutting or other method approved by Departmental Representative.
  - .3 Protect adjacent joint and load transfer devices.

- .4 Protect adjacent granular materials.
- .12 Use as backfill in open excavations provided voids are filled. Remove from open excavations pieces of concrete and masonry.
  - .1 Do not backfill basement areas until inspected by Departmental Representative.
- .13 Remove existing equipment, services, and obstacles where required for refinishing or making good of existing surfaces, and replace as work progresses.
- .14 At end of each day's work, leave Work in safe and stable condition.
  - .1 Protect interiors of parts not to be demolished from exterior elements at all times.
- .15 Demolish to minimize dusting. Keep materials wetted as directed by Departmental Representative.
- .16 Demolish masonry and concrete walls in pieces suitable for reuse as specified.
- .17 Remove structural framing.
- .18 Contain fibrous materials to minimize release of airborne fibres while being transported within facility.
- .19 Only dispose of material specified by selected alternative disposal option as directed by Departmental Representative.
  - .1 Additional disposal options to be provided by Departmental Representative prior to disposal.
- .20 Remove and dispose of demolished materials except where noted otherwise and in accordance with authorities having jurisdiction.
- .21 Remove following materials and equipment, store, protect, and reinstall in new building, using qualified tradesmen:
  - .1 Kiosk Antenna
- .22 Use natural lighting to do Work where possible.
  - .1 Shut off lighting except those required for security purposes at end of each day.

### **3.3 CLEANING**

- .1 Develop Waste Reduction Workplan related to Work of this Section and in accordance with Section 01 35 43 – Environmental Procedures.
- .2 Waste Management: separate waste materials for recycling and reuse 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 Divert excess materials from landfill to site approved Departmental Representative.
- .4 Designate appropriate security resources / measures to prevent vandalism, damage and theft.
- .5 Locate stockpiled materials convenient for use in new construction. Eliminate double handling wherever possible.
- .6 Stockpile materials designated for alternate disposal in location which facilitates removal from site and examination by potential end markets, and which does not impede disassembly, processing, or hauling procedures.
  - .1 Label stockpiles, indicating material type and quantity.
- .7 Separate from general waste stream each of following materials. Stockpile materials in neat and orderly fashion in location and as directed by Departmental Representative for alternate disposal. Stockpile materials in accordance with applicable fire and safety regulations.
  - .1 Glass fibre ceiling tiles.
  - .2 Wood fibre ceiling tiles.
  - .3 Power source poles deemed unfit for reuse by Departmental Representative.



- .4 Wiring and conduit.
- .5 Outlets/switches.
- .6 Floor receptacles.
- .7 Metal duct work, baffles, HVAC equipment.
- .8 Demountable partitions.
- .9 Drapes.
- .10 Tracks and blinds.
- .11 Insulation batts.
- .12 Miscellaneous metals.
- .13 Carpet.
- .8 Supply separate, clearly marked disposal bins for categories of waste material. Do not remove bins from site until inspected and approved by Departmental Representative.
- .9 Stockpile on site insulation Batts, steel studs and clips in good condition for reuse in new construction.
- .10 Remove stockpiled material as directed by Departmental Representative, when it interferes with operations of project construction.
- .11 Remove stockpiles of like materials by alternate disposal option once collection of materials is complete.
- .12 Transport material designated for alternate disposal using approved receiving organizations listed in Waste Reduction Workplan and in accordance with applicable regulations.
  - .1 Written authorization from Departmental Representative is required to deviate from receiving organizations listed in Waste Reduction Workplan.
- .13 Dispose of materials not designated for alternate disposal in accordance with applicable regulations.
  - .1 Disposal facilities must be those approved of and listed in Waste Reduction Workplan.
  - .2 Written authorization from Departmental Representative is required to deviate from disposal facilities listed in Waste Reduction Workplan.

**END OF SECTION**

## **PART 1 GENERAL**

### **1.1 RELATED REQUIREMENTS**

- .1 Section 02 42 13 Deconstruction of Structures
- .2 Section 02 82 00 Asbestos Abatement
- .3 Section 02 83 10 Lead-Base Paint Abatement
- .4 Section 01 74 21 Construction/Demolition Waste Management Disposal

### **1.2 REFERENCE STANDARDS**

- .1 Canadian Council of Ministers of the Environment (CCME)
  - .1 PN 1326-2003, Environmental Code of Practice for Aboveground and Underground Tank Systems Containing Petroleum Products and Allied Petroleum Products.
- .2 Canada Green Building Council (CaGBC)
  - .1 LEED Canada-NC Version 1.0-2004, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Package For New Construction and Major Renovations (including Addendum 2007).
  - .2 LEED Canada-2009, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Package For Design and Construction.
  - .3 LEED Canada-CI Version 1.0-2007, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Guide For Commercial Interiors.
  - .4 LEED Canada-EBOM 2009, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Guide For Existing Buildings: Operations and Maintenance.
- .3 CSA International
  - .1 CSA S350-M1980(R2003), Code of Practice for Safety in Demolition of Structures.
- .4 Federal Legislation
  - .1 Canadian Environmental Assessment Act (CEAA), 1995, c. 37.
  - .2 Canadian Environmental Protection Act (CEPA), 1999, c. 33.
  - .3 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.
  - .4 Motor Vehicle Safety Act 1993, c. 16 (MVSA).

### **1.3 DEFINITIONS**

- .1 Alternate Disposal: reuse and recycling of materials by designated facility, user or receiving organization which has valid Certificate of Approval to operate. Alternative to landfill disposal.
- .2 Deconstruction: systematic dismantling of structure in a manner that achieves safe removal/disposal of hazardous materials and maximum salvage/recycling of materials.
  - .1 Ultimate objective is to recover potentially valuable resources while diverting from landfill what has traditionally been significant portion of waste system.
- .3 Demolition: rapid destruction of structure with or without prior removal of hazardous materials.
- .4 Disassembly: physical detachment of materials from structure: prying, pulling, cutting, unscrewing.
- .5 Hauler: company (possessing appropriate and valid Certificate of Approval) contracted to transport waste, reusable or recyclable materials off site to designated facility, user or receiving organization.

- .6 Hazardous Materials: dangerous substances, dangerous goods, hazardous commodities and hazardous products, including but not limited to: corrosive agents, flammable substances, ammunition, explosives, radioactive substances, or other material that can endanger human health, well-being or environment if handled improperly.
- .7 Processing: tasks which are subsequent to disassembly and may include: moving materials, de-nailing, cleaning, separating and stacking.
- .8 Recyclable: ability of product or material to be recovered at end of its life cycle and re-manufactured into new product for reuse by others.
- .9 Recycle: process by which waste and recyclable materials are transformed or collected for purpose of being transferred into new products.
- .10 Recycling: process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for purpose of using in altered form.
  - .1 Recycling does not include burning, incinerating, or thermally destroying waste.
- .11 Reuse: repeated use of product in same form but not necessarily for same purpose. Reuse includes:
  - .1 Salvaging reusable materials from remodelling projects, before demolition stage, for resale, reuse on current project or for storage for use on future projects.
  - .2 Returning reusable items including pallets or unused products to vendors.
- .12 Salvage: removal of structural and non-structural materials from deconstruction/disassembly projects for purpose of reuse or recycling.
- .13 Source Separation: acts of keeping different types of waste materials separate, beginning from first time they became waste.
- .14 Used Building Material Receipt: receipt issued at end destination for materials designated for alternate disposal.
- .15 Waste Audit (WA): detailed inventory of materials in building. Involves quantifying (by volume or weight) amounts of materials and wastes generated during deconstruction. Indicates quantities of reuse, recycling and landfill.
- .16 Waste Management Coordinator (WMC): contractor representative responsible for supervising waste management activities as well as coordinating related, required submittal and reporting requirements.
- .17 Waste Reduction Workplan (WRW): written report which outlines actions to be taken to reduce, reuse and recycle materials during course of deconstruction. Actions based on finding of the Waste Audit (WA).
- .18 Weigh Bill: receipt received from recycling facility indicating weight and content of each load/bin of material.

#### 1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Scheduling:
  - .1 Employ necessary means to meet project time lines without compromising specified minimum rates of material diversion. In event of unforeseen delay notify Departmental Representative.

#### 1.5 PERFORMANCE REQUIREMENTS

- .1 Demolish existing Kiosk building
- .2 Separate materials from waste stream to obtain minimum percentages of diversion as follows:

Reuse	Recycling	%
Kiosk Antenna		100
	Metals	75
	Plastics	75
	Concrete Rubble	75

	Clean Wood	75
	Cardboard	75

## 1.6 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00- Submittal Procedures.
- .2 Keep copies of submittals on file for minimum of five years after completion of project.
- .3 WMC is responsible for fulfillment of reporting requirements.
- .4 Prior to start of Work on site, submit detailed WA indicating descriptions of and anticipated quantities of materials to be reused, recycled and landfilled in accordance with Section 01 74 21- Construction/Demolition Waste Management and Disposal.
- .5 Prior to start of Work on site, submit pre-demolition audit and deconstruction/disassembly plan in accordance with Section 01 35 73- Procedures for Deconstruction of Structures.
- .6 Based on findings of WA submit WRW indicating schedule of selective demolition, material descriptions and quantities to be salvaged, number and location of bins, anticipated frequency of tipping, and names and addresses of receiving organizations in accordance with Section 01 74 21- Construction/Demolition Waste Management and Disposal.
- .7 Submit copies of certificates: weigh bills from authorized disposal sites and reuse and recycling facilities for material removed from site to Departmental Representative weekly.
  - .1 Written authorization from Departmental Representative is required to deviate from receiving organizations listed in WRW.
  - .2 Include following information:
    - .1 Time and date of removal.
    - .2 Description of materials.
    - .3 Weight of material.
    - .4 Breakdown of reuse, recycling and landfill percentages.
    - .5 End destination of materials.
- .8 Hazardous Materials:
  - .1 Submit description of Hazardous Materials and Notification of Filing with proper authorities prior to beginning of Work as required.
- .9 Workers, haulers and subcontractors must possess current, applicable permits to remove, handle and dispose of wastes categorized Provincially as hazardous.
  - .1 Provide proof of compliance within 24 hours.

## 1.7 DECONSTRUCTION DRAWINGS

- .1 Where required by authorities having jurisdiction, submit for approval drawings, diagrams and details showing sequence of deconstruction work, materials designated for salvage and support of structures and underpinning.
- .2 Submit drawings stamped and signed by qualified professional Architect registered or licensed in Provinces of British Columbia, Canada, and Alberta, Canada.

## 1.8 QUALITY ASSURANCE

- .1 Qualifications: provide adequate workforce training through meetings and demonstrations. Have someone on site with deconstruction experience throughout project for consultation and supervision purposes.
- .2 Regulatory Requirements:
  - .1 Ensure Work is performed in compliance with MVSA, CEPA, TDGA, CEAA, applicable Provincial/Territorial regulations.
- .3 Site Meetings: conduct project meetings every week.

- .1 Arrange for site visit with Departmental Representative to examine existing site conditions adjacent to demolition work, prior to start of Work.
- .2 Ensure project manager, WMC, and subcontractor representatives attend.

#### **1.9 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Packaging Waste Management: remove for reuse by manufacturer and return of padding, crates, packaging materials pallets, as specified in Waste Reduction Workplan in accordance with Section 01 74 21- Construction/Demolition Waste Management and Disposal.

#### **1.10 ENVIRONMENTAL REQUIREMENTS**

- .1 Do Work in accordance with Section 01 35 43- Environmental Procedures.
- .2 Ensure deconstruction work does not adversely affect adjacent watercourses, groundwater and wildlife, or contribute to excess air noise pollution.
- .3 Fires and burning of waste or materials is not permitted on site.
- .4 Do not bury waste or materials on site unless approved in writing by Departmental Representative.
- .5 Do not dispose of waste or volatile materials into watercourses, storm or sanitary sewers.
  - .1 Ensure proper disposal procedures in accordance with applicable Provincial/Territorial regulations.
- .6 Do not pump water containing suspended materials into watercourses, storm or sanitary sewers, or onto adjacent properties in accordance with authorities having jurisdiction.
- .7 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with authorities having jurisdiction.
- .8 Protect trees, plants and foliage on site and adjacent properties where indicated.
- .9 Prevent extraneous materials from contaminating air beyond deconstruction area, by providing temporary enclosures during Work.
- .10 Cover or wet down dry materials and waste to prevent blowing dust and debris. Control dust on temporary roads.
- .11 Employ reasonable means necessary to protect salvaged materials from vandalism, theft, adverse weather, or inadvertent damage by heavy machinery.
- .12 Use natural lighting to do Work where possible.
  - .1 Shut off lighting except those required for security purposes at end of each day.
- .13 Organize site and workers in manner which promotes efficient flow of materials through disassembly, processing, stockpiling, and removal.

#### **1.11 SITE CONDITIONS**

- .1 Existing Conditions:
  - .1 Should materials resembling spray or trowel applied asbestos or other designated substance listed as hazardous be encountered in course of deconstruction, stop work, take preventative measures, and notify Departmental Representative immediately. Do not proceed until written instructions have been received.
  - .2 Label and package component parts of mechanical and electrical material specified for salvage in accordance with Departmental Representative's instructions to prevent damage or loss.

- .2 List items to be salvaged for reuse:
  - .1 Kiosk Antenna
- .3 Structures to be demolished to be based on their condition at time of examination prior to tendering.
  - .1 Remove, protect and store salvaged items as directed by Departmental Representative. Salvage items as identified by Departmental Representative. Deliver to Departmental Representative as directed.
- .4 Storage and Protection:
  - .1 Store materials salvaged for reuse and recycling in locations as outlined in Waste Reduction Workplan.
  - .2 Maximum permitted duration of material storage on site 6 months after project completion.
  - .3 Prevent movement, settlement or damage of adjacent services, structures, trees, walks, adjacent grades, paving, and landscaping. Provide underpinning, shoring, and bracing as required. Repair damage caused by deconstruction as directed by Departmental Representative.
  - .4 Support affected structures and, if safety of structure being deconstructed adjacent structures appears to be endangered, take preventative measures. Cease operations and immediately notify Departmental Representative.
  - .5 Prevent debris from blocking surface drainage system, elevators, mechanical and electrical systems.

## **PART 2 PRODUCTS**

### **2.1 EQUIPMENT**

- .1 Leave equipment and machinery running only while in use, except where extreme temperatures prohibit shutting down.
- .2 Where possible use water efficient wetting equipment/trucks/attachments when minimizing dust.
- .3 Demonstrate that tools are being used in manner which allows for salvage of materials in best condition possible.

## **PART 3 EXECUTION**

### **3.1 SELECTIVE DEMOLITION**

- .1 Reuse of Building Elements: this project has been designed to result in end of project rates for reuse of building elements as follows: Do not demolish building elements beyond what is indicated on drawings without approval by Departmental Representative.
  - .1 Building Structure and Shell: 75 percent.
  - .2 Interior Non-Shell Elements: 50 percent.

### **3.2 SITE VERIFICATION OF CONDITIONS**

- .1 Determine if Environmental Assessment (EA) is required under requirements of CEAA.
  - .1 If necessary, employ licensed consultant to perform EA.
  - .2 Communicate findings and conclusions in writing to Departmental Representative prior to start of Work.
- .2 Employ necessary means to assess site conditions and structures to determine quantity and locations of hazardous materials.

- .3 Investigate site and structures to determine dismantling, processing and storage logistics required prior to beginning of Work.
- .4 Develop strategy for deconstruction to facilitate optimum salvage of reusable and recyclable materials.

### **3.3 PREPARATION**

- .1 Obtain necessary permits and approvals including demolition.
  - .1 Provide copies to Departmental Representative prior to start of Work on site.
- .2 Disconnect and re-route electrical, telephone and communication service lines entering buildings to be deconstructed. Post warning signs on electrical lines and equipment which must remain energized to serve other products during period of demolition.
- .3 Locate and protect utility lines. Do not disrupt active or energized utilities designated to remain undisturbed.
- .4 Disconnect and cap designated mechanical services.
  - .1 Natural gas supply lines: remove in accordance with utility company requirements.
  - .2 Sewer and water lines: remove in accordance with requirements of authority having jurisdiction.
  - .3 Other underground services: remove and dispose of as directed by Departmental Representative.
  - .4 Underground storage tanks: remove and dispose of in accordance with CCME Code of Practice PN1326 and directions of Departmental Representative.
  - .5 Post signs in visible locations and appropriate languages which indicates to workers, subcontractors, haulers, and public, bin location and use i.e. ("CLEAN WOOD ONLY").

### **3.4 REMOVAL OF HAZARDOUS WASTES**

- .1 Prior to start of deconstruction work remove contaminated or hazardous materials as defined by authorities having jurisdiction and as directed by Departmental Representative from site and dispose of [at designated disposal facilities] in safe manner in accordance with TDGA and other applicable regulatory requirements, in accordance with Section 02 81 01- Hazardous Materials.

### **3.5 DISASSEMBLY**

- .1 Materials removed are property of Departmental Representative.
- .2 Throughout course of deconstruction pay close attention to connections and material assemblies. Employ workmanship procedures which minimize damage to materials and equipment.
- .3 Ensure workers and subcontractors are briefed to carry out work in accordance with appropriate deconstruction techniques.
- .4 Project supervisor with previous deconstruction experience must be present on site throughout project.
- .5 Deconstruct in accordance with CSA S350 and other applicable safety standards.
- .6 Workers must utilize adequate fall protection and certified harness and belay systems where Departmental Representative considers it necessary.
- .7 Maintain structural integrity of structure.
- .8 Systematically remove finishes, furnishings, and mechanical and electrical equipment as instructed by Departmental Representative.
- .9 Carefully remove windows and doors from structure.
- .10 Disassemble non-loadbearing interior partitions and remove materials from structure.

- .11 Disassemble in sequence: roof, interior loadbearing partitions, exterior walls, floors, and foundation.
- .12 Wherever possible, transfer material assemblies from heights to ground level for easier disassembly. Take appropriate measures to ensure safety.
- .13 Separate from waste stream, material in condition suitable for reuse and/or recycling.
- .14 Remove and store materials to be salvaged, in manner to prevent damage.
  - .1 Store and protect in accordance with requirements for maximum preservation of material.
  - .2 Handle salvaged materials as new materials.
- .15 Source separate for recycling materials that cannot be salvaged for reuse including wood, metal, concrete and asphalt.
- .16 Remove materials that cannot be salvaged for reuse or recycling and dispose of in accordance with applicable codes at licensed facilities.
- .17 Where existing materials are to be re-used in Work, use special care in removal, handling, storage and re-installation to assure proper function in completed work.

### **3.6 PROCESSING**

- .1 Designate location for processing of materials which eliminates double handling and provides adequate space to maintain efficient material flow.
- .2 Separate, strip, and de-nail materials to ensure best possible condition of salvaged materials.
- .3 Keep processing area clean and free of excess debris.
- .4 Supply separate, marked disposal bins for categories of waste material. Notify Departmental Representative prior to removal of bins from site].
- .5 Separate processed materials into organized piles for stockpiling. Provide collection area for materials designated for alternate disposal. Pile materials on pallets to facilitate transport to storage area.

### **3.7 STOCKPILING**

- .1 Label stockpiles, indicating material type and quantity.
- .2 Designate appropriate security resources/measures to prevent vandalism, damage and theft.
- .3 Locate stockpiled materials convenient for use in new construction. Eliminate double handling wherever possible.
- .4 Stockpile materials designated for alternate disposal in location which facilitates removal from site and examination by potential end markets, and which does not impede disassembly, processing, or hauling procedures.
- .5 Material designated for alternate disposal not retailed on site should be marketed to approved receiving organizations listed in Waste Reduction Workplan.

### **3.8 SELLING OF MATERIALS**

- .1 Designate full-time attendant responsible for on-site sale of materials.
- .2 Restrict times of sale to not interfere with deconstruction operations.
- .3 Issue used building material receipt for materials sold on site, to include: appropriate signatures, time, material descriptions, date, name of recipient, and quantities.

### **3.9 REMOVAL FROM SITE**

- .1 Transport material designated for alternate disposal to approved receiving organizations listed in Waste Reduction Workplan and in accordance with applicable regulations. Do



not deviate from receiving organizations listed in Waste Reduction Workplan without prior written authorization from Departmental Representative.

- .2 Dispose of materials not designated for alternate disposal in accordance with applicable regulations. Disposal facilities must be approved of and listed in Waste Reduction Workplan. Do not deviate from disposal facilities listed in Waste Reduction Workplan without prior written authorization from Departmental Representative.

### **3.10 CLEANING AND RESTORATION**

- .1 Keep site clean and organized throughout deconstruction.
- .2 Upon completion of project, remove debris, trim surfaces and leave work site clean.
- .3 Upon completion of project, reinstate areas affected by Work to match condition which existed prior to beginning of Work.

**END OF SECTION**

## **PART 1        GENERAL**

### **1.1        SUMMARY**

- .1        Remove hazardous materials in accordance with Hazardous Materials Assessment (Appendix B).

### **1.2        RELATED REQUIREMENTS**

- .1        Section 02 41 00        Demolition
- .2        Section 02 41 16        Deconstruction of Structures
- .3        Section 02 82 00.01    Asbestos Abatement – Minimum Precautions
- .4        Section 02 83 10        Lead-Base Paint Abatement- Minimum Precautions
- .5        Section 02 84 00        Polychlorinate Biphenyl Remediation

### **1.3        REFERENCE STANDARDS**

- .1        Canada Green Building Council (CaGBC)
  - .1        LEED Canada-NC Version 1.0-2004, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Package For New Construction and Major Renovations (including Addendum 2007).
  - .2        LEED Canada-CI Version 1.0-[2007], LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Guide For Commercial Interiors.
- .2        Canadian Environmental Protection Act, 1999 (CEPA 1999)
  - .1        Export and Import of Hazardous Waste and Hazardous Recyclable Material Regulations (SOR/2005-149).
- .3        Department of Justice Canada (Jus)
  - .1        Transportation of Dangerous Goods Act, 1992 (TDG Act) 1992, (c. 34).
  - .2        Transportation of Dangerous Goods Regulations (T-19.01-SOR/2001-286).
- .4        Green Seal Environmental Standards (GS)
  - .1        GS-11-2008, 2nd Edition, Paints and Coatings.
  - .2        GS-36-00, Commercial Adhesives.
- .5        Health Canada / Workplace Hazardous Materials Information System (WHMIS)
  - .1        Material Safety Data Sheets (MSDS).
- .6        National Research Council Canada (NRC)
  - .1        National Fire Code of Canada 2015(NFC).
- .7        South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards
  - .1        SCAQMD Rule 1113-A2007, Architectural Coatings.
  - .2        SCAQMD Rule 1168-A2005, Adhesive and Sealant Applications.

### **1.4        DEFINITIONS**

- .1        Dangerous Goods: product, substance, or organism specifically listed or meets hazard criteria established in Transportation of Dangerous Goods Regulations.
- .2        Hazardous Material: product, substance, or organism used for its original purpose; and is either dangerous goods or material that will cause adverse impact to environment or adversely affect health of persons, animals, or plant life when released into the environment.
- .3        Hazardous Waste: hazardous material no longer used for its original purpose and that is intended for recycling, treatment or disposal.

## **1.5 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 hazardous materials and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 Submit two copies of WHMIS MSDS in accordance with Section 01 35 43- Environmental Procedures and Section 01 35 29.06- Health and Safety Requirements to Departmental Representative for each hazardous material required prior to bringing hazardous material on site.
  - .3 Submit hazardous materials management plan to Departmental Representative that identifies hazardous materials, usage, location, personal protective equipment requirements, and disposal arrangements.
- .3 Sustainable Design Submittals:
  - .1 LEED Canada-CI Version 1.0 Submittals: in accordance with Section 01 33 00- Submittal Procedures.
  - .2 Construction Waste Management:
    - .1 Submit project Waste Reduction Workplan highlighting recycling and salvage requirements.
    - .2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating that 75% of construction wastes were recycled or salvaged.
  - .3 Low-Emitting Materials: submit listing of adhesives and sealants and paints and coatings used in building, comply with VOC and chemical component limits or restrictions requirements.

## **1.6 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Transport hazardous materials and wastes in accordance with Transportation of Dangerous Goods Act, Transportation of Dangerous Goods Regulations, and applicable provincial regulations.
  - .1 When exporting hazardous waste to another country, ensure compliance with Export and Import of Hazardous Waste and Hazardous Recyclable Materials Regulations.
- .4 Storage and Handling Requirements:
  - .1 Co-ordinate storage of hazardous materials with Departmental Representative and abide by internal requirements for labelling and storage of materials and wastes.
  - .2 Store and handle hazardous materials and wastes in accordance with applicable federal and provincial laws, regulations, codes, and guidelines.
  - .3 Store and handle flammable and combustible materials in accordance with National Fire Code of Canada (NFC) requirements.
  - .4 Keep no more than 45 litres of flammable and combustible liquids such as gasoline, kerosene and naphtha for ready use.
    - .1 Store flammable and combustible liquids in approved safety cans bearing the Underwriters' Laboratory of Canada or Factory Mutual seal of approval.
    - .2 Storage of quantities of flammable and combustible liquids exceeding 45 litres for work purposes requires the written approval of the Departmental Representative.

- .5 Transfer of flammable and combustible liquids is prohibited within buildings.
- .6 Transfer flammable and combustible liquids away from open flames or heat-producing devices.
- .7 Solvents or cleaning agents must be non-flammable or have flash point above 38 degrees C.
- .8 Store flammable and combustible waste liquids for disposal in approved containers located in safe, ventilated area. Keep quantities to minimum.
- .9 Observe smoking regulations, smoking is prohibited in areas where hazardous materials are stored, used, or handled.
- .10 Storage requirements for quantities of hazardous materials and wastes in excess of 5 kg for solids, and 5 litres for liquids:
  - .1 Store hazardous materials and wastes in closed and sealed containers.
  - .2 Label containers of hazardous materials and wastes in accordance with WHMIS.
  - .3 Store hazardous materials and wastes in containers compatible with that material or waste.
  - .4 Segregate incompatible materials and wastes.
  - .5 Ensure that different hazardous materials or hazardous wastes are stored in separate containers.
  - .6 Store hazardous materials and wastes in secure storage area with controlled access.
  - .7 Maintain clear egress from storage area.
  - .8 Store hazardous materials and wastes in location that will prevent them from spilling into environment.
  - .9 Have appropriate emergency spill response equipment available near storage area, including personal protective equipment.
  - .10 Maintain inventory of hazardous materials and wastes, including product name, quantity, and date when storage began.
  - .11 When hazardous waste is generated on site:
    - .1 Co-ordinate transportation and disposal with Departmental Representative.
    - .2 Comply with applicable federal, provincial and municipal laws and regulations for generators of hazardous waste.
    - .3 Use licensed carrier authorized by provincial authorities to accept subject material.
    - .4 Before shipping material obtain written notice from intended hazardous waste treatment or disposal facility it will accept material and it is licensed to accept this material.
    - .5 Label container[s] with legible, visible safety marks as prescribed by federal and provincial regulations.
    - .6 Only trained personnel handle, offer for transport, or transport dangerous goods.
    - .7 Provide photocopy of shipping documents and waste manifests to Departmental Representative.
    - .8 Track receipt of completed manifest from consignee after shipping dangerous goods. Provide photocopy of completed manifest to Departmental Representative.

- .9 Report discharge, emission, or escape of hazardous materials immediately to Departmental Representative and appropriate provincial authority. Take reasonable measures to control release.
  - .12 Ensure personnel have been trained in accordance with Workplace Hazardous Materials Information System (WHMIS) requirements.
  - .13 Report spills or accidents immediately to Departmental Representative. Submit a written spill report to Departmental Representative within 24 hours of incident.
- .5 Develop Waste Reduction Workplan related to Work of this Section and in accordance with Section 01 35 43- Environmental Procedures and Section 01 74 21- Construction/Demolition Waste Management and Disposal.
- .6 Packaging Waste Management: remove for reuse and return of packaging materials, pallets, padding, crates, as specified in Waste Reduction Workplan in accordance with Section 01 35 43 – Environmental Procedures and Section 01 74 21- Construction/Demolition Waste Management and Disposal.

## **PART 2 PRODUCTS**

### **2.1 MATERIALS**

- .1 Description:
  - .1 Bring on site only quantities hazardous material required to perform Work.
  - .2 Maintain MSDS in proximity to where materials are being used. Communicate this location to personnel who may have contact with hazardous materials.
  - .3 Sustainability Characteristics:
    - .1 Adhesives and Sealants in accordance with Section 07 92 00- Joint Sealants.
      - .1 Adhesives and Sealants: maximum VOC limit 50g/L to GS-36.
    - .2 Primers, coatings, and paints in accordance with manufacturer's recommendations for surface conditions and Section 09 91 00- Painting.
      - .1 Primer: maximum VOC limit 250g/L to GS-11.
      - .2 Paints: maximum VOC limit 50g/L to GS-11.
      - .3 Coatings: maximum VOC limit 50g/L to SCAQMD Rule 1113.

## **PART 3 EXECUTION**

### **3.1 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 recycling in accordance with Section 01 35 43- Environmental Procedures and Section 01 74 21- Construction/Demolition Waste Management and Disposal.
  - .1 Dispose of hazardous waste materials in accordance with applicable federal and provincial acts, regulations, and guidelines.
  - .2 Recycle hazardous wastes for which there is approved, cost effective recycling process available.

- .3 Send hazardous wastes to authorized hazardous waste disposal or treatment facilities.
- .4 Burning, diluting, or mixing hazardous wastes for purpose of disposal is prohibited.
- .5 Disposal of hazardous materials in waterways, storm or sanitary sewers, or in municipal solid waste landfills is prohibited.
- .6 Dispose of hazardous wastes in timely fashion in accordance with applicable provincial regulations.
- .7 Minimize generation of hazardous waste to maximum extent practicable. Take necessary precautions to avoid mixing clean and contaminated wastes.
- .8 Identify and evaluate recycling and reclamation options as alternatives to land disposal, such as:
  - .1 Hazardous wastes recycled in manner constituting disposal.
  - .2 Hazardous waste burned for energy recovery.
  - .3 Lead-acid battery recycling.
  - .4 Hazardous wastes with economically recoverable precious metals.

**END OF SECTION**

## **PART 1 GENERAL**

### **1.1 SUMMARY**

- .1 Remove asbestos in accordance with Hazardous Materials Assessment (Appendix B).
- .2 Comply with requirements of this Section when performing following work:
  - .1 Removing ceiling tiles that are asbestos-containing material, if the tiles cover an area less than 7.5 square metres and are removed without being broken, cut, drilled, abraded, ground, sanded or vibrated.
  - .2 Removing non-friable asbestos-containing materials, other than ceiling tiles, if the material is installed or removed without being broken, cut, drilled, abraded, ground, sanded or vibrated at applicable locations indicated in the Hazardous Materials Assessment for Kicking Horse and Monarch Campgrounds as prepared by Alberta Safety & Environmental Services (Appendix B).
  - .3 Break, cut, grind, sand, drill, scrape, vibrate or abrade non-friable asbestos containing materials using non-powered hand-held tools, and the material is wetted to control the spread of dust or fibres.
  - .4 Removing less than one square metre of drywall in which joint-filling compounds that are asbestos containing materials have been used.

### **1.2 RELATED REQUIREMENTS**

- .1 Section 02 42 13 Deconstruction of Structures
- .2 Section 02 42 16 Structure Demolition
- .3 Section 02 83 10 Lead- Base Paint Abatement
- .4 Section 02 84 00 Polychlorinate Biphenyl Remediation

### **1.3 REFERENCE STANDARDS**

- .1 Department of Justice Canada (Jus)
  - .1 Canadian Environmental Protection Act, 1999 (CEPA).
- .2 Transport Canada (TC)
  - .1 Transportation of Dangerous Goods Act, 1992 (TDGA).
- .3 Parks Canada Regulations and Guidelines

### **1.4 DEFINITIONS**

- .1 HEPA vacuum: High Efficiency Particulate Air filtered vacuum equipment with filter system capable of collecting and retaining fibres greater than 0.3 microns in any direction at 99.97% efficiency.
- .2 Amended Water: water with non-ionic surfactant wetting agent added to reduce water tension to allow thorough wetting of fibres.
- .3 Asbestos-Containing Materials (ACMs): materials that contain 0.5 per cent or more asbestos by dry weight and are identified under Existing Conditions including fallen materials and settled dust.
- .4 Asbestos Work Area: area where work takes place which will, or may, disturb ACMs.
- .5 Authorized Visitors: Engineers, Consultants or designated representatives, and representatives of regulatory agencies.
- .6 Competent worker: in relation to specific work, means a worker who:
  - .1 Is qualified because of knowledge, training and experience to perform the work.
  - .2 Is familiar with the provincial and federal laws and with the provisions of the regulations that apply to the work.
  - .3 Has knowledge of all potential or actual danger to health or safety in the work.

- .7 Friable material: means material that:
  - .1 When dry, can be crumbled, pulverized or powdered by hand pressure, or
  - .2 Is crumbled, pulverized or powdered.
- .8 Non-Friable Material: material that when dry cannot be crumbled, pulverized or powdered by hand pressure.
- .9 Occupied Area: any area of the building or work site that is outside Asbestos Work Area.
- .10 Polyethylene: polyethylene sheeting or rip-proof polyethylene sheeting with tape along edges, around penetrating objects, over cuts and tears, and elsewhere as required to provide protection and isolation.
- .11 Sprayer: garden reservoir type sprayer or airless spray equipment capable of producing mist or fine spray. Must have appropriate capacity for work.

## **1.5 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submittals in accordance with Section 01 33 00- Submittal Procedures.
- .2 Submit proof satisfactory to Departmental Representative that suitable arrangements have been made to dispose of asbestos-containing waste in accordance with requirements of authority having jurisdiction.
- .3 Submit Provincial/Territorial and/or local requirements for Notice of Project Form.
- .4 Submit proof of Contractor's Asbestos Liability Insurance.
- .5 Submit to Departmental Representative necessary permits for transportation and disposal of asbestos-containing waste and proof that asbestos-containing waste has been received and properly disposed.
- .6 Submit proof that all asbestos workers and/or supervisor have received appropriate training and education by a competent person in the hazards of asbestos exposure, good personal hygiene and work practices while working in Asbestos Work Areas, and the use, cleaning and disposal of respirators and protective clothing.
- .7 Submit proof satisfactory to Departmental Representative that employees have respirator fitting and testing. Workers must be fit tested (irritant smoke test) with respirator that is personally issued.

## **1.6 QUALITY ASSURANCE**

- .1 Regulatory Requirements: comply with Federal, Provincial/Territorial, and local requirements pertaining to asbestos, provided that in case of conflict among these requirements or with these specifications, more stringent requirement applies. Comply with regulations in effect at time Work is performed.
- .2 Health and Safety:
  - .1 Perform construction occupational health and safety in accordance with local health and safety regulations.
  - .2 Safety Requirements: worker protection.
    - .1 Protective equipment and clothing to be worn by workers while in Asbestos Work Area include:
      - .1 Air purifying half-mask respirator with N-100, R-100 or P-100 particulate filter, personally issued to worker and marked as to efficiency and purpose, suitable for protection against asbestos and acceptable to Provincial Authority having jurisdiction. The respirator to be fitted so that there is an effective seal between the respirator and the worker's face, unless the respirator is equipped with a hood or helmet. The respirator to be cleaned, disinfected and inspected after use on each shift, or more often if necessary, when issued for the exclusive use of one worker, or after each use when used by more than one worker. The



respirator to have damaged or deteriorated parts replaced prior to being used by a worker; and, when not in use, to be stored in a convenient, clean and sanitary location. The employer to establish written procedures regarding the selection, use and care of respirators, and a copy of the procedures to be provided to and reviewed with each worker who is required to wear a respirator. A worker not to be assigned to an operation requiring the use of a respirator unless he or she is physically able to perform the operation while using the respirator.

- .2 Disposable-type protective clothing that does not readily retain or permit penetration of asbestos fibres. Protective clothing to be provided by the employer and worn by every worker who enters the work area, and the protective clothing shall consist of a head covering and full body covering that fits snugly at the ankles, wrists and neck, in order to prevent asbestos fibres from reaching the garments and skin under the protective clothing to include suitable footwear, and to be repaired or replaced if torn.
- .2 Eating, drinking, chewing, and smoking are not permitted in Asbestos Work Area.
- .3 Before leaving Asbestos Work Area, the worker can decontaminate his or her protective clothing by using a vacuum equipped with a HEPA filter, or by damp wiping, before removing the protective clothing, or, if the protective clothing will not be reused, place it in a container for dust and waste. The container to be dust tight, suitable for asbestos waste, impervious to asbestos, identified as asbestos waste, cleaned with a damp cloth or a vacuum equipped with a HEPA filter immediately before removal from the work area, and removed from the work area frequently and at regular intervals.
- .4 Facilities for washing hands and face shall be provided within or close to the Asbestos Work Area.
- .5 Ensure workers wash hands and face when leaving Asbestos Work Area. Facilities for washing are to be provided at site by the Contractor.
- .6 Ensure that no person required to enter an Asbestos Work Area has facial hair that affects seal between respirator and face.

## **1.7 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate waste materials for recycling and reuse in accordance with Section 01 74 21- Construction/Demolition Waste Management and Disposal.
- .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal corrugated cardboard, plastic, polystyrene, paper, and packaging material in appropriate on-site bins for recycling in accordance with Waste Reduction Workplan.
- .4 Separate for recycling and reuse and place in designated containers metal, steel, plastic, and wood in accordance with Waste Reduction Workplan.
- .5 Place materials defined as hazardous or toxic in designated containers.
- .6 Handle and dispose of hazardous materials in accordance with the CEPA, TDGA, Regional and Municipal regulations.
- .7 Fold up metal banding, flatten and place in designated area for recycling.
- .8 Disposal of asbestos waste generated by removal activities must comply with Federal, Provincial, Territorial and Municipal regulations. Dispose of asbestos waste in sealed double thickness 6 mils bags or leak proof drums. Label containers with appropriate warning labels.

- .9 Provide manifests describing and listing waste created. Transport containers by approved means to licensed landfill for burial.

## **1.8 EXISTING CONDITIONS**

- .1 Reports and information pertaining to ACMs to be handled, removed, or otherwise disturbed and disposed of during this Project are bound into this specification immediately after this Section at back.
- .2 Notify Parks Canada Representative of friable material discovered during Work and not apparent from drawings, specifications, or report pertaining to Work. Do not disturb such material pending instructions from Departmental Representative.

## **1.9 SCHEDULING**

- .1 Hours of Work: perform work involving work covered by this specification section during the hours agreed upon by the Contractor and the Departmental Representative.

## **1.10 PERSONNEL TRAINING**

- .1 Before beginning Work, provide Departmental Representative satisfactory proof that every worker has had instruction and training in hazards of asbestos exposure, in personal hygiene and work practices, and in use, cleaning, and disposal of respirators and protective clothing.
- .2 Instruction and training related to respirators includes, following minimum requirements:
  - .1 Fitting of equipment.
  - .2 Inspection and maintenance of equipment.
  - .3 Disinfecting of equipment.
  - .4 Limitations of equipment.
- .3 Instruction and training must be provided by a competent, qualified person.

## **PART 2 PRODUCTS**

### **2.1 MATERIALS**

- .1 Drop Sheets:
  - .1 Polyethylene: 0.15 mm thick.
  - .2 FR polyethylene: 0.15 mm thick woven fibre reinforced fabric bonded both sides with polyethylene.
- .2 Wetting Agent: 50% polyoxyethylene ester and 50% polyoxyethylene ether mixed with water in a concentration to provide thorough wetting of asbestos-containing material.
- .3 Waste Containers: contain waste in two separate containers.
  - .1 Inner container: 0.15 mm thick sealable polyethylene waste bag.
  - .2 Outer container: sealable metal or fibre type where there are sharp objects included in waste material; otherwise outer container may be sealable metal or fibre type or second 0.15 mm thick sealable polyethylene bag.
  - .3 Labelling requirements: affix pre-printed cautionary asbestos warning in both official languages that is visible when ready for removal to disposal site.
- .4 Slow - drying sealer: non-staining, clear, water - dispersible type that remains tacky on surface for at least 8 hours and designed for purpose of trapping residual asbestos fibres.
- .5 Tape: fibreglass - reinforced duct tape suitable for sealing polyethylene under both dry conditions and wet conditions using amended water.

## **PART 3 EXECUTION**

### **3.1 PROCEDURES**

- .1 Do construction occupational health and safety in accordance with local health and safety requirements.
- .2 Before beginning Work, isolate Asbestos Work Area using, minimum, preprinted cautionary asbestos warning signs in both official languages that are visible at access routes to Asbestos Work Area.
  - .1 Remove visible dust from surfaces in the work area where dust is likely to be disturbed during course of work.
  - .2 Use HEPA vacuum or damp cloths where damp cleaning does not create a hazard and is otherwise appropriate.
  - .3 Do not use compressed air to clean up or remove dust from any surface.
- .3 Prevent spread of dust from Asbestos Work Area using measures appropriate to work to be done.
  - .1 Use FR polyethylene drop sheets over flooring such as carpeting that absorbs dust and over flooring in Asbestos Work Area where dust and contamination cannot otherwise be safely contained. Drop sheets are not to be reused.
- .4 Wet materials containing asbestos to be cut, ground, abraded, scraped, drilled, or otherwise disturbed unless wetting creates hazard or causes damage.
  - .1 Use garden reservoir type low - velocity fine - mist sprayer.
  - .2 Perform Work to reduce dust creation to lowest levels practicable.
  - .3 Work will be subject to visual inspection and air monitoring.
  - .4 Contamination of surrounding areas indicated by visual inspection or air monitoring will require complete enclosure and clean-up of affected areas.
- .5 Frequently and at regular intervals during Work and immediately on completion of work:
  - .1 Dust and waste to be cleaned up and removed using a vacuum equipped with a HEPA filter, or by damp mopping or wet sweeping, and placed in a waste container, and
  - .2 Drop sheets to be wetted and placed in a waste container as soon as practicable.
- .6 Cleanup:
  - .1 Place dust and asbestos containing waste in sealed dust-tight waste bags. Treat drop sheets and disposable protective clothing as asbestos waste; wet and fold these items to contain dust, and then place in plastic bags.
  - .2 Clean exterior of each waste-filled bag using damp cloths or HEPA vacuum and place in second clean waste bag immediately prior to removal from Asbestos Work Area.
  - .3 Seal waste bags and remove from site. Dispose of in accordance with requirements of Provincial/Territorial and Federal Authority having jurisdiction. Supervise dumping and ensure that dump operator is fully aware of hazardous nature of material to be dumped and that the appropriate guidelines and regulations for asbestos disposal are followed.
  - .4 Perform final thorough clean-up of Work areas and adjacent areas affected by Work using HEPA vacuum.

**END OF SECTION**

## **PART 1 GENERAL**

### **1.1 SUMMARY**

- .1 Comply with requirements of this Section when performing following Work:
  - .1 Removal of lead-containing coatings with a chemical gel or paste and fibrous laminated cloth wrap on ceilings, walls, and toilet partitions.
  - .2 Removal of lead-containing coatings or materials using a power tool with an effective dust collection system equipped with a HEPA filter on ceilings, walls, and toilet partitions.
  - .3 Removal of lead-containing coatings or materials with non-powered hand tool, other than manual scraping and sanding on ceilings, walls, and toilet partitions.

### **1.2 RELATED REQUIREMENTS**

- .1 Section 02 42 13 Deconstruction of Structures
- .2 Section 02 42 16 Structure Demolition
- .3 Section 02 20 00.01 Asbestos Abatement- Minimum Precautions
- .4 Section 02 84 00 Polychlorinate Biphenyl Remediation

### **1.3 REFERENCE STANDARDS**

- .1 Department of Justice Canada
  - .1 Canadian Environmental Protection Act, 1999 (CEPA).
- .2 Health Canada
  - .1 Workplace Hazardous Materials Information System (WHMIS), Material Safety Data Sheets (MSDS).
- .3 Human Resources and Social Development Canada (HRSDC)
  - .1 Canada Labour Code Part II, - SOR 86-304 - Occupational Health and Safety Regulations.
- .4 Transport Canada (TC)
  - .1 Transportation of Dangerous Goods Act, 1992 (TDGA).
- .5 U.S. Environmental Protection Agency (EPA)
  - .1 EPA 747-R-95-007-1995, Sampling House Dust for Lead.
- .6 U.S. Department of Health and Human Services/Centers for Disease Control and Prevention/National Institute for Occupational Safety and Health (NIOSH)
  - .1 NIOSH 94-113 - NIOSH Manual of Analytical Methods (NMAM), 4th Edition (1994).
- .7 U.S. Department of Labour - Occupational Safety and Health Administration (OSHA) - Toxic and Hazardous Substances
  - .1 Lead in Construction Regulation - 29 CFR 1926.62-1993.
- .8 Underwriters' Laboratories of Canada (ULC)
- .9 Parks Canada Regulations and Guidelines

### **1.4 DEFINITIONS**

- .1 HEPA vacuum: High Efficiency Particulate Air filtered vacuum equipment with a filter system capable of collecting and retaining fibres greater than 0.3 microns in any direction at 99.97% efficiency.
- .2 Authorized Visitors: Departmental Representative or designated representative[s].
- .3 Polyethylene: polyethylene sheeting or rip-proof polyethylene sheeting with tape along edges, around penetrating objects over cuts and tears, and elsewhere as required to

provide protection and isolation. For protection of underlying surfaces from damage and to prevent lead dust entering in clean area.

- .4 Sprayer: garden reservoir type sprayer or airless spray equipment capable of producing mist or fine spray. Must be appropriate capacity for scope of work.
- .5 Action level: employee exposure, without regard to use of respirators, to airborne concentration of lead of 50 micrograms per cubic metre of air (50 ug/m3) calculated as 8-hour time-weighted average (TWA). Minimum precautions for lead abatement are based on airborne lead concentrations less than 0.05 milligrams per cubic metre of air for removal of lead based paint by methods noted in paragraph 1.1.
- .6 Competent person: Departmental Representative capable of identifying existing lead hazards in workplace taking corrective measures to eliminate them.
- .7 Lead dust: wipe sampling on vertical surfaces and/or horizontal surfaces, dust and debris is considered to be lead contaminated if it contains more than 40 micrograms of lead in dust per square foot.

## **1.5 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00- Submittal Procedures.
- .2 Provide proof satisfactory to Parks Canada Representative that suitable arrangements have been made to dispose of lead based paint waste in accordance with requirements of authority having jurisdiction.
- .3 Provide proof of Environmental Liability and Contractor's General Insurance.
- .4 Quality Control:
  - .1 Provide Departmental Representative necessary permits for transportation and disposal of lead based paint waste and proof that lead based paint waste has been received and properly disposed.
  - .2 Provide proof satisfactory to Departmental Representative that employees have had instruction on hazards of lead exposure, respirator use, dress, and aspects of work procedures and protective measures.

## **1.6 QUALITY ASSURANCE**

- .1 Regulatory Requirements: comply with Federal, Provincial/Territorial and local requirements pertaining to lead paint, provided that in case of conflict among those requirements or with these specifications more stringent requirement applies. Comply with regulations in effect at time work is performed.
- .2 Health and Safety:
  - .1 Do construction occupational health and safety in accordance with local Health and Safety Requirements.
  - .2 Safety Requirements: worker and visitor protection.
    - .1 Protective equipment and clothing to be worn by workers and visitors in work Area include:
      - .1 Respirator NIOSH approved and equipped with replaceable HEPA filter cartridges with an assigned protection factor of 10, acceptable to Authority having jurisdiction. Suitable for type of lead and level of lead dust exposure. Provide sufficient amount of filters.
      - .2 Half mask respirator: half-mask particulate respirator with P - series filter, and 99% efficiency could be provided.
    - .2 Eating, drinking, chewing, and smoking are not permitted in work area.
    - .3 Ensure workers wash hands and face when leaving work area. Facilities for washing are to be provided at site by the Contractor.
    - .4 Visitor Protection:

- .1 Provide approved respirators to Authorized Visitors to work areas.
- .2 Instruct Authorized Visitors procedures to be followed in entering and exiting work area.

#### **1.7 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 Handle and dispose of hazardous materials in accordance with CEPA, TDGA, Regional and Municipal regulations.
- .3 Disposal of lead waste generated by removal activities must comply with Federal, Provincial, Territorial and Municipal regulations. Dispose of lead waste in sealed double thickness 6 ml bags or leak proof drums. Label containers with appropriate warning labels.
- .4 Provide manifests describing and listing waste created. Transport containers by approved means to licensed landfill for burial.

#### **1.8 EXISTING CONDITIONS**

- .1 Reports and information pertaining to lead based paint to be handled, removed, or otherwise disturbed and disposed of during this Project are bound into this specification immediately after this Section at back.
- .2 Notify Departmental Representative of lead based paint discovered during Work and not apparent from drawings, specifications, or report pertaining to Work. Do not disturb such material until instructed by Departmental Representative.

#### **1.9 SCHEDULING**

- .1 Not later than two days before beginning Work on this Project notify following in writing:
  - .1 Appropriate Regional or Zone Director of Medical Services Branch, Health Canada.
  - .2 Provincial Ministry of Labour.
  - .3 Disposal Authority.
- .2 Inform sub trades of presence of lead-containing materials identified in Existing Conditions.
- .3 Provide Departmental Representative copy of notifications prior to start of Work.
- .4 Hours of Work: perform work involving work covered by this specification section during the hours agreed upon by the General Contractor and the Owner

#### **1.10 PERSONNEL TRAINING**

- .1 Provide Departmental Representative satisfactory proof that every worker has had instruction and training in hazards of lead exposure, in personal hygiene, in aspects of work procedures, and in use, cleaning, and disposal of respirators.
- .2 Instruction and training related to respirators includes, at minimum:
  - .1 Proper fitting of equipment.
  - .2 Inspection and maintenance of equipment.
  - .3 Disinfecting of equipment.
  - .4 Limitations of equipment.
- .3 Instruction and training must be provided by competent, qualified person.
- .4 Supervisory personnel to complete required training.

## **PART 2 PRODUCTS**

### **2.1 MATERIALS**

- .1 Polyethylene 0.15mm thick unless otherwise specified; in sheet size to minimize joints.
- .2 Tape: fibreglass - reinforced duct tape suitable for sealing polyethylene under dry conditions and wet conditions using amended water.
- .3 Slow - drying sealer: non-staining, clear, water - dispersible type that remains tacky on surface for at least 8 hours and designed for purpose of trapping residual lead paint residue.
- .4 Lead waste containers: metal type acceptable to dump operator with tightly fitting covers and 0.15mm thickness sealable polyethylene liners.
  - .1 Label containers with pre-printed bilingual cautionary Warning Lead clearly visible when ready for removal to disposal site.

## **PART 3 EXECUTION**

### **3.1 SUPERVISION**

- .1 One Supervisor for every ten workers is required.
- .2 Supervisor must remain within work area during disturbance, removal, or handling of lead based paints.

### **3.2 PREPARATION**

- .1 Remove and store items to be salvaged or reused.
  - .1 Protect and wrap items and transport and store in area specified by Departmental Representative.
- .2 Work Area:
  - .1 Shut off and isolate HVAC system to prevent dust dispersal into other building areas. Conduct smoke tests to ensure duct work is airtight.
  - .2 Pre-clean fixed casework and equipment within work area, using HEPA vacuum and cover and seal with polyethylene sheeting and tape.
  - .3 Clean work area using HEPA vacuum. If not practicable, use wet cleaning method. Do not raise dust.
  - .4 Seal off openings with polyethylene sheeting and seal with tape.
  - .5 Protect floor surfaces covered from wall to wall with polyethylene sheets.
  - .6 Maintain emergency fire exits or establish alternatives satisfactory to Authority having jurisdiction.
  - .7 Where water application is required for wetting lead containing materials, provide temporary water supply appropriately sized for application of water as required.
  - .8 Provide electrical power and shut off for operation of powered tools and equipment. Provide 24 volt safety lighting and ground fault interrupter circuits on power source for electrical tools, in accordance with applicable CSA Standard. Ensure safe installation of electrical cables and equipment.
- .3 Do not start work until:
  - .1 Arrangements have been made for disposal of waste.
  - .2 Tools, equipment, and materials waste containers are on site.
  - .3 Arrangements have been made for building security.
  - .4 Notifications have been completed and preparatory steps have been taken.

### **3.3 LEAD ABATEMENT**

- .1 Removal of lead-containing coatings with a chemical gel or paste and fibrous laminated cloth wrap; or removal equipped with HEPA filters; or removal with using power tools non-powered hand tool, other than manual scraping and sanding.
- .2 Remove lead based paint in small sections and pack as it is being removed in sealable 0.15mm plastic bags and place in labelled containers for transport.
- .3 Seal filled containers. Clean external surfaces thoroughly by wet sponging. Remove from immediate working area to staging area. Clean external surfaces thoroughly again by wet sponging. Wash containers thoroughly pending removal to outside. Ensure containers are removed by workers who have entered from uncontaminated areas dressed in clean coveralls.
- .4 After completion of stripping work, wire brush and wet sponge surface from which lead based paint has been removed to remove visible material. During this work keep surfaces wet.
- .5 After wire brushing and wet sponging to remove visible lead based paint, and after encapsulating lead containing material impossible to remove, wet clean entire work area, and equipment used in process. After inspection by Departmental Representative apply continuous coat of slow drying sealer to surfaces of work area. Do not disturb work area for 8 hours no entry, activity, ventilation, or disturbance during this period.

### **3.4 INSPECTION**

- .1 Perform inspection to confirm compliance with specification and governing authority requirements. Deviations from these requirements not approved in writing by Departmental Representative will result in work stoppage, at no cost to Owner.
- .2 Departmental Representative will inspect work for:
  - .1 Adherence to specific procedures and materials.
  - .2 Final cleanliness and completion.
  - .3 No additional costs will be allowed by Contractor for additional labour or materials required to provide specified performance level.

### **3.5 LEAD SURFACE SAMPLING - WORK AREAS**

- .1 Final lead surface sampling to be conducted as follows:
  - .1 After work area has passed a visual inspection for cleanliness approved and accepted by Departmental Representative. Apply coat of lock-down agent to surfaces within enclosure, and appropriate setting period of 8 hours has passed, Departmental Representative will perform lead wipe sampling.
    - .1 Final lead wipe sampling results from horizontal and vertical surfaces must show lead levels of less than 40 micrograms of lead in dust per square foot. Samples collected and analyzed in accordance with EPA 747-R-95-007.
    - .2 If wipe sampling results show levels of lead in excess of 40 micrograms per square foot, re-clean work area at contractor's expense and apply another acceptable coat of lock-down agent to surfaces.
    - .3 Repeat as necessary until fibre levels are less than 40 micrograms per square foot.

### **3.6 FINAL CLEANUP**

- .1 Following cleaning and when lead wipe surfaces sampling are below acceptable concentrations, proceed with final cleanup.



- .2 Remove polyethylene sheet by rolling it away from walls to centre of work area. Vacuum visible lead containing particles observed during cleanup, immediately, using HEPA vacuum.
- .3 Place polyethylene sheets, tape, cleaning material, clothing, and contaminated waste in plastic bags and sealed labelled waste containers for transport.
- .4 Conduct final check to ensure no dust or debris remains on surfaces as result of dismantling operations.

### **3.7 RE-ESTABLISHMENT OF OBJECTS AND SYSTEMS**

- .1 Repair or replace objects damaged in course of work to their original state or better, as directed by Departmental Representative.

**END OF SECTION**

## **PART 1 GENERAL**

### **1.1 RELATED REQUIREMENTS**

- .1 Section 02 42 13 Deconstruction of Structures
- .2 Section 02 42 16 Structure Demolition
- .3 Section 02 20 00.01 Asbestos Abatement – Minimum Precautions
- .4 Section 02 83 10 Lead-Base Paint Abatement – Minimum Precautions

### **1.2 REFERENCE STANDARDS**

- .1 American Board of Industrial Hygiene (ABIH)
- .2 Canadian Council of Ministers of the Environment (CCME)
  - .1 PN1205-1995, PCB Transformer Decontamination: Standards and Protocols.
- .3 Department of Justice Canada (Jus)/CEPA SOR/92-507-SOR/2000-102, Storage of PCB Material Regulations
  - .1 Canadian Environmental Protection Act, 1999 (CEPA).
- .4 Environment Canada
  - .1 Manual for Spills of Hazardous Materials-1985.
- .5 National Research Council Canada (NRC)
  - .1 National Fire Code of Canada 2015(NFC).
- .6 Saskatchewan: Consolidated Statutes of Saskatchewan/Environmental Management and Protection Act 2002
  - .1 The PCB Waste Storage Regulations 21/89, R.R.S., c. E-10.2.
- .7 Transport Canada (TC)
  - .1 Transportation of Dangerous Goods Act, 1992 (TDGA).
- .8 Chlorobiphenyls Regulations (SOR/91-152; Amended SOR/2000-102)
  - .1 Regulations Respecting Mobile System for the Destruction and Treatment of Chlorobiphenyls that are Operated by or Under Contract with Federal Institutions (SOR/90-5; amended SOR/93-231 and SOR/2000-105).
  - .2 Regulations Respecting the Storage of Material Containing Chlorobiphenyls (PCBs) SOR/92-507, Amended SOR/2000-102).
  - .3 Regulations Respecting the Import and Export of Hazardous Wastes (SOR/92-637; Amended 94-459; SOR 94-684; SOR/2000-103).
  - .4 Waste Management - PCBs, R.R.O. Regulation 362/90.
  - .5 Mobile PCB Destruction Facilities, R.R.O. Regulation 352/90.
  - .6 Regulation 347, General Waste Management, as Amended.

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

- .1 Provide submittals in accordance with Section 01 33 00- Submittal Procedures.
- .2 Prior to starting work, Contractor performing work of this section to provide:
  - .1 Workplace Safety and Insurance Board Clearance Certificate.
  - .2 Insurance certificates.
  - .3 Company Health and Safety Policy.
  - .4 Certificate of Approval for Transportation of PCB Waste and Location of Destruction Facility.
  - .5 WHMIS Training Certificates for Personnel.
  - .6 Material Safety Data Sheets for chemicals or material to be used.
- .3 Submittals to Local Fire Department and Departmental Representative.

- .1 2 copies of books and records listed under Record Keeping of Control Submittals Article in PART 1 of this Section.
- .4 Waste location and description including:
  - .1 Building in which PCB waste is stored.
  - .2 Size of property used for storage site.
  - .3 Precise location of PCB waste at storage site.
  - .4 Container storage method used.
  - .5 Spill containment features in place at storage site.
  - .6 Security measures in place at storage site.
  - .7 Fire detection systems in place at storage site.

#### **1.4 CONTROL SUBMITTALS**

- .1 Co-ordinate procedural requirements with Section 01 45 00- Quality Control.
- .2 Record keeping: maintain and make available for review by environmental officer and Departmental Representative.
  - .1 Receipt of waste showing:
    - .1 Date of receipt of waste.
    - .2 Description of PCB waste including nameplate description, serial number, PCB registration number and quantity.
    - .3 Condition of PCB waste.
    - .4 Source of PCB waste.
    - .5 Name of carrier of PCB waste.
    - .6 Name of individual who accepted receipt of PCB waste.
  - .2 Removal of waste showing:
    - .1 Date of removal of PCB waste.
    - .2 Description of PCB waste including nameplate description, serial number, PCB registration number and quantity.
    - .3 Condition of PCB waste.
    - .4 Name of carrier of PCB waste.
    - .5 Destination of PCB waste.
    - .6 Name of individual authorizing transport of PCB waste.
  - .3 Monthly inspection, repair and replacement reports.
  - .4 Submit records to [Consultant] [Departmental Representative] [DCC Representative] as requested.

#### **1.5 QUALITY ASSURANCE**

- .1 Co-ordinate with Section 01 45 00- Quality Control.
- .2 Instruct personnel on dangers of PCB exposure, respirator use, decontamination and applicable Federal, Provincial/Territorial and Municipal Regulations.
- .3 Obtain services of industrial hygienist certified by American Board of Industrial Hygiene to certify training, review and approve PCB removal plan, including determination of need for personnel protective equipment (PPE) in performing PCB removal work.
- .4 Complete work so that at no time do PCB's contaminate site environment.

#### **1.6 SUPERVISION**

- .1 Provide on-site, a supervisor, with authority to oversee health and safety, remediation methods, scheduling, labour and equipment requirements.

- .2 One supervisor for every 10 workers is required.

## **1.7 DELIVERY, STORAGE AND HANDLING**

- .1 Place materials defined as hazardous or toxic in designated containers.
- .2 Handle and dispose of hazardous materials in accordance with the CEPA, TDGA, Regional and Municipal regulations.
- .3 Owners or operators of storage sites.
  - .1 Provide method for determining concentration of PCBs in particular waste at request of environment officer and Departmental Representative.
  - .2 Ensure personnel are familiar with and understand current PCB waste management procedures and use of personal protection equipment and clean-up techniques.
- .4 Disposal of PCB waste generated by removal activities must comply with Federal, Provincial, Territorial and Municipal regulations.
  - .1 Dispose of PCB waste in leak proof drums.
  - .2 Containers must be labelled with appropriate warning labels.
- .5 Create manifests describing and listing waste created and transport containers by approved means to licenced facility for storage.
  - .1 For each bulk load of PCBs: identity PCB waste, earliest date of removal from service for disposal, and weight in kilograms of the PCB waste.
  - .2 For each PCB Article Container or PCB Container: unique identifying number, type of PCB waste (i.e., soil, debris, small capacitors), earliest date of removal from service for disposal, and weight in kilograms of PCB waste contained.
  - .3 For each PCB Article not in PCB Container or PCB Article Container: serial number if available, or other identification if there is no serial number, date of removal from service for disposal, and weight in kilograms of PCB waste in each PCB Article.

## **PART 2 PRODUCTS**

### **2.1 STORAGE GENERAL**

- .1 Storage of PCB materials in accordance with Authority having jurisdiction.

### **2.2 STORAGE ENCLOSURE**

- .1 Isolate PCB control area by physical boundaries to prevent unauthorized entry of personnel.
- .2 Food, drink and smoking materials are not permitted in areas where PCBs are handled or PCB items are stored.
- .3 Room, building or structure with lockable entrance.
- .4 Temporary storage facility to be a fully enclosed block wall room within building with appropriate warning signs.
- .5 Woven mesh wire fence or other fence with similar characteristics at least 2.0 metres high, with lockable entrance.
- .6 Smoking is not permitted within 15 m of PCB control area.
  - .1 Provide and post "No Smoking" signs as directed by Departmental Representative.

## **2.3 STORAGE CONTAINERS**

- .1 Exterior containers:
  - .1 Structurally-sound and weather-sealed to hold PCB solids, PCB light ballasts, drained PCB containers or drained PCB equipment.
- .2 PCB solid storage.
  - .1 Drums and containers:
    - .1 Designed with sufficient durability and strength to prevent PCB solids from being released into environment, affected by weather, or contaminated by external sources.
    - .2 Steel or other material approved by Departmental Representative.
  - .2 Drums:
    - .1 Capacity no greater than 205 litres.
    - .2 Steel of minimum 1.2 mm for solids.
    - .3 Ensure closed-head double-bung steel drum with removable steel lid securely attached and complete with PCB-resistant gasket for solids.
    - .4 Paint or treat interior to prevent rusting.
  - .3 Drum Liners:
    - .1 6 mil clear polyethylene bag, 914 mm x 1524 mm, with opening at 914 mm end.

## **2.4 FLOORING AND ACCESSORIES**

- .1 Constructed of concrete or other material as approved by Departmental Representative.
- .2 Sufficient siding to contain at least twice volume of PCB liquid contained in largest item of PCB equipment on site or 25 percent of volume of PCB liquid on site, whichever is greater.
- .3 PCB Absorbing Surfaces:
  - .1 Floor, curbing, siding
- .4 Floor Opening, Floor Drains and Sumps:
  - .1 Closed and sealed to prevent escape of liquid.
  - .2 Connected to drainage system suitable for liquid dangerous goods that terminates at location where spilled liquids will be contained and recovered and where spilled liquids will not create fire hazard or risk to public health or safety.

## **2.5 EMERGENCY RESPONSE EQUIPMENT AND SYSTEMS**

- .1 Safety requirements in storage area:
  - .1 Heat and smoke sensory controls:
    - .1 Stops ventilation fan and closes intake and exhaust dampers of fan in event of fire inside building.
  - .2 Indoor fire alarm system:
    - .1 Fully operative and maintained, inspected and tested to National Fire Code of Canada (NFC).
    - .2 Portable fire extinguishers to be selected, installed, maintained, inspected and tested to National Fire Code of Canada (NFC).
    - .3 Automatic fire suppression system, as and when required to National Fire Code of Canada (NFC).
- .2 Storage site clean-up materials:
  - .1 Ensure availability at all time of sorbent or solvents, for clean-up of liquid or solids.

- .2 Ensure availability at all times of inert absorbent in sufficient quantity to contain minor leakage.
  - .1 Place in bottom of each container holding PCB equipment or fluorescent lighting ballasts.
- .3 Respirators: Certified by the National Institute of Occupational Safety and Health (NIOSH) or other testing agency acceptable to the Ministry of Labour.
  - .1 Use approved full-face organic vapour cartridge respirator for exposure to hot PCB.
  - .2 Vapour concentration less than or equal to 5 mg/m<sup>3</sup>.
    - .1 Supplied-air respirator with full face piece, helmet or hood.
    - .2 Self-contained breathing apparatus with full face piece.
  - .3 Vapour concentration greater than 5 mg/m<sup>3</sup> or unknown concentrations.
    - .1 Self-contained breathing apparatus with full face piece operated in positive pressure mode.
    - .2 Type C supplied-air respirator with full face piece operated in positive pressure of continuous flow mode and auxiliary self-contained breathing apparatus operated in positive pressure mode.

## 2.6 WARNING SIGNS AND LABELS

- .1 Label capacitors containing 0.5 kilogram or more of chlorobiphenyls with black and white serialized label, as approved by Departmental Representative in accordance with Manual of Spills of Hazardous Materials.
- .2 Label container with a capacitor containing 0.5 kg or more of chlorobiphenyls with black and white serialized, "ATTENTION PCB" label, as approved by Departmental Representative in accordance with Manual of Spills of Hazardous Materials.
- .3 Label electrical transformers, electromagnets and other equipment containing chlorobiphenyls in concentration exceeding 1% with black and white, serialized, "ATTENTION PCB" label, as approved by Departmental Representative in accordance with Manual of Spills of Hazardous Materials.
- .4 Label equipment and containers of equipment containing chlorobiphenyls in concentration exceeding 50 parts per million by weight but not greater than 1% with non-serialized, Warning Label for PCB-Contaminated Equipment as approved by Departmental Representative in accordance with Manual of Spills of Hazardous Materials.
- .5 Label containers of equipment, and drained containers containing chlorobiphenyls in concentration exceeding 1% with non-serialized, black and white, "ATTENTION PCB" label, as approved by Departmental Representative in accordance with Manual of Spills of Hazardous Materials.
- .6 Label containers of PCB material and drained containers of PCB material with chlorobiphenyl concentration exceeding 50 parts per million by weight with non-serialized, Warning Label for PCB-Contaminated Equipment as approved by Departmental Representative in accordance with Manual of Spills of Hazardous Materials.
- .7 Label doors to storage sites, fencing and other security barriers enclosing storage sites with non-serialized, black and white, "ATTENTION PCB" label, as approved by Departmental Representative in accordance with Manual of Spills of Hazardous Materials.
- .8 Maintain signs and labels in clear and legible condition.

## **PART 3 EXECUTION**

### **3.1 GENERAL**

- .1 Do construction occupational health and safety in accordance with local Health and Safety Requirements.
- .2 Store PCB waste materials to CEPA SOR/92-507.
- .3 Select PCB removal procedure to minimize contamination of work areas with PCB or other PCB-contaminated debris/waste. Handle PCBs such that no skin contact occurs.
- .4 As feasible, do not carry out PCB handling operations in confined spaces. Confined space means space having limited means of egress and inadequate cross ventilation.
- .5 Ensure that work operations or processes involving PCB or PCB-contaminated materials are conducted in accordance with Federal, Provincial/Territorial and Municipal Regulations and applicable requirements of this Section, including but not limited to:
  - .1 Obtaining advance approval of PCB storage sites.
  - .2 Notify Departmental Representative prior to beginning operations.
  - .3 Report leaks and spills to Departmental Representative.
  - .4 Maintain access log of employees working in PCB control area and provide copy to Departmental Representative upon completion of operations.
  - .5 Inspect PCB and PCB-contaminated items and waste containers for leaks and forward copies of inspection reports to Departmental Representative.
  - .6 Maintain spill kit for emergency spills entitled "PCB Spill Kit".
  - .7 Maintain inspection, inventory and spill records.

### **3.2 ACCESS TO STORAGE SITE**

- .1 Keep entrance to site locked or guarded.
- .2 Maintain register at site containing name, address, telephone number and place of business of each person who enters, or is authorized to enter site.
- .3 Permit only authorized personnel to enter site.

### **3.3 ACCESS TO STORED MATERIAL**

- .1 Store materials and equipment to permit easy access for inspection.

### **3.4 STORAGE PRACTICES**

- .1 Stack containers only if designed for stacking.
- .2 Stack liquid containers or drums no higher than 2 containers.
- .3 Separate stacked drums from each other with pallets.
- .4 Store material to prevent it catching fire.
- .5 Store material to prevent it being released.
- .6 Store PCB material together, and away from other stored materials.
- .7 Exterior:
  - .1 Cover PCB liquid containers with waterproof roof or cover extending beyond curbing or sides of container.
  - .2 Elevate PCB waste containers and PCB equipment on pallets or other suitable devices to reduce corrosion.
  - .3 Store transformers on skids.
- .8 Interior:
  - .1 Place on skids or pallets PCB equipment and containers of PCB material not permanently secured to floor or surface.

### 3.5 HANDLING TRANSFORMERS

- .1 Decontamination of stored waste PCB transformers:
  - .1 Drain dielectric fluid at installation location.
  - .2 Send fluid to approved incinerator for destruction.
  - .3 Drain transformer, switches, and regulators of free flowing liquid prior to transportation. Place drained liquids in DOT certified drums. Drums to contain not more than 190 L of oil.
  - .4 Transport transformer carcass to decontamination facility.
- .2 Re-use of transformers:
  - .1 Dielectric fluid concentration:
    - .1 Mineral oil transformers:
      - .1 Decontaminate by retrofilling.
      - .2 PCB fluid concentration no greater than 50 ppm verified by 90-day test.
    - .2 Askarel transformers:
      - .1 Decontaminate by series retrofilling.
      - .2 PCB fluid concentration no greater than 50 ppm verified by 90-day test.
      - .3 PCB fluid concentration no greater than 50 ppm verified on an annual basis for three years after completion of decontamination process.
      - .4 Silicone as final dielectric fluid:
        - .1 PCB fluid concentration no greater than 50 ppm verified for ten years at five year intervals.
      - .5 Porous materials:
        - .1 Considered PCB waste unless shown otherwise.
        - .2 Destroyed by methods approved for PCB waste.
  - .3 Recycling of Transformers:
    - .1 Dielectric fluid concentration:
      - .1 PCB fluid concentration no greater than 5 ppm verified by 90-day test in accordance with The PCB Waste Storage Regulations 21/89.
      - .2 PCB fluid concentration no greater than 50 ppm verified by 90-day test in accordance with The PCB Waste Storage Regulations 21/89.
      - .3 Small pole mount mineral oil transformers:
        - .1 Drained.
        - .2 PCB fluid concentration no greater than 500 ppm.
    - .2 Surface contamination:
      - .1 Solvent cleaned:
        - .1 10 ug/100 cm<sup>2</sup>.
      - .2 Shredded and incinerated:
        - .1 Less than 0.5 ppm by weight.
        - .2 10 ug/100 cm<sup>2</sup>.
    - .3 Porous materials:
      - .1 Considered PCB waste unless proven otherwise.
  - .4 Landfilling of Transformers:
    - .1 PCB fluid concentration no greater than 50 ppm before draining.



### **3.6 HANDLING LIQUID CHLOROBIPHENYL (54% CHLORINE)**

- .1 Use impervious clothing (nitrile), gloves, face shields 200 mm minimum and other appropriate protective clothing necessary to prevent skin contact. Do not use natural rubber, neoprene, or polyvinyl chloride (PVC).
- .2 Place contaminated clothing in closed containers for storage. Dispose of contaminated clothing in same manner as PCBs.
- .3 Ensure that contaminated non-pervious clothing is removed promptly and not reworn until cleaned.
- .4 Wear splash-proof safety goggles where liquid chlorobiphenyl (54% chlorine) may contact eyes.

### **3.7 EMERGENCY RESPONSES**

- .1 General:
  - .1 Immediately report to Departmental Representative PCB spills on ground or in water, PCB spills in drip pans, or PCB leaks.
  - .2 Rope off area around edges of PCB leak or spill and post "PCB Spill Authorized Personnel Only" caution sign. Immediately transfer leaking items to drip pan or other container.
  - .3 Initiate cleanup of spills as soon as possible, but no later than 48 hours of its discovery. If misting, elevated temperatures or open flames are present, or if spill is situated in confined space, notify Departmental Representative. Mop up liquid with rags or other conventional absorbent. Properly contained and dispose of spent absorbent as solid PCB waste.
  - .4 Workers to evacuate site. When leaving, shut down water in use. Only personnel trained in use of, and wearing SCUBA apparatus, will be allowed to re-enter site.
  - .5 Do not return to site until Owner's representative and Ministry of the Environment representatives have declared the area safe for re-entry.
- .2 Spill, leak, and disposal procedures:
  - .1 Permit access to only those wearing protective equipment and clothing.
  - .2 Issue poison warnings.
  - .3 Call local fire department or PCB Emergency Response Team.
  - .4 Avoid contact and inhalation.
  - .5 Remove ignition sources.
  - .6 Ventilate areas of spill or leak.
  - .7 Stop or reduce discharge if possible without risk.
  - .8 Collect spilled material for reclamation.
  - .9 Do not flush to sewer.
  - .10 Use only inert vermiculite absorbents as approved by Departmental Representative.
  - .11 Wipe contaminated area with rags and kerosene. Do not use acetone or toluene.
  - .12 Notify environmental authorities to determine disposal and clean-up procedures.
- .3 Fire protection and emergency procedures plan for storage sites.
  - .1 Ensure most recent revision of plan is in effect.
  - .2 Develop plan in consultation with local fire department.
  - .3 Ensure employees authorized to enter PCB storage site are familiar with contents of fire protection and emergency procedures plan.
  - .4 Send one copy to local fire department.
  - .5 Display one copy at storage site in area accessible in fire or spill situation.

- .6 Display one copy at storage site owner's place of business.
- .4 Respirators:
  - .1 Use when chlorobiphenyl concentrations are above permissible exposure levels.
  - .2 Use when entering tanks or closed vessels.
  - .3 Use in emergency situations.
- .5 Permissible exposure limit.
  - .1 0.5 milligram of chlorobiphenyl (54% chlorine) per cubic metre of air, averaged over 8 hours.
- .6 Fire protection:
  - .1 Wear totally encapsulated suit and self-contained breathing apparatus with full face piece operated in positive pressure mode

### **3.8 SANITATION**

- .1 Promptly wash liquid-contaminated skin with soap or mild detergent and water.
- .2 Prohibit eating and smoking in areas where liquid chlorobiphenyl (54% chlorine) is handled, processed or stored.
- .3 Wash hands thoroughly with soap or mild detergent and water after handling liquid chlorobiphenyl (54% chlorine).

### **3.9 PCB CONTAMINATED SOILS**

- .1 Excavation Procedures:
  - .1 Notify Departmental Representative at least 48 hours prior to start of excavation of contaminated soils.
  - .2 Use methods and equipment that result in minimal disturbance to remaining soil beyond excavation limits.
  - .3 Remove and dispose of material that becomes contaminated as result of Contractor's operation at no additional cost.
  - .4 Stage operations to minimize time contaminated soil is exposed to weather.
  - .5 Provide protection measures around area of contaminated soils to divert runoff of water from within excavation boundaries.
- .2 Underground Utilities:
  - .1 Location of existing utilities indicated is approximate and other underground utilities may be present. Scan construction site with electromagnetic and sonic equipment and mark surface of ground where existing underground utilities are discovered.
  - .2 Physically verify location and elevation of existing utilities indicated prior to beginning procedure. If utilities other than those indicated are found, stop Work and contact Departmental Representative. Protect existing utilities from damage and intrusion of PCBs
- .3 Dust Control:
  - .1 Maintain strict dust control to prevent dust particles with PCB's attached from becoming airborne. Sprinkle or treat soil at site and other areas disturbed by operations with dust suppressants or water.
- .4 Wash Down of Solid Material:
  - .1 Remove asphalt pavement, concrete slabs, and structures encountered above or below ground surface within excavation limits.
  - .2 Brush to remove soil materials and clean to limit specified for PCB surface contaminated solids by double rinsing, and place in adjacent rubble pile.

- .3 Collect and dispose of wash down water as contaminated water. Sample each type of solid material using either wipe samples or destructive samples at locations as directed by Departmental Representative.
- .4 Analyze samples for PCBs. Collect and test field blanks and replicates. Repeat cleaning process and testing until PCBs are below acceptable limits.
- .5 Remove contaminated soil to horizontal and vertical limits as indicated. Verify limits of clean soils by testing and sampling.
- .6 Handle and dispose of material within this area as PCB contaminated.
- .7 After excavation to indicated limits, conduct analysis of excavation to determine if remaining PCB contaminated soils exist.
- .8 Collect samples and test by field screening.
- .9 When field screening results show PCB concentrations below contamination level, test using confirmation sampling and testing. If groundwater is encountered prior to reaching vertical limits, notify Departmental Representative.
- .5 Field Screening:
  - .1 Collect soil samples at same interval as determined for confirmatory grid sampling plan along bottom and along sidewalls of excavation, and test using field screening test.
- .6 Confirmation Sampling and Testing:
  - .1 When field screening results show PCB concentrations below contaminated level, test using confirmation sampling and testing.
  - .2 Sample along bottom and sidewalls of excavation.
  - .3 Compositing of samples for analysis is not allowed.
  - .4 Determine moisture content of sample.
- .7 Additional Excavations:
  - .1 If field screening results indicate PCB contaminated soils remain, notify Departmental Representative.
  - .2 Where directed, continue excavation horizontal and vertical limits as directed by Departmental Representative.
  - .3 Collect and analyse additional confirmation samples in new excavation areas.
- .8 Stockpiled Material:
  - .1 Place soil removed from excavation in temporary containment area near excavation area.
  - .2 Divert water from containment area.
  - .3 Cover containment area with 0.75 mm polyethylene sheeting.
  - .4 Place excavated soil on impervious barrier and cover with 0.15mm polyethylene sheeting.
  - .5 Provide straw bale berm around outer limits of containment area and cover with polyethylene sheets.
  - .6 Secure edges of sheets to keep polyethylene sheeting in place.
  - .7 Cover excavated contaminated soil when not being worked. Maintain sheeting and replace when worn or ripped, or soil may be stockpiled in trucks suitable for carrying PCB contaminated soils.
- .9 Composite Testing of Stockpiled Material:
  - .1 Take composite samples from stockpiled material prior to removing from site.
  - .2 Analyze minimum of one composite sample for every 100 cubic metres or fraction thereof of soil to be disposed of from site.
  - .3 To develop composite sample of size necessary to run required tests, take several samples from different areas along surface and in centre of the stockpile.

- .4 Combine these samples and thoroughly mix to develop composite sample.
- .10 Contaminated Water:
  - .1 Furnish labour, materials, and equipment necessary for collecting, treating, and discharging of PCB-contaminated surface and subsurface water in excavations at site.
  - .2 Conduct excavation and backfilling operations at site in manner that minimizes amount of surface and subsurface water which may collect in open excavation.
  - .3 Collect standing surface water in contact with PCB contaminated material.
  - .4 Collect wash water.
  - .5 Collect ground, surface, and rain water contaminated by operations including water collected in open excavation pit or temporary containment.
  - .6 Soak up with absorbent material so that no free liquid is present.
  - .7 Containerize, sample, and analyse PCB absorbed material and dispose of as specified for contaminated soils.
  - .8 Subsurface Drainage:
    - .1 Remove water by pumping or other methods to prevent softening of surfaces exposed by excavation.
    - .2 Provide water treatment necessary to treat water to levels specified.
    - .3 Operate dewatering system continuously until construction work below existing water levels is complete.
    - .4 After placement of initial backfill, water level may be allowed to rise, but never above 300 mm below prevailing level of excavation or backfill.
    - .5 Submit performance records weekly.
    - .6 Measure and record performance of dewatering system at same time each day by use of observation wells or piezometers installed in conjunction with dewatering system
  - .9 Treatment System Requirements:
    - .1 Contractor is responsible for all aspects of verifying design parameters designing, providing, installing, operating, maintaining, and removing collection, storage, and treatment facilities as required to discharge treated waters within treatment limits required. Treatment system requirements:
      - .1 Be capable of removing PCB contaminants to below limit defined for contaminated water.
      - .2 Include effluent holding tanks designed to allow on-site testing of water quality prior to discharge.
      - .3 Include recycle capability for retreatment of effluent not meeting discharge requirements of this specification, as determined by on-site testing.
  - .10 Treatment System Operations:
    - .1 Monitor, test, and adjust the treatment system in compliance with Federal, Provincial/Territorial and Municipal regulatory requirements.
    - .2 If there is conflict between requirements, use more stringent requirement.
  - .11 Discharge of Treated Water:
    - .1 Do not discharge any water until tests results showing water is below PCB contaminated water limits.
    - .2 Provide erosion control at outlet of piping to minimize erosion.

- .3 Discharge for treated water to a location designated by Departmental Representative.
- .12 Cleanup and Removal of Treatment System:
  - .1 Upon completion of Work, close and remove from site surface water and groundwater treatment system.
  - .2 Restore site to its original condition.
  - .3 Containerize, sample, test, and dispose of carbon, residues, cleaning aids, decontamination liquids, and waste as specified for contaminated soils.
- .11 Transportation and Disposal:
  - .1 Furnish labour, materials, and equipment necessary to store, transport, and dispose of PCB contaminated material in accordance with Federal, Provincial/Territorial and Municipal requirements.
  - .2 Prepare and maintain waste shipment records and manifests as required.
  - .3 Transport PCB contaminated soils in vehicles designed to carry PCB contaminated soils in accordance with Federal, Provincial/Territorial and Municipal requirements.
  - .4 Transport PCB contaminated solid material, articles, or equipment in approved containers with removable heads in accordance with TDGA.
  - .5 Store liquid PCBs in Specification approved containers in accordance with TDGA.
  - .6 In addition to those requirements:
    - .1 Inspect and document vehicles and containers for proper operation and covering. Repair or replace damaged containers.
    - .2 Inspect vehicles and containers for proper markings, manifest documents, and other requirements for waste shipment.
    - .3 Perform and document decontamination procedures prior to leaving the site and again before leaving disposal site.
  - .7 Weight Certification:
    - .1 Weigh vehicles transporting PCB contaminated materials at provincially certified weigh scale within 24 km of site.
  - .8 Shipping Documentation:
    - .1 Before transporting PCB waste, sign and date manifest.
    - .2 Return signed copy to Departmental Representative.
    - .3 Ensure that manifest accompanies PCB waste at all times.
    - .4 Ensure transporter provides copy of manifest signed and dated by disposal facility.
  - .9 Solvent Cleaning:
    - .1 Clean contaminated tools, and containers, after use by rinsing three times with appropriate solvent or by wiping down three times with solvent wetted rag. Suggested solvents are Stoddard solvent or hexane.
- .12 Reports:
  - .1 Prepare and submit a remediation closeout report at completion of Work.
- .13 Backfilling, Grading, Topsoiling and Seeding.
  - .1 Begin backfilling in accordance with Section 31 23 33.01- Excavating, Trenching and Backfilling of excavation within 10 calendar days after receiving confirmatory test results that indicate no further PCB contamination is present.
  - .2 Soils brought in from off site for use as backfill to contain less than one part per million (ppm) PCBs.

- .3 Provide borrow site testing for PCBs from composite sample of material from borrow site, with at least one test from each borrow site.
- .4 Do not bring material on site until tests have been approved by Departmental Representative.
- .5 Provide backfill and compaction, grading and seeding in accordance with technical specifications.

### **3.10**

#### **FIELD QUALITY CONTROL**

- .1 Owners or Operators of Storage Sites:
  - .1 At request of inspector, measure concentration of PCBs in accordance with CEPA SOR/92-507 - Storage of PCB Material Regulations.
  - .2 Inspect storage site monthly and repair or replace, if necessary, PCB equipment, floors, drains, drainage systems, waterproof roofs or barriers, fire prevention apparatus, personnel protection equipment, security fences and materials used for clean-up at site.
  - .3 Immediately repair or replace drum, container or equipment found to be leaking PCBs.
  - .4 Immediately clean up contaminated area.
  - .5 Ensure controlled access to storage site to prevent entry by unauthorized persons.

**END OF SECTION**

## **PART 1        GENERAL**

### **1.1            SUMMARY**

- .1        Remove mould in accordance with Hazardous Materials Assessment (Appendix B).

### **1.2            RELATED REQUIREMENTS**

- .1        Section 02 41 00        Demolition
- .2        Section 02 41 16        Deconstruction of Structures
- .3        Section 02 81 01        Hazardous Materials
- .4        Section 02 82 00.01    Asbestos Abatement – Minimum Precautions
- .5        Section 02 83 10        Lead-Base Paint Abatement- Minimum Precautions
- .6        Section 02 84 00        Polychlorinate Biphenyl Remediation

### **1.3            REFERENCE STANDARDS**

- .1        American Conference of Governmental Industrial Hygienists (ACGIH), Bioaerosols Assessment and Control 1999.
- .2        Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1        Material Safety Data Sheets (MSDS).
- .3        New York City Department of Health - Bureau of Environmental and Occupational Disease Epidemiology's Guidelines on the Assessment and Remediation of Fungi in Indoor Environment 2000.
- .4        United States Department of Labor Occupational Safety and Health Administration (OSHA)
  - .1        29 CFR 1910.134 - Respiratory Protection.
  - .2        29 CFR 1910.1200 - Hazard Communication.
- .5        United States Environmental Protection Agency (EPA), Mould Remediation in Schools and Commercial Buildings, 2001.

### **1.4            DEFINITIONS**

- .1        Cleaning solution: detergent solution.
- .2        Competent person: individuals Departmental Representative who can demonstrate that mould remediation training has been obtained, is capable of identifying existing microbial hazards in workplace and selecting appropriate control strategy for microbial exposure.
- .3        Contractor: remediation contractor providing demolition and removal services as defined in specification.
- .4        Fibre reinforced polyethylene sheet (FRPS): rip-proof fibre reinforced polyethylene sheet sheeting with added fibre reinforced adhesive tape along edges.
- .5        HEPA vacuum: High Efficiency Particulate Air filtered vacuum equipment with filter system capable of collecting and retaining particles greater than 0.3 microns in any direction at 99.97% efficiency.
- .6        HVAC: heating ventilating and air-conditioning system[s] which serve occupied areas. Includes but is not limited to air handling units, duct work, terminal boxes and vents.
- .7        Mould Contaminated Work Area: specific area or location where actual work is being performed or such other areas of a facility where it has been determined that it may be hazardous to public health as result of mould remediation.
- .8        Occupied Area: areas of building or work site that is outside of Mould Contaminated Work Area.
- .9        PPE: Personnel Protection Equipment.

- .10 Sprayer: garden reservoir type sprayer or airless spray equipment capable of producing mist or fine spray. Must have a minimum of six litres capacity for work.

## **1.5 REGULATORY REQUIREMENTS**

- .1 Comply with regulations in effect at time work is performed. In case of conflict among these requirements or with these specifications the more stringent requirement applies. If no regulations exist, follow guidelines most widely accepted by recognized professional organizations such as occupational hygienists, health professionals or environmental engineers as listed in paragraph 1.2 Referenced Standards.

## **1.6 CLOSEOUT SUBMITTALS**

- .1 Maintain general log to provide permanent record of project. Maintain logs and other required documentation as part of permanent project file.

## **1.7 INSTRUCTION AND TRAINING**

- .1 Before commencing work, provide to Departmental Representative satisfactory proof that every worker has had instruction and training in potential health hazards of mould exposure, handling of hazardous materials, and in use of disposable respirators and protective clothing. This training can be performed as part of program to comply with requirements of OSHA Hazard Communication Standard.
- .2 Instruction and training must be provided by designated construction safety advisor.

## **1.8 WORKER PROTECTION**

- .1 Non-powered disposable filter-type respirator of type N95 OSHA 29 CFR 1910.134, suitable for protection against mould and acceptable to Provincial Authority having jurisdiction.
- .2 Gloves and eye protection.
- .3 Disposable paper coveralls are recommended.
- .4 No person required to enter Mould Contaminated Work Area to have facial hair that affects seal between respirator and face.
- .5 Eating, drinking and chewing are not permitted in Mould Contaminated Work Area.
- .6 Before leaving Mould Contaminated Work Area, dispose of protective clothing as waste as specified.
- .7 Ensure workers wash hands and face after leaving Mould Contaminated Work Area. Facilities for washing are located at site by General Contractor.

## **1.9 HOURS OF WORK**

- .1 Typical work schedule - Perform work after normal working hours and on weekends. Include in Contract Sum additional costs due to this requirement. Be available to work continuously from beginning to end of project.

## **PART 2 PRODUCTS**

### **2.1 MATERIALS**

- .1 Drop Sheets: 0.15 mm thick woven fibre reinforced fabric bonded both sides with fibre reinforced polyethylene sheet.
- .2 Disposal bags: dust-tight 0.15 mm clear polyethylene waste bags.
- .3 Wetting Agent: water to mist mould-containing material.
- .4 Cleaning solution: detergent solution for damp wipe and/or mop.



- .5 Fibre reinforced adhesive tape: used in sealing joints of fibre reinforced polyethylene sheets and for attachment of fibre reinforced polyethylene sheet to finished and unfinished surfaces. Fibre reinforced adhesive tape must be capable of adhering under both dry and wet conditions.
- .6 Materials: provide materials such as fibre reinforced polyethylene sheeting, lumber, nails, and hardware necessary to construct and dismantle barriers that isolate Mould Contaminated Work Area.

## **2.2 TOOLS AND EQUIPMENT**

- .1 Tools and equipment: suitable for use with microbial contamination and must be able to withstand de-contamination.
- .2 Personnel protective equipment (protective clothing, disposable respirators): provided in sufficient quantities for duration of project.
- .3 Vacuum cleaners: equipped with HEPA filters.
- .4 Ladders and/or scaffolds: adequate length, strength and sufficient quantity to support work schedule.

## **PART 3 EXECUTION**

### **3.1 PREPARATION OF MOULD WORK AREA (&LT;1 TO 3 SQUARE METRES IN OCCUPIED SPACE)**

- .1 Mould Contaminated Work Area and areas adjacent and around area: to be unoccupied. Vacating people from spaces adjacent to Mould Work Area is not necessary but is recommended in case of infants (less than 12 months old), elderly people, persons having undergone recent surgery, immune suppressed people or people with chronic inflammatory lung diseases.
- .2 Clean movable objects within proposed Mould Contaminated Work Area using HEPA filtered vacuum equipment, damp wipe surfaces and remove such objects from Mould Contaminated Work Area to secure and clean area.
- .3 Remove visible dust from surfaces in Mould Contaminated Work Area where dust is likely to be disturbed during course of work. Use HEPA vacuum and damp wipe area.
- .4 Do not use compressed air to clean up or remove dust from surfaces.
- .5 Seal off return air grills in Mould Contaminated Work Area with fibre reinforced polyethylene sheeting and fibre reinforced adhesive tape to minimize migration of contaminants to other parts of building.
- .6 Use 0.15 mm fibre reinforced polyethylene drop sheets tightly sealed with fibre reinforced adhesive tape over flooring in Mould Contaminated Work Area[s].

### **3.2 PREPARATION OF MOULD WORK AREA (&LT; 1 SQUARE METRE IN HVAC SYSTEM)**

- .1 HVAC system[s]: to be shut down prior to remedial activities.
- .2 Take necessary precautions to ensure that components of HVAC system[s] are not contaminated during remediation. Remove and bag filters.
- .3 Barriers: to be erected around Mould Contaminated Work Area before remediation using a single layer of 0.15 mm fibre reinforced polyethylene sheeting affixed to floor and ceiling with fibre reinforced adhesive tape, with slit entry and covering flap, to contain dust and debris.
- .4 Use 0.15 mm fibre reinforced polyethylene drop sheets tightly sealed to floor with fibre reinforced adhesive tape to minimize dust and contamination.

**3.3 MICROBIAL REMEDIATION MOULD WORK AREA (&LT;1 TO 3 SQUARE METRES IN OCCUPIED SPACE)**

- .1 Use sprayer (low-velocity, fine-mist) to mist (not wet) materials containing mould to be cut. Perform work in a manner to reduce dust creation to lowest levels practicable.
- .2 Non-porous and semi-porous materials can be cleaned using detergent solution and reused depending on depth to which microbial growth has penetrated substrate. Wood to be discarded if fungal growth has affected its soundness.
- .3 Porous materials wallboards, insulation, and ceiling tiles with more than small area of mould contamination and/or dampness to be removed, discarded and replaced.
- .4 Porous materials identified as lightly contaminated that can be cleaned by damp wiped can be reused, but to be discarded and replaced if possible.
- .5 Dispose of contaminated building materials as specified.
- .6 During remediation, should Departmental Representative suspect contamination of areas outside Mould Contaminated Work Area, contractor to stop remediation work and immediately decontaminate these affected areas. Eliminate causes of such contamination. Unprotected individuals are prohibited from entering contaminated area[s] until a visual inspection determines area[s] are free from contamination.
- .7 Notify Departmental Representative of mould contaminated material discovered during work and not apparent from drawings, specifications or report pertaining to work. Do not disturb such material pending instructions from Departmental Representative.

**3.4 MICROBIAL REMEDIATION MOULD WORK AREA (&LT; 1 SQUARE METRE IN HVAC SYSTEM)**

- .1 Use sprayer (low-velocity, fine-mist) to mist (not wet) materials containing mould to be cut. Perform work in a manner to reduce dust creation to lowest levels practicable.
- .2 Porous materials in HVAC system[s] such as insulation of interior lined ducts and filters must be removed to bare (underlying) metal and materials properly discarded.
- .3 Dispose of contaminated building materials as specified.
- .4 During remediation, should Departmental Representative suspect contamination of areas outside Mould Work Area, contractor to stop remediation work and immediately decontaminate these affected areas. Eliminate causes of such contamination. Unprotected individuals shall be prohibited from entering contaminated area[s] until visual inspection determines the area[s] are free from contamination.
- .5 Notify Departmental Representative of mould contaminated material discovered during work and not apparent from drawings, specifications, or report pertaining to work. Do not disturb such material pending instructions from Departmental Representative.
- .6 Submit Material Safety Data Sheet for biocides and use as recommended by HVAC manufacturer with HVAC components.

**3.5 REPAIR AND CLEAN-UP**

- .1 Clean, frequently during work and immediately after completion of work, Mould Contaminated Work Area using a HEPA vacuum and by damp mopping with cleaning solution.
- .2 Perform restoration of designated Mould Contaminated Work Area as specifies.
- .3 Leave areas dry and visibly free from contamination, debris and dust.
- .4 Perform final thorough clean-up of work areas and adjacent areas affected by work using HEPA vacuum and damp mopping with detergent solution.

### **3.6 WASTE DISPOSAL**

- .1 Place dust and mould-containing waste in doubled-bagged dust-tight 0.15 mm clear polyethylene waste bags. Treat drop sheets and disposable protective clothing as waste; fold these items to contain dust, and place in plastic bags. Securely seal bags.
- .2 Clean exterior of each waste-filled bag using damp cloths and cleaning solution or HEPA vacuum prior to removal from Mould Contaminated Work Area.
- .3 Remove waste bags from site and dispose. There is no special requirements for disposal of mouldy materials, as such they can be disposed of in landfill.

### **3.7 RE-ESTABLISHMENT OF OBJECTS AND SYSTEMS**

- .1 Relocate objects moved to temporary locations to their proper positions. Ensure objects are cleaned before been moved into cleaned areas.
- .2 Remount objects removed to former positions.
- .3 Reinstall filters in HVAC system[s].
- .4 Re-establish mechanical and electrical systems to proper working order.

### **3.8 FINAL CLEARANCE**

- .1 Departmental Representative to conduct thorough visual inspection to detect visible accumulations of dust or bulk materials remaining in work area. Should dust, debris, microbial contamination, or residue be detected repeat cleaning until area meets approval.

**END OF SECTION**

## **PART 1 GENERAL**

### **1.1 RELATED REQUIREMENTS**

- .1 Section 03 20 00: Concrete Reinforcement
- .2 Section 03 30 00: Cast-in-Place Concrete
- .3 Section 32 16 15: Concrete Walks, Curbs And Gutters

### **1.2 REFERENCE STANDARDS**

- .1 All referenced standards to be the current edition or the edition referenced by the applicable Building Code in force at the time of building permit application, as noted on Structural Drawings.
- .2 Canadian Standards Association (CSA International)
  - .1 CSA-A23.1-04/A23.2-04, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
  - .2 CSA-O86S1-05, Supplement No. 1 to CAN/CSA-O86-01, Engineering Design in Wood.
  - .3 CSA O121-M1978(R2003), Douglas Fir Plywood.
  - .4 CSA O151-04, Canadian Softwood Plywood.
  - .5 CSA O153-M1980(R2003), Poplar Plywood.
  - .6 CAN/CSA-O325.0-92(R2003), Construction Sheathing.
  - .7 CSA O437 Series-93(R2006), Standards for OSB and Waferboard.
  - .8 CSA S269.1-1975(R2003), Falsework for Construction Purposes.
  - .9 CAN/CSA-S269.3-M92(R2003), Concrete Formwork, National Standard of Canada
- .3 Underwriters' Laboratories of Canada (ULC)
  - .1 CAN/ULC-S701-05, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.
- .4 American Concrete Institute (ACI):
  - .1 ACI 117, Specification for Tolerances for Concrete Construction and Materials.
  - .2 ACI 347, Guide to Formwork for Concrete.

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

- .1 Submittals in accordance with Section 01 33 00- Submittal Procedures.
- .2 Submit shop drawings for formwork and falsework.
  - .1 Submit drawings stamped and signed by professional engineer registered or licensed in British Columbia, Canada.
- .3 Submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 02 81 01- Hazardous Materials.
- .4 Indicate method and schedule of construction, shoring, stripping and re-shoring procedures, materials, arrangement of joints, special architectural exposed finishes, ties, liners, and locations of temporary embedded parts. Comply with CAN/CSA-S269.3 for formwork drawings.
- .5 Indicate formwork design data: permissible rate of concrete placement, and temperature of concrete, in forms.
- .6 Indicate sequence of erection and removal of formwork/falsework as directed by Departmental Representative.

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

- .1 Waste Management and Disposal:
  - .1 Separate waste materials for recycling in accordance with Section 01 74 21 - Construction/demolition Waste Management And Disposal.
  - .2 Place materials defined as hazardous or toxic in designated containers.

### **PART 2 PRODUCTS**

#### **2.1 DESIGN REQUIREMENTS**

- .1

#### **2.2 MATERIALS**

- .1 Formwork materials:
  - .1 For concrete without special architectural features, use wood and wood product formwork materials to CAN/CSA-O86.
  - .2 For concrete with special architectural features, use formwork materials to CSA-A23.1/A23.2.
  - .3 Rigid insulation board: to CAN/ULC-S701.
- .2 Tubular column forms: round, spirally wound laminated fibre forms, internally treated with release material.
- .3 Form ties:
  - .1 For concrete not designated 'Architectural', use removable or snap-off metal ties, fixed or adjustable length, free of devices leaving holes larger than 25 mm diameter in concrete surface.
  - .2 For Architectural concrete, use snap ties complete with plastic cones and light grey concrete plugs.
- .4 Form release agent: non-toxic, biodegradable, low VOC.
- .5 Form stripping agent: colourless mineral oil, non-toxic, biodegradable, low VOC, free of kerosene, with viscosity between 70 and 110s Saybolt Universal at 40 degrees C, flashpoint minimum 150 degrees C, open cup.
- .6 Falsework materials: to CSA-S269.1.
- .7 Sealant: to Section 07 92 00- Joint Sealants.

### **PART 3 EXECUTION**

#### **3.1 FABRICATION AND ERECTION**

- .1 Verify lines, levels and centres before proceeding with formwork/falsework and ensure dimensions agree with drawings.
- .2 Obtain Departmental Representative's approval for use of earth forms framing openings not indicated on drawings.
- .3 Hand trim sides and bottoms and remove loose earth from earth forms before placing concrete.
- .4 Fabricate and erect falsework in accordance with CSA S269.1.
- .5 Refer to architectural drawings for concrete members requiring architectural exposed finishes.
- .6 Do not place shores and mud sills on frozen ground.

- .7 Provide site drainage to prevent washout of soil supporting mud sills and shores.
- .8 Fabricate and erect formwork in accordance with CAN/CSA-S269.3 to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CSA-A23.1/A23.2.
- .9 Align form joints and make watertight.
  - .1 Keep form joints to minimum.
- .10 Locate horizontal form joints for exposed columns 2400mm above finished floor elevation.
- .11 Use 25mm chamfer strips on external corners and/or 25mm fillets at interior corners, joints, unless specified otherwise.
- .12 Form chases, slots, openings, drips, recesses, expansion and control joints as indicated.
- .13 Build in anchors, sleeves, and other inserts required to accommodate Work specified in other sections.
  - .1 Ensure that anchors and inserts will not protrude beyond surfaces designated to receive applied finishes, including painting.
- .14 Clean formwork in accordance with CSA-A23.1/A23.2, before placing concrete.

### **3.2 REMOVAL AND RESHORING**

- .1 Leave formwork in place for following minimum periods of time after placing concrete.
  - .1 1 day.
- .2 Remove formwork when concrete has reached 15MPa
- .3 Re-use formwork and falsework subject to requirements of CSA-A23.1/A23.2.

**END OF SECTION**

**PART 1 GENERAL**

**1.1 RELATED REQUIREMENTS**

- .1 Section 03 10 00: Concrete Forming and Accessories.
- .2 Section 03 30 00: Cast-in-Place Concrete
- .3 Section 04 20 00: Unit Masonry.
- .4 Section 32 16 15: Concrete Walks, Curbs And Gutters

**1.2 PRICE AND PAYMENT PROCEDURES**

- .1 Measurement and Payment:
  - .1 No measurement will be made under this Section.
    - .1 Include reinforcement costs in items of concrete work in Section 03 30 00- Cast-In-Place Concrete.

**1.3 REFERENCE STANDARDS**

- .1 All referenced standards shall be the current edition or the edition referenced by the applicable Building Code in force at the time of building permit application, as noted on Structural Drawings.
- .2 American Concrete Institute (ACI)
  - .1 SP-66, ACI Detailing Manual 2004.
- .3 ASTM International
  - .1 ASTM A82/A82M, Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
  - .2 ASTM A143/A143M, Standard Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement.
  - .3 ASTM A185/A185M, Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
  - .4 ASTM A775/A775M, Standard Specification for Epoxy-Coated Reinforcing Steel Bars.
- .4 CSA International
  - .1 CSA-A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
  - .2 CAN/CSA-A23.3, Design of Concrete Structures.
  - .3 CSA-G30.18, Carbon Steel Bars for Concrete Reinforcement.
  - .4 CSA-G40.20/G40.21, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
  - .5 CSA W186, Welding of Reinforcing Bars in Reinforced Concrete Construction.
- .5 Reinforcing Steel Institute of Canada (RSIC)
  - .1 RSIC, Reinforcing Steel Manual of Standard Practice.

**1.4 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00- Submittal Procedures.
- .2 Prepare reinforcement drawings in accordance with RSIC Manual of Standard Practice, unless the Contract Documents contain a more stringent requirement. Conform to ACI SP 66 Detailing Manual whenever a detail condition is not covered by any of the above.

- .3 Shop Drawings:
  - .1 Submit drawings stamped and signed by professional engineer registered or licensed in British Columbia, Canada.
    - .1 Indicate placing of reinforcement and:
      - .1 Bar bending details.
      - .2 Lists.
      - .3 Quantities of reinforcement.
      - .4 Sizes, spacings, locations of reinforcement with identifying labels.
      - .5 Mechanical splices if approved by Departmental Representative
  - .2 Detail lap lengths and bar development lengths to CAN/CSA-A23.3, unless otherwise indicated.
    - .1 Provide Tension Lap type B [unless otherwise indicated]].

## **1.5 QUALITY ASSURANCE**

- .1 Submit in accordance with Section 01 45 00- Quality Control and as described in PART 2 - SOURCE QUALITY CONTROL.
  - .1 Mill Test Report: upon request, provide Departmental Representative with certified copy of mill test report of reinforcing steel.

## **1.6 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Replace defective or damaged materials with new.

## **PART 2 PRODUCTS**

### **2.1 MATERIALS**

- .1 Substitute different size bars only if permitted in writing by Departmental Representative.
- .2 Reinforcing steel: billet steel, grade 400 deformed bars to CSA-G30.18, unless indicated otherwise.
- .3 Reinforcing steel: weldable low alloy steel deformed bars to CSA-G30.18.
- .4 Cold-drawn annealed steel wire ties: to ASTM A82/A82M.
- .5 Welded steel wire fabric: to ASTM A185/A185M.
- .6 Welded deformed steel wire fabric: to ASTM A82/A82M.
- .7 Epoxy Coating of non-prestressed reinforcement: to ASTM A775/A775M.
- .8 Chairs, bolsters, bar supports, spacers: to CSA-A23.1/A23.2.
- .9 Mechanical splices: subject to approval of Departmental Representative.
- .10 Plain round bars: to CSA-G40.20/G40.21.

### **2.2 FABRICATION**

- .1 Fabricate reinforcing steel in accordance with CSA-A23.1/A23.2.
- .2 Obtain Departmental Representative's written approval for locations of reinforcement splices other than those shown on placing drawings.



- .3 Upon approval of Departmental Representative, weld reinforcement in accordance with CSA W186.
- .4 Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and lists.

### **2.3 SOURCE QUALITY CONTROL**

- .1 Upon request, provide Departmental Representative with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis, minimum [4] weeks prior to beginning reinforcing work.

## **PART 3 EXECUTION**

### **3.1 FIELD BENDING**

- .1 Do not field bend or field weld reinforcement except where indicated or authorized by Departmental Representative.
- .2 When field bending is authorized, bend without heat, applying slow and steady pressure.
- .3 Replace bars, which develop cracks or splits.

### **3.2 PLACING REINFORCEMENT**

- .1 Place reinforcing steel in accordance with CSA-A23.1/A23.2.
- .2 Use plain round bars as slip dowels in concrete.
  - .1 Paint portion of dowel intended to move within hardened concrete with one coat of asphalt paint.
  - .2 When paint is dry, apply thick even film of mineral lubricating grease.
- .3 Prior to placing concrete, obtain Departmental Representative's approval of reinforcing material and placement.
- .4 Ensure cover to reinforcement is maintained during concrete pour.
- .5 Protect [epoxy] [paint]coated portions of bars with covering during transportation and handling.

### **3.3 FIELD TOUCH-UP**

- .1 Touch up damaged and cut ends of epoxy coated or galvanized reinforcing steel with compatible finish to provide continuous coating.

### **3.4 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 recycling in accordance with Section 01 74 21- Construction/Demolition Waste Management and Disposal.

**END OF SECTION**

**PART 1 GENERAL**

**1.1 RELATED REQUIREMENTS**

- .1 Section 03 10 00: Concrete Forming and Accessories.
- .2 Section 03 20 00: Concrete Reinforcing.
- .3 Section 03 35 00: Concrete Finishing.
- .4 Section 05 12 23: Structural Steel for Buildings.
- .5 Section 32 16 15: Concrete Walks, Curbs And Gutters.

**1.2 PRICE AND PAYMENT PROCEDURES**

- .1 Measurement and Payment:
  - .1 Cast-in-place concrete will not be measured but will paid for as fixed price item.
  - .2 Supply and installation of anchor bolts, nuts and washers and bolt grouting will not be measured but considered incidental to work.

**1.3 REFERENCE STANDARDS**

- .1 All referenced standards to be the current edition or the edition referenced by the applicable Building Code in force at the time of building permit application, as noted on Structural Drawings.
- .2 ASTM International
  - .1 ASTM C260/C260M, Standard Specification for Air-Entraining Admixtures for Concrete.
  - .2 ASTM C309, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
  - .3 ASTM C494/C494M, Standard Specification for Chemical Admixtures for Concrete.
  - .4 ASTM C1017/C1017M, Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
  - .5 ASTM D412, Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension.
  - .6 ASTM D1751, Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
  - .7 ASTM D1752, Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.
- .3 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-37.2, Emulsified Asphalt, Mineral Colloid-Type, Unfilled, for Dampproofing and Waterproofing and for Roof Coatings.
  - .2 CAN/CGSB-51.34, Vapour Barrier, Polyethylene Sheet for Use in Building Construction.
- .4 CSA International
  - .1 CSA A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
  - .2 CSA A283, Qualification Code for Concrete Testing Laboratories.
  - .3 CSA A3000, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).

#### **1.4 ABBREVIATIONS AND ACRONYMS**

- .1 Portland Cement: hydraulic cement, blended hydraulic cement (XXb - b denotes blended) and Portland-limestone cement.
  - .1 Type GU, GUb and GUL - General use cement.
  - .2 Type MS and MSb - Moderate sulphate-resistant cement.
  - .3 Type MH, MHb and MHL - Moderate heat of hydration cement.
  - .4 Type HE, HEb and HEL - High early-strength cement.
  - .5 Type LH, LHb and LHL - Low heat of hydration cement.
  - .6 Type HS and HSb - High sulphate-resistant cement.
- .2 Fly ash:
  - .1 Type F - with CaO content less than 15%.
  - .2 Type CI - with CaO content ranging from 15 to 20%.
  - .3 Type CH - with CaO greater than 20%.
- .3 GGBFS - Ground, granulated blast-furnace slag.

#### **1.5 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00- Submittal Procedures.
- .2 Provide two copies of WHMIS MSDS in accordance with Section 01 35 29.06- Health and Safety Requirements and 01 35 43- Environmental Procedures.

#### **1.6 QUALITY ASSURANCE**

- .1 Quality Assurance: in accordance with Section 01 45 00- Quality Control.
- .2 Provide Departmental Representative, minimum 2 weeks prior to starting concrete work, with valid and recognized certificate from plant delivering concrete.
  - .1 Provide test data and certification by qualified independent inspection and testing laboratory that materials and mix designs used in concrete mixture will meet specified requirements.
- .3 Minimum 2 weeks prior to starting concrete work, provide proposed quality control procedures for review by Departmental Representative on following items:
  - .1 Falsework erection.
  - .2 Hot weather concrete.
  - .3 Cold weather concrete.
  - .4 Curing.
    - .1 Where HVSCM concrete is used, a detailed curing plan is required
  - .5 Finishes.
  - .6 Formwork removal.
  - .7 Joints.
- .4 Quality Control Plan: provide written report to Departmental Representative verifying compliance that concrete in place meets performance requirements of concrete as established in PART 2 - PRODUCTS.
- .5 Sustainability Standards Certification:
  - .1 Construction Waste Management: provide copy of plan.

#### **1.7 DELIVERY, STORAGE AND HANDLING**

- .1 Delivery and Acceptance Requirements:
  - .1 Concrete hauling time: deliver to site of Work and discharged within 120 minutes maximum after batching.

- .1 Do not modify maximum time limit without receipt of prior written agreement from Departmental Representative and concrete producer as described in CSA A23.1/A23.2.
  - .2 Deviations to be submitted for review by Departmental Representative.
- .2 Packaging Waste Management: In accordance with Section 01 74 21- Construction/Demolition Waste Management and Disposal.

## **PART 2 PRODUCTS**

### **2.1 DESIGN CRITERIA**

- .1 Alternative 1 - Performance: to CSA A23.1/A23.2, and as described in MIXES of PART 2 - PRODUCTS.

### **2.2 PERFORMANCE CRITERIA**

- .1 Quality Control Plan: ensure concrete supplier meets performance criteria of concrete as established by Departmental Representative and provide verification of compliance as described in PART 1 - QUALITY ASSURANCE.

### **2.3 MATERIALS**

- .1 Portland Cement: to CSA A3001, Type HS, GU.
- .2 Blended hydraulic cement: Type GUB, HSb to CSA A3001.
- .3 Supplementary cementing materials: GGBFS, Type CI fly ash replacement to CSA A3001.
- .4 Water: to CSA A23.1.
- .5 Aggregates: to CSA A23.1/A23.2.
- .6 Admixtures:
  - .1 Air entraining admixture: to ASTM C260.
  - .2 Chemical admixture: to ASTM C494. Departmental Representative to approve accelerating or set retarding admixtures during cold and hot weather placing.
- .7 Shrinkage compensating grout: premixed compound consisting of non-metallic aggregate, Portland cement, water reducing and plasticizing agents to CSA A23.1/A23.2.
  - .1 Compressive strength: 40 MPa at 28 days.
- .8 Curing compound: to ASTM C309, Type1-D with fugitive dye.

### **2.4 MIXES**

- .1 Alternative 1 - Performance Method for specifying concrete: to meet Departmental Representative performance criteria to CSA A23.1/A23.2.
  - .1 Ensure concrete supplier meets performance criteria as established below and provide verification of compliance as in Quality Control Plan.
  - .2 Provide concrete mix to meet following hard state requirements:
    - .1 Refer to drawings
  - .3 Provide quality management plan to ensure verification of concrete quality to specified performance.
  - .4 Concrete supplier's certification: both batch plant and materials meet CSA A23.1 requirements.

## **PART 3 EXECUTION**

### **3.1 PREPARATION**

- .1 Obtain Departmental Representative's written approval before placing concrete.
  - .1 Provide 24 hours minimum notice prior to placing of concrete.
- .2 Place concrete reinforcing in accordance with Section 03 20 00- Concrete Reinforcing.
- .3 During concreting operations:
  - .1 Development of cold joints not allowed.
  - .2 Ensure concrete delivery and handling facilitates placing with minimum of re-handling, and without damage to existing structure or Work.
- .4 Pumping of concrete is permitted only after approval of equipment and mix.
- .5 Ensure reinforcement and inserts are not disturbed during concrete placement.
- .6 Protect previous Work from staining.
- .7 Clean and remove stains prior to application for concrete finishes.
- .8 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.
- .9 Do not place load upon new concrete until authorized by Departmental Representative.

### **3.2 INSTALLATION/APPLICATION**

- .1 Do cast-in-place concrete work to CSA A23.1/A23.2.
- .2 Sleeves and inserts:
  - .1 Do not permit penetrations, sleeves, ducts, pipes or other openings to pass through joists, beams, column capitals or columns, except where indicated or approved by Departmental Representative.
  - .2 Where approved by Departmental Representative, set sleeves, ties, pipe hangers and other inserts and openings as indicated or specified elsewhere.
  - .3 Sleeves and openings greater than 100 x 100 mm not indicated, must be reviewed by Departmental Representative.
  - .4 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain written approval of modifications from Departmental Representative before placing of concrete.
  - .5 Confirm locations and sizes of sleeves and openings shown on drawings.
  - .6 Set special inserts for strength testing as indicated and as required by non-destructive method of testing concrete.
- .3 Anchor bolts:
  - .1 Set anchor bolts to templates in co-ordination with appropriate trade prior to placing concrete.
  - .2 Protect anchor bolt holes from water accumulations, snow and ice build-ups.
  - .3 Set bolts and fill holes with epoxy grout, as noted on drawings.
  - .4 Locate anchor bolts used in connection with expansion shoes, rollers and rockers with due regard to ambient temperature at time of erection.
- .4 Drainage holes and weep holes:
  - .1 Form weep holes and drainage holes in accordance with Section 03 10 00- Concrete Forming and Accessories. If wood forms are used, remove them after concrete has set.
  - .2 Install weep hole tubes and drains as indicated.
- .5 Dovetail anchor slots: in accordance with Section 04 05 00- Common Work Results for Masonry.

- .1 Install continuous vertical anchor slot to forms where masonry abuts concrete wall or columns.
- .2 Install continuous vertical anchor slots at 800mm on centre where concrete walls are masonry faced.
- .6 Grout under base plates using procedures in accordance with manufacturer's recommendations which result in 100% contact over grouted area.
- .7 Finishing and curing:
  - .1 Finish concrete to CSA A23.1/A23.2.
  - .2 Use procedures as reviewed by Departmental Representative and those noted in CSA A23.1/A23.2 to remove excess bleed water. Ensure surface is not damaged.

### **3.3 SURFACE TOLERANCE**

- .1 Concrete tolerance to CSA A23.1 Straightedge Method.

### **3.4 FIELD QUALITY CONTROL**

- .1 Site tests: conduct tests as follows [in accordance with Section 01 45 00- Quality Control and submit report as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS].
  - .1 Concrete pours.
  - .2 Slump.
  - .3 Air content.
  - .4 Compressive strength at 7 and 28 or 7 and 56days, as per specified performance exposure class.
  - .5 Air and concrete temperature.
- .2 Inspection and testing of concrete and concrete materials will be carried out by testing laboratory designated by Departmental Representative for review to CSA A23.1/A23.2.
  - .1 Ensure testing laboratory is certified to CSA A283.
- .3 The Owner will pay for costs of tests as specified in Section 01 29 83- Payment Procedures for Testing Laboratory Services.
- .4 Inspection or testing by Consultant will not augment or replace Contractor quality control nor relieve Contractor of his contractual responsibility.

### **3.5 CLEANING**

- .1 Clean in accordance with Section 01 74 11- Cleaning.
- .2 Waste Management: separate waste materials in accordance with Section 01 74 21- Construction/Demolition Waste Management and Disposal.
  - .1 Provide appropriate area on job site where concrete trucks and be safely washed.
  - .2 Do not dispose of unused admixtures and additive materials into sewer systems, into lakes, streams, onto ground or in other location where it will pose health or environmental hazard.
  - .3 Prevent admixtures and additive materials from entering drinking water supplies or streams.
  - .4 Using appropriate safety precautions, collect liquid or solidify liquid with inert, noncombustible material and remove for disposal.
  - .5 Dispose of waste in accordance with applicable local, Provincial/Territorial and National regulations.

**END OF SECTION**

**PART 1 GENERAL**

**1.1 RELATED REQUIREMENTS**

- .1 Section 03 30 00 Cast-In-Place Concrete
- .2 Section 07 92 00 Joint Sealants

**1.2 REFERENCE STANDARDS**

- .1 Canada Green Building Council (CaGBC)
  - .1 LEED Canada-NC Version 1.0-2004, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Package For New Construction and Major Renovations (including Addendum 2007).
  - .2 LEED Canada-CI Version 1.0-2007, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Guide For Commercial Interiors.
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-25.20-95, Surface Sealer for Floors.
- .3 CSA International
  - .1 CAN/CSA-A23.1-09/A23.2-09, Concrete Materials and Methods of Concrete Construction//Methods of Test for Concrete.
- .4 South Coast Air Quality Management District (SCAQMD), California State
  - .1 SCAQMD Rule 1168-A2005 (June 2006), Adhesives and Sealants Applications.

**1.3 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit submittals in accordance with Section 01 33 00- Submittal Procedures.
- .2 Product Data:
  - .1 Provide manufacturer's printed product literature and data sheets for concrete finishes and include product characteristics, performance criteria, physical size, finish and limitations.
    - .1 Provide two copies of WHMIS MSDS in accordance with Section 01 35 29.06- Health and Safety Requirements, and 01 35 43- Environmental Procedures. WHMIS MSDS acceptable to Labour Canada and Health and Welfare Canada for concrete floor treatment materials. Indicate VOC content in g/L.
    - .2 Include application instructions for concrete floor treatments.
- .3 Sustainable Design Submittals:
  - .1 LEED Canada- CI Version 1.0 Submittals: in accordance with Section 01 33 00- Submittal Procedures.

**1.4 ENVIRONMENTAL REQUIREMENTS**

- .1 Temporary lighting:
  - .1 Minimum 1200 W light source, placed 2.5 m above floor surface, for each 40 sq m of floor being treated.
- .2 Electrical power:
  - .1 Provide sufficient electrical power to operate equipment normally used during construction.
- .3 Work area:
  - .1 Make work area water tight protected against rain and detrimental weather conditions.



- .4 Temperature:
  - .1 Maintain ambient temperature of not less than 10 degrees C from 7 days before installation to at least 48 hours after completion of work and maintain relative humidity not higher than 40% during same period.
- .5 Moisture:
  - .1 Ensure concrete substrate is within moisture limits prescribed by flooring manufacturer.
- .6 Safety:
  - .1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials.
- .7 Ventilation:
  - .1 Departmental Representative will arrange for ventilation system to be operated during installation of concrete floor treatment materials. Ventilate area of work as directed by Departmental Representative by use of approved portable supply and exhaust fans.
  - .2 Ventilate enclosed spaces in accordance with Section 01 35 29.06- Health and Safety Requirements.
  - .3 Provide continuous ventilation during and after coating application.

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

- .1 Deliver, store and handle materials in accordance with Section with manufacturer's written instructions 01 61 00- Common Product Requirements.
- .2 Delivery and Acceptance Requirements:
  - .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .3 Packaging Waste Management: remove for reuse by manufacturer of padding, crates, pallets, packaging materials in accordance with Section 01 74 21- Construction/Demolition Waste Management and Disposal.
  - .1 Materials and Resources Credit and MRc2.2 Construction Waste Management: Divert 75% From Landfill: prepare Construction Waste Reduction Workplan in accordance with Section 01 78 00- Closeout Submittals, 01 35 43- Environmental Procedures, and 01 74 21- Construction/Demolition Waste Management and Disposal.

## **PART 2 PRODUCTS**

### **2.1 PERFORMANCE REQUIREMENTS**

- .1 Product quality and quality of work in accordance with Section 01 61 00- Common Product Requirements.
- .2 Submit written declaration that components used are compatible and will not adversely affect finished flooring products and their installation adhesives.

### **2.2 CHEMICAL HARDENERS**

- .1 Type 1 - Sodium silicate.
- .2 Water: potable.

## **2.3 SEALING COMPOUNDS**

- .1 Surface sealer: to CAN/CGSB-25.20, Type 1 - solvent-based, and clear.
- .2 Sealants: maximum VOC limit 250g/L to SCAQMD Rule 1168.
- .3 Surface sealer: acrylic carnuba wax.
- .4 Surface sealers are not manufactured or formulated with lead, halogenated solvents, formaldehyde, mercury, aromatic solvents, cadmium, or hexavalent chromium

## **2.4 CURING COMPOUNDS**

- .1 Select low VOC curing compounds.

## **2.5 CONCRETE STAINS**

- .1 Select low VOC concrete stains.

## **2.6 MIXES**

- .1 Mixing ratios in accordance with manufacturer's written instructions.

# **PART 3 EXECUTION**

## **3.1 EXAMINATION**

- .1 Verify that site conditions, substrate, and slab surfaces are ready to receive work and elevations are as recommended by manufacturer's written instructions.

## **3.2 PREPARATION OF EXISTING SLAB**

- .1 Rub exposed sharp edges of concrete with carborundum to produce 3 mm radiused edges unless otherwise indicated.
- .2 Saw cut control joints to CAN/CSA-A23.1, 24 hours maximum after placing of concrete.
- .3 Use mechanical stripping to remove chlorinated rubber or existing surface coatings.
- .4 Use eye protection and respiratory equipment during stripping of chlorinated rubber or existing surface coatings.

## **3.3 APPLICATION**

- .1 Apply concrete finishing floor hardener in accordance with manufacturer's written instructions.
- .2 After floor treatment is dry, seal control joints and joints at junction with vertical surfaces with sealant.
  - .1 Sealants: in accordance with Section 07 92 00- Joint Sealants
- .3 Apply floor treatment in accordance with Sealer manufacturer's written instructions.
- .4 Clean over spray. Clean sealant from adjacent surfaces.

## **3.4 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 recycling in accordance with Section 01 74 21- Construction/Demolition Waste Management and Disposal.

### **3.5 PROTECTION**

- .1 Protect finished installation in accordance with manufacturer's instructions.

### **3.6 SCHEDULE**

- .1 Table:

Surface Sealer	Location
CAN/CGSB-25.20, Type 1 - waterbased	All Exterior Concrete Pads

**END OF SECTION**

**PART 1 GENERAL**

**1.1 RELATED WORK**

- .1 Section 04 05 12 - Mortar and Masonry Grout: Mortar, grout and parging.
- .2 Section 04 05 19 - Masonry Reinforcement and Connectors: Reinforcing and tying.
- .3 Section 04 05 23 - Masonry Accessories.
- .4 Section 04 22 00 - Concrete Masonry Units.
- .5 Section 07 21 13 - Rigid Board Insulation.

**1.2 REFERENCES**

- .1 CSA-A179-14, Mortar and Grout for Unit Masonry.
- .2 CSA-A371-14, Masonry Construction for Buildings.
- .3 CSA-A370-14, Connectors for Masonry.

**1.3 SAMPLES**

- .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.

**1.4 TEST REPORTS**

- .1 Submit laboratory test reports in accordance Section 01 33 00 - Submittal Procedures.
- .2 Submit laboratory test reports certifying compliance of masonry units and mortar ingredients with specification requirements.

**1.5 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver materials to job site in dry condition.
- .2 Keep materials dry until use.
- .3 Store under waterproof cover on pallets or plank platforms held off ground by means of plank or timber skids.

**1.6 ENVIRONMENTAL REQUIREMENTS**

- .1 Cold weather requirements
  - .1 In accordance with CSA-A371.
  - .2 Supplement Clause 6.7.2 of CSA-A371 with following requirements:
    - .1 Maintain temperature of mortar between 5°C and 50°C until batch is used.
- .2 Hot weather requirements
  - .1 Protect freshly laid masonry from drying too rapidly, by means of waterproof, non-staining coverings.
  - .2 Keep masonry dry using waterproof, non-staining coverings that extend over walls and down sides sufficient to protect walls from wind driven rain, until masonry work is completed and protected by flashings or other permanent construction.
- .3 Protect masonry and other work from marking and other damage. Protect completed work from mortar droppings. Use non-staining coverings.
- .4 Provide temporary bracing of masonry work during and after erection until permanent lateral support is in place.

## **PART 2 PRODUCTS**

### **2.1 MATERIALS**

- .1 Masonry materials are specified in related Sections indicated in 1.1.

## **PART 3 EXECUTION**

### **3.1 INSTALLATION**

- .1 Do masonry work in accordance with CSA-A371 except where specified otherwise.
- .2 Build masonry plumb, level, and true to line, with vertical joints in alignment.
- .3 Layout coursing and bond to achieve correct coursing heights, and continuity of bond above and below openings, with minimum of cutting.

### **3.2 CONSTRUCTION**

- .1 Exposed masonry
  - .1 Remove chipped, cracked, and otherwise damaged units in exposed masonry and replace with undamaged units.
- .2 Jointing
  - .1 Allow joints to set just enough to remove excess water, then use tool with round jointer to provide smooth, joints true to line, compressed, uniformly concave joints.
  - .2 Strike flush all joints concealed in walls and joints in walls to receive plaster, tile, insulation, or other applied material except paint or similar thin finish coating.
- .3 Cutting
  - .1 Cut out for electrical switches, outlet boxes, and other recessed or built-in objects.
  - .2 Make cuts straight, clean, and free from uneven edges.
- .4 Building-In
  - .1 Build in items required to be built into masonry.
  - .2 Prevent displacement of built-in items during construction. Check plumb, location and alignment frequently, as work progresses.
  - .3 Brace door jambs to maintain plumb. Fill spaces between jambs and masonry with mortar.
- .5 Support of loads
  - .1 Use 30 MPa concrete to Section 03 30 00 - Cast-in-Place Concrete, where concrete fill is used in lieu of solid units.
  - .2 Use grout to CSA A179 where grout is used in lieu of solid units.
  - .3 Install building paper below voids to be filled with concrete; keep paper 25 mm back from faces of units.
- .6 Lintel, Bond Beams and Block Cores with Reinforcement
  - .1 Use 15 MPa concrete fill and shall have a maximum aggregate size of 14 mm and a slump of 150 +/- 20 mm.
- .7 Provision for movement
  - .1 Leave 40 mm space between top of non-load bearing walls and partitions and structural elements. Do not use wedges.
  - .2 Built masonry to tie in with stabilizers, with provision for vertical movement.

- .8 Control joints
  - .1 Provide control joints in masonry and veneer masonry at 9 metre maximum spacing. Coordinate with openings and Consultant prior to installation.

### **3.3 SITE TOLERANCES**

- .1 Tolerances in notes to Clause 6.2 of CSA-A371 apply.

### **3.4 FIELD QUALITY CONTROL**

- .1 Refer to Section 01 29 83 – Payment Procedures for Testing and Laboratory Services.
- .2 Contractor is responsible for carrying out quality control including inspection and testing.
- .3 Quality assurance will be carried out and paid by Departmental Representative.

**END OF SECTION**

**PART 1 GENERAL**

**1.1 RELATED WORK**

- .1 Section 04 05 10 - Masonry Procedures.

**1.2 REFERENCES**

- .1 CSA A179-14, Mortar and Grout for Unit Masonry.

**1.3 SAMPLES**

- .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.

**PART 2 PRODUCTS**

**2.1 MATERIALS**

- .1 Use same brands of materials and source of aggregate for entire project.
- .2 Mortar and grout: CSA A179.
- .3 Use aggregate passing 1.18 mm sieve where 6 mm thick joints are indicated.
- .4 Colour: ground coloured natural aggregates or metallic oxide pigments.
- .5 Mortar for exterior masonry above grade:
  - .1 Loadbearing: Type S based on Property specifications.
  - .2 Non-loadbearing: Type S based on Property specifications.
- .6 Mortar for interior masonry:
  - .1 Non-loadbearing: Type N based on Property specifications.
  - .2 Loadbearing: Type S based on Property specifications.
- .7 Grout: to CSA A179, Table 7.

**2.2 MIXES**

- .1 Mix grout to semi-fluid consistency.

**PART 3 EXECUTION**

**3.1 CONSTRUCTION**

- .1 Do masonry mortar and grout work in accordance with CSA A179 except where specified otherwise.
- .2 Apply parging in uniform coating not less than total 10 mm thick, where indicated.

**END OF SECTION**

**PART 1 GENERAL**

**1.1 RELATED WORK**

- .1 Section 04 05 10 - Masonry Procedures.
- .2 Section 04 05 23 - Masonry Accessories.

**1.2 REFERENCES**

- .1 CAN/CSA-A23.1-14, Concrete Materials and Methods of Concrete Construction.
- .2 CSA-A370-14, Connectors for Masonry.
- .3 CSA-A371-14, Masonry Construction for Buildings.
- .4 CSA G30.18-14, Billet-Steel Bars for Concrete Reinforcement.
- .5 CSA-S304.1-14, Masonry Design for Buildings.
- .6 CSA W186-M1990 R 2016, Welding of Reinforcing Bars in Reinforced Concrete Construction.

**1.3 SOURCE QUALITY CONTROL**

- .1 Upon request, provide Departmental Representative with certified copy of mill test report of reinforcement steel and connectors, showing physical and chemical analysis, minimum 5 weeks prior to commencing reinforcement work.
- .2 Upon request inform the Departmental Representative of proposed source of material to be supplied.

**1.4 SHOP DRAWINGS**

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop drawings consist of bar bending details, lists and placing drawings.
- .3 On placing drawings, indicate sizes, spacing, location and quantities of reinforcement and connectors.

**PART 2 PRODUCTS**

**2.1 MATERIALS**

- .1 Bar reinforcement: to CSA-A371 and CSA G30.18, Grade 400.
- .2 Wire reinforcement: to CSA-A371.
- .3 Connectors: to CSA-A370 and CSA3-S304.
- .4 Corrosion protection: to CSA-S304, galvanized.

**2.2 FABRICATION**

- .1 Fabricate reinforcing in accordance with CAN/CSA-A23.1 and Reinforcing Steel Manual of Standard Practice.
- .2 Fabricate connectors in accordance with CSA-A370.
- .3 Obtain Departmental Representative's approval for locations of reinforcement splices other than shown on placing drawings.
- .4 Ship reinforcement and connectors, clearly identified in accordance with drawings.



## **PART 3 EXECUTION**

### **3.1 GENERAL**

- .1 Do masonry connectors and reinforcement in accordance with CSA-A370, CSA-A371, CAN/CSA-A23.1 and CSA-S304 unless indicated otherwise.
- .2 Prior to placing grout, obtain Departmental Representative's approval of placement of reinforcement and connectors.
- .3 Do additional reinforcement of masonry as indicated.

### **3.2 REINFORCED LINTELS, BOND BEAMS AND BLOCK CORES**

- .1 Reinforce masonry lintels, bond beams and block cores as indicated.
- .2 Place and grout reinforcement in accordance with CSA-S304.

### **3.3 REINFORCEMENT**

- .1 Lap locations shall be staggered minimum 800 mm from course to course.
- .2 Joint reinforcement shall be made continuous at wall corners and wall intersections by use of "L" and "T" shaped pieces specifically fabricated for these applications.

### **3.4 GROUTING**

- .1 Grout masonry in accordance with CSA-S304 and as indicated.

### **3.5 METAL ANCHORS**

- .1 Do metal anchors as indicated.

### **3.6 LATERAL SUPPORT AND ANCHORAGE**

- .1 Do lateral support and anchorage in accordance with CSA-S304 and as indicated.
- .2 Secure veneer to masonry with ties at max. 600 mm O.C. vertically and 800 mm O.C. horizontally.
- .3 Install top row of masonry connectors not more than one-half of typical tie spacing below top of veneer panels.

### **3.7 CONTROL JOINTS**

- .1 Terminate reinforcement 25 mm short of each side of control joints unless otherwise indicated.

### **3.8 FIELD BENDING**

- .1 Do not field bend reinforcement and connectors except where indicated or authorized by Departmental Representative.
- .2 When field bending is authorized, bend without heat, applying a slow and steady pressure.
- .3 Replace bars and connectors which develop cracks or splits.

### **3.9 FIELD TOUCH-UP**

- .1 Touch up damaged and cut ends of epoxy coated or galvanized reinforcement steel and connectors with compatible finish to provide continuous coating.

**END OF SECTION**

**PART 1 GENERAL**

**1.1 RELATED WORK**

- .1 Section 04 05 00 – Common Work Results for Masonry.
- .2 Section 04 05 19 - Masonry Reinforcement and Connectors.

**1.2 REFERENCES**

- .1 ASTM D2240-2015, Test Method for Rubber Property - Durometer Hardness.
- .2 CSA-A371-14, Masonry Construction for Buildings.

**PART 2 PRODUCTS**

**2.1 MATERIALS**

- .1 Control joint filler: purpose-made elastomer to ASTM D2240 of size and shape indicated.
- .2 Lap adhesive: recommended by masonry flashing manufacturer.
- .3 Weep hole vents: galvanized steel Block-Lok BL-D.
- .4 Metal flashings.
  - .1 Wall Base Flashing - Same material as building flashings, 0.91 mm thickness, AZ150, factory pre-coat colour to be selected from manufacturer's standard range of colours.
  - .2 Lintel Flashing - Similar to wall base flashing except 0.61 mm thickness.

**PART 3 EXECUTION**

**3.1 INSTALLATION**

- .1 Install continuous control joint fillers in all control joints.
- .2 Install weep hole vents in vertical joints immediately over flashings, in exterior wythes of cavity wall and masonry veneer wall construction, at maximum horizontal spacing of 600 mm oc.

**3.2 CONSTRUCTION**

- .1 Build in flashings in masonry in accordance with CSA A371 as follows:
  - .1 Install flashings under exterior masonry bearing on foundation walls, slabs, shelf angles, and steel angles over openings. Install flashings under weep hole courses and as indicated.
  - .2 In cavity walls and veneered walls, carry flashings from front edge of masonry, under outer wythe, then up backing not less than 150 mm, and as follows:
    - .1 For masonry backing embed flashing 25 mm in joint.
    - .2 For concrete backing, insert flashing into reglets.
  - .3 For wood frame backing, staple flashing to walls behind sheathing paper.
  - .4 For gypsum board backing, bond to wall using manufacturer's recommended adhesive.
  - .5 Lap joints 150 mm and seal with adhesive.

**END OF SECTION**

## **PART 1 GENERAL**

### **1.1 RELATED WORK**

- .1 Section 04 05 00 – Common Work Results for Masonry.
- .2 Section 04 05 12 - Mortar and Masonry Grout.
- .3 Section 04 05 19 - Masonry Reinforcement and Connectors.
- .4 Section 04 05 23 - Masonry Accessories.

### **1.2 REFERENCES**

- .1 CSA-A165 SERIES-14 CSA Standards on Concrete Masonry Units.

## **PART 2 PRODUCTS**

### **2.1 MATERIALS**

- .1 Concrete Masonry Units:
  - .1 For each delivery to site, obtain from material supplier written certificate that concrete masonry units which were medium pressure cured, have completed curing process in manufacturer's plant and are ready for construction. Forward certificates to the Departmental Representative.
  - .2 Prior to commencement of masonry construction submit to the Departmental Representative copy of test reports for specified range of concrete masonry units. Test data shall have been obtained either from manufacturer's in-house testing or from independent testing agency retained by manufacturer. Test data shall be maximum nine (9) months old at time of submission.
  - .3 Standard concrete block units: to CSA-A165 Series.
  - .4 Classification: H/15/C/M.
  - .5 Hollow, normal weight.
  - .6 Size: metric modular: see structural/architectural drawings.
  - .7 Special shapes: provide bull-nosed units for exposed corners. Provide purpose-made shapes for lintels and bond beams. Provide additional special shapes as indicated.
  - .8 Concrete block units must be minimum 28 days old before using it in construction.
  - .9 Face of masonry units to be of uniform texture, free from spalled or broken edges.
  - .10 Water-repellent admixture: Integral water repellent admixture as recommended by concrete unit manufacturer.
- .2 Allan Block Masonry Units:
  - .1 200 x 200 x 400 mm Aztec blocks in "Silverado Blend"
  - .2 Aztec Capstone in "Silverado Blend"

## **PART 3 EXECUTION**

### **3.1 INSTALLATION**

- .1 Concrete block units and block veneer.
  - .1 Bond: running.
  - .2 Height: 200 mm for one block and one joint.

- .3 Jointing: concave where exposed or where paint or other finish coating is specified.
- .4 Install reinforcement and concrete in block cores as indicated.
- .5 Install corner blocks at all openings (doorways, exposed finishes at ventilation openings, etc.)
- .6 Construct cavity walls using techniques that will minimize mortar dropping in cavity space. This may require the use of batten boards to catch mortar droppings. No mortar shall bridge cavity space or plug cavity vents at bottom of cavity.
- .2 Concrete block lintels.
  - .1 Install reinforced concrete block lintels over openings in masonry where steel or reinforced concrete lintels are not indicated.
  - .2 End bearing: not less than 200 mm.
- .3 Steel lintels.
  - .1 Install steel lintels over openings in block veneer as indicated.
- .4 Allan Block Masonry Units:
  - .1 As per manufacturer's literature.

### **3.2**

#### **CLEANING**

- .1 Standard and Decorative block: Allow mortar droppings on masonry to partially dry then remove by means of trowel, followed by rubbing lightly with small piece of block and finally by brushing.

**END OF SECTION**

## **PART 1        GENERAL**

### **1.1        RELATED REQUIREMENTS**

- .1      Section 04 05 00        Common Work Results for Masonry
- .2      Section 04 05 12        Masonry Mortar and Grout
- .3      Section 04 05 19        Masonry Anchorage and Reinforcing
- .4      Section 07 62 00        Metal Flashing and Trim
- .5      Section 07 92 00        Joint Sealants

### **1.2        REFERENCE STANDARDS**

- .1      American Concrete Institute (ACI)
  - .1      ACI 530/530.1-11, Building Code Requirements and Specifications for Masonry Structures and Related Commentaries.
- .2      ASTM International
  - .1      ASTM A153/A153M-09, Standard Specification for Zinc Coated (Hot Dip) on Iron and Steel Hardware.
  - .2      ASTM A508/A508M-05b(2010), Standard Specification for Quenched and Tempered Vacuum-Treated Carbon and Alloy Steel Forgings for Pressure Vessels.
  - .3      ASTM A580/A580M-13a, Standard Specification for Stainless Steel Wire.
  - .4      ASTM C97/C97M-09, Standard Test Methods for Absorption and Bulk Specific Gravity of Dimension Stone.
  - .5      ASTM C99/C99M-09, Standard Test Method for Modulus of Rupture of Dimension Stone.
  - .6      ASTM C119-11 Standard Terminology Relating to Dimension Stone.
  - .7      ASTM C144-11, Standard Specification for Aggregate for Masonry Mortar.
  - .8      ASTM C150/C150M-12, Standard Specification for Portland Cement.
  - .9      ASTM C170/C170M-09, Standard Test Method for Compressive Strength of Dimension Stone.
  - .10     ASTM C207-06(2011), Standard Specification for Hydrated Lime for Masonry Purposes.
  - .11     ASTM C241/C241M-13, Standard Test Method for Abrasion Resistance of Stone Subjected to Foot Traffic.
  - .12     ASTM C270-12a, Standard Specification for Mortar for Unit Masonry.
  - .13     ASTM C568/C568M-10, Standard Specification for Limestone Dimension Stone.
  - .14     ASTM C780/C780M-12a, Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.
  - .15     ASTM C880/C880M-09, Standard Test Method for Flexural Strength of Dimension Stone.
  - .16     ASTM C1242-12ae1, Standard Guide for Design, Selection, and Installation of Stone Anchors and Anchoring Systems.
- .3      Canada Green Building Council (CaGBC)
  - .1      LEED Canada-NC Version 1.0-[2004], LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Package For New Construction and Major Renovations (including Addendum 2007).
  - .2      LEED Canada-CI Version 1.0-2007, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Guide For Commercial Interiors.

- .3 LEED Canada 2009 for Design and Construction-2010, LEED Canada 2009 for Design and Construction Leadership in Energy and Environmental Design Green Building Rating System Reference Guide.
- .4 LEED Canada for Existing Buildings, Operations and Maintenance-2009, LEED Canada 2009 Leadership In Energy and Environmental Design Green Building Rating System Reference Guide.
- .4 CSA Group
  - .1 CAN/CSA-A179-04(R2009), Mortar and Grout for Unit Masonry.
  - .2 CAN/CSA-A370-04(R2009), Connectors for Masonry.
  - .3 CAN/CSA-A371-04(R2009), Masonry Construction for Buildings.
  - .4 CAN/CSA-A3000-08, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
- .5 International Masonry Industry All-Weather Council (IMIAC)
  - .1 Recommended Practices and Guide Specifications for Cold Weather Masonry Construction.
- .6 South Coast Air Quality Management District (SCAQMD)
  - .1 SCAQMD Rule 1168-05, Adhesive and Sealant Applications.

### 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 dimensional stone veneer cladding and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
  - .1 Submit drawings stamped and signed by professional engineer registered or licensed in British Columbia, Canada.
  - .2 Indicate sizes and sections of stone, arrangements of joints and bonding, anchoring, dowelling and cramping.
  - .3 Each stone indicated on shop drawings must bear corresponding number marked on its back or bed.
- .4 Samples:
  - .1 Submit sample for each finish product specified, 2 complete sets representing manufacturer's full range of available colours, textures, and patterns.
- .5 Sustainable Design Submittals:
  - .1 LEED Canada submittals: in accordance with Section 01 33 00- Submittal Procedures.
  - .2 Construction Waste Management:
    - .1 Submit project Waste Reduction Workplan highlighting recycling and salvage requirements.
    - .2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating that 75% of construction wastes were recycled or salvaged.
  - .3 Recycled Content:
    - .1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of post-consumer content, and total cost of materials for project.
  - .4 Regional Materials: submit evidence that project incorporates required percentage.

#### **1.4 QUALITY ASSURANCE**

- .1 Test Reports: submit certified test reports including sand gradation tests in accordance with CAN/CSA-A179 showing compliance with specified performance characteristics and physical properties, and in accordance with Section 04 05 00- Common Work Results for Masonry.
- .2 Mock-ups:
  - .1 Construct mock-ups in accordance with Section 01 45 00- Quality Control.
    - .1 Construct mock-up panel of exterior dimension stone veneer construction 1200 x 1800 mm, showing colours and textures, use of reinforcement, ties, through wall flashing, weep holes, jointing, coursing, mortar and quality of work.
    - .2 Mock-up used:
      - .1 To judge quality of work, substrate preparation, operation of equipment and material application.
    - .3 Perform test cleaning on mock-up to ensure desired result as per article CLEANING.

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

- .1 Deliver, store and handle materials in accordance with Section 01 61 00- Common Product Requirements and 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 dry location, off ground, and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect dimension stone veneer cladding from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.
- .4 Develop Waste Reduction Workplan related to Work of this Section and in accordance with Section 01 35 43 – Environmental Procedures.
- .5 Packaging Waste Management: remove for reuse by manufacturer of padding, crates, packaging materials, pallets, as specified in Waste Reduction Workplan in accordance with Section 01 74 21- Construction/Demolition Waste Management and Disposal.

#### **1.6 SITE CONDITIONS**

- .1 Ambient Conditions:
  - .1 Do not install at temperatures below 10 degrees C or above 30 degrees C.
  - .2 Maintain temperatures at or above 10 degrees C until cementitious materials have fully cured.
  - .3 Cold Weather Requirements: IMIAC - Recommended Practices and Specifications for Cold Weather Masonry Construction.
  - .4 Do not apply epoxy mortar and grouts at temperatures below 15 degrees C or above 25 degrees C.
- .2 Field Measurements:
  - .1 Make field measurements necessary to ensure the proper fit of all members.

## **PART 2 PRODUCTS**

### **2.1 ACCEPTABLE MANUFACTURER**

- .1 Manufacturer: K2 Stone Inc., 930 Maughan Road, Duke Point Industrial Park, Nanaimo B.C., V9X 1J2, Phone: (250) 722-2420 or (866) 722-2406, URL: [www.K2Stone.ca](http://www.K2Stone.ca) .

### **2.2 DESIGN CRITERIA**

- .1 General: design, fabricate and install stonework to withstand normal loads from wind, gravity, movement of building structure, seismic forces and thermally induced movement, as well as to resist deterioration under conditions of normal use including exposure to weather, without failure.
- .2 Engineering Calculations: base calculations on design loads, material properties, and applicable safety factors, in compliance with applicable codes and Building Standards. Include following information as part of calculations:
  - .1 Stone loads and allowable loads,
  - .2 Stone thicknesses,
  - .3 Support and anchorage loads, stresses, safety factors, design loads, and allowable loads,
  - .4 Support and anchorage sizes.
- .3 Design connections and attachments for full bed stone to CAN/CSA-A370.
- .4 Design, detail and fabricate connections to provide allowance for fabrication tolerances, erection tolerances and structural deflections. Refer to CAN/CSA-A370 and CAN/CSA-A371.
- .5 Control of Corrosion: prevent galvanic and other forms of corrosion by insulating metals and other materials from direct contact with non-compatible materials, or by suitable coating.

### **2.3 MORTAR MATERIALS**

- .1 Portland Cement: to CAN/CSA-A3000, Type GU: colour as selected by Departmental Representative.
- .2 Hydrated Lime: to ASTM C207, Type SA.
- .3 Mortar Aggregate: to CAN/CSA-A179, standard masonry type; clean, dry, protected against dampness, freezing, and foreign matter.
- .4 Colour Pigment: natural oxide pigment, to be selected by Departmental Representative
- .5 Water: potable, clean and free of deleterious amounts of acids, alkalies or organic materials.

### **2.4 MANUFACTURED UNITS**

- .1 Ashlar Stone: Pacific Ashlar Full Bed Masonry, as described below:
  - .1 Bed Thickness: 89 mm thick;
  - .2 Ashlar Sizes: 152 mm length x 50 mm height stones, in the following bond percentages:
    - .1 Face Height A: 600 mm
    - .2 Face Height B: 1300 mm
  - .3 Finish: Pacific Ashlar.
  - .4 Colour and Pattern: Pacific Ashlar.
- .2 Ashlar Stone: Pacific Ashlar Thinstone Veneer, as described below:
  - .1 Bed Thickness: 19 mm thick;



- .2 Ashlar Sizes: 152 mm length x 50 mm height stones, in the following bond percentages:
  - .1 Face Height A: 600 mm
  - .2 Face Height B: 1300 mm
- .3 Finish: Pacific Ashlar.
- .4 Colour and Pattern: Pacific Ashlar.

## **2.5 REINFORCEMENT AND ANCHORAGES**

- .1 Anchors, Cramps, Dowels: hot dip galvanized steel.
- .2 Wall Ties: to CAN/CSA-A370, hot dip galvanized steel.
- .3 Fasteners: hot dip galvanized steel.
- .4 Shop Finishing:
  - .1 Hot Dip Galvanizing: to ASTM A153/A153M, Class B2.

## **2.6 FLASHING**

- .1 Flexible Flashing: air/vapour barrier sheet membrane, as specified under Section 07 62 00 – Metal Flashing and Trim.
- .2 Flexible Flashing: sheet polyethylene; 0.5 mm thick.
- .3 Sheet Metal: galvanized steel.

## **2.7 ACCESSORIES**

- .1 Mortar: in accordance with Section 04 05 12- Masonry Mortar and Grout.
- .2 Setting Buttons: resilient plastic, type; non-staining; sized to suit joint thicknesses and bed depths without intruding into required depths of joint sealants or causing third-side adhesion between sealant and setting button.
- .3 Weep Hole Vents: purpose made plastic louvered vents, insect proof.
- .4 Sealant and Backer Rod: in accordance with Section 07 92 00- Joint Sealants.

## **2.8 MORTAR MIXES**

- .1 Limestone Dimension Stone Mortar: to CAN/CSA-A179, Proportion specification, 1 part Portland cement, 1 part hydrated lime, 6 parts mortar aggregate by volume for both cementitious materials and aggregate; integral colour selected by Departmental Representative.

## **2.9 MORTAR MIXING**

- .1 Thoroughly mix mortar ingredients in proper quantities needed for immediate use to requirements of CAN/CSA-A179.
- .2 Add mortar colour and admixtures to requirements of manufacturer's instructions.
- .3 Provide uniformity of mix and colouration.
- .4 Start masonry work after mortar is tested and approved by Departmental Representative.
- .5 Take representative samples for testing consistency of strength and colour according to CAN/CSA-A179.
- .6 Use mortar within 2 hours after mixing at temperatures of 26 degrees C, or 2-1/2 hours at temperatures under 10 degrees C.

## **2.10 FABRICATION**

- .1 Cut stone to shape and dimensions and full to square with joints as indicated.
  - .1 Dress exposed faces true.

- .2 Cut stone for copings, cornices, sills, caps, to lay on its natural quarry bed.
- .2 Cut-in reglets for flashings where indicated.
- .3 Execute profiled work from full size details and templates.
  - .1 Make exposed arises in true alignment and ease slightly to prevent snipping.
- .4 Back-check stone contacting structural members as indicated.
  - .1 Allow minimum of 25 mm clearance between back of stone and steel and concrete structural members.
  - .2 Shape beds of stone resting on structural work to fit supports.
- .5 Cut stones for anchors, cramps, dowels and support systems.
  - .1 Provide Lewis pin and clamp holes in pieces which cannot be manually lifted.
  - .2 Do not cut holes in exposed surfaces.
- .6 Finish exposed faces and edges of stones to comply with requirements indicated for finish and to match approved samples and field-constructed mock-up.

## **2.11 GROUT**

- .1 In accordance with Section 04 05 12 – Masonry Mortar and Grout

## **2.12 JOINT SEALANTS AND BACKER RODS**

- .1 Non-staining type, as specified in Section 07 92 00- Joint Sealants.

## **2.13 FABRICATION TOLERANCES**

- .1 Fabricate limestone dimension stone to the following tolerances:
  - .1 Unit Length: plus or minus 4 mm.
  - .2 Unit Height: plus or minus 4 mm.
  - .3 Deviation From Square: plus or minus 4 mm, with measurement taken using the longest edge as the base.
  - .4 Bed Depth: plus or minus 4 mm.

# **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 dimensional stone veneer cladding 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 Waterproof exterior slabs on back prior to setting.
- .2 Clean stone surfaces by washing with stiff fibre brush and water.

## **3.3 INSTALLATION/TOLERANCES**

- .1 Variation from Plumb: plus or minus 5 mm per 3 metres maximum.
- .2 Variation from Level: plus or minus 10 mm per 6 metres maximum.

- .3 Variation from Linear Building Line: plus or minus 10 mm per 6 metres maximum.
- .4 Variation in Cross-Sectional Dimensions: plus 10 mm or minus 5 mm.

### **3.4 SETTING STONE - GENERAL**

- .1 Construction in accordance with CAN/CSA-A371.
- .2 Reinforcement and anchorage in accordance with Section 04 05 19- Masonry Anchorage and Reinforcing.
- .3 Set stones plumb, true, and level, to requirements as indicated and approved shop drawings.
- .4 Align stone edges and faces according to established relationships and indicated tolerances.
- .5 Provide movement joints of widths and at locations indicated. Ensure movement joints are kept free of mortar.

### **3.5 SETTING STONE WITH MORTAR**

- .1 Set stones in full bed of mortar with vertical joints buttered and placed full, except where otherwise specified.
  - .1 Completely fill anchor, dowel and lifting holes.
- .2 Lay stone veneer in coursed ashlar bond.
  - .1 Connect stone veneer to structural back-up with approved wall ties, spaced not more than 405 mm horizontally and 610 mm vertically.
- .3 Lay stone panel cladding to patterns indicated on drawings.
  - .1 Install anchors, dowels and cramps.
  - .2 Shim and adjust supports to set stones accurately in locations indicated with uniform joints of widths indicated.
- .4 Make joints 6 mm thick.
- .5 Embed only ends of lugged sills and steps in mortar.
  - .1 Leave balance of joint open for final pointing.
- .6 Place soft-wood wedges under stones to maintain joint thickness.
  - .1 Set heavy stones and projecting courses after mortar in courses below has hardened sufficiently to support weight.
- .7 Brace and anchor projecting stones until wall above is set.
- .8 Use soaked softwood wedges to support stone in proper alignment until mortar has set.
  - .1 Remove wedges when dry and without breaking them off, fill voids with pointing mortar.
- .9 Install through-wall flashing membranes at continuous shelf angles, steel lintels, ledges and similar obstructions to the downward flow of water.
- .10 Install weep hole vents at 600 mm on center at bottom of walls.
- .11 Tool joints after initial set has occurred.
- .12 Rake out joints to 25 mm depth and make ready for pointing with pointing mortar sealant.
  - .1 Sponge stone face along joints and remove droppings and splashed mortar immediately.
- .13 Set copings, with unfilled vertical joints.
- .14 Grouting: pack ends of exposed joints with plastic foam joint filler and after wetting ends of stone, fill joint with grouting mortar to within 19 mm of top.
  - .1 Grout vertical joints of copings.
  - .2 After grout has set, remove packing for pointing.
- .15 Pointing: remove dirt and loose mortar from joints by using pressurized airstream.

- .1 Wet joints for mortar pointing. Dry joints for sealant pointing.
- .2 Point joints with pointing mortar in 2 stages. Rub smooth with appropriate tool to slightly concave joint.
- .3 Point coping joints with sealant. Do work in accordance with Section 07 92 00- Joint Sealants.

### **3.6 SETTING STONE WITH SEALANT JOINTS**

- .1 Attach anchors, dowels and cramps securely to stone and back-up surfaces
- .2 Shim and adjust supports to set stones accurately in locations indicated with uniform joints of widths indicated.
- .3 Completely fill anchor, dowel and lifting holes with sealant.
  - .1 Install compressive material above and below dowels, where dowel holes occur at movement joints.
- .4 Make joints 6 mm thick.
- .5 Place soft-wood wedges under stones to maintain joint thickness.
  - .1 Locate wedges back from face of stone to provide space for sealant application in accordance with Section 07 92 00- Joint Sealants.
- .6 Brace and anchor projecting stones until wall above is set.
- .7 Install through-wall flashing membranes at continuous shelf angles, steel lintels, ledges and similar obstructions to the downward flow of water.
- .8 Install weep hole vents at 600 mm on centre horizontally at bottom of walls.
- .9 Seal joints with backer rods and joint sealant in accordance with Section 07 92 00- Joint Sealants.

### **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 Clean stone as work progresses.
  - .1 Allow mortar droppings on stone to partially dry then remove by means of brushing with a stiff fibre brush.
- .3 Post-Construction: clean mock-up panel as directed below and leave for one week. If no harmful effects appear and after mortar has set and cured, clean masonry as follows:
  - .1 Protect windows, sills, doors, trim and other work from damage.
  - .2 Remove large particles with stiff fibre brushes without damaging surface. Saturate masonry with clean water and flush off loose mortar and dirt.
  - .3 Scrub with solution of 25 ml trisodium phosphate and 25 ml household detergent dissolved in 1 litre of clean water using stiff fibre brushes, then clean off immediately with clean water using hose.
  - .4 Repeat cleaning process as often as necessary to remove mortar and other stains.
- .4 Use alternative cleaning solutions and methods for difficult to clean stone only after consultation with masonry unit manufacturer.
- .5 Waste Management: separate waste materials for recycling and reuse 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.

### **3.8 PROTECTION**

- .1 Protect stone from damage resulting from subsequent construction operations.

- .2 Use protection materials and methods which will not stain or damage stone.
- .3 Remove protection materials upon Substantial Performance of Work, or when risk of damage is no longer present.

**END OF SECTION**

**PART 1 GENERAL**

**1.1 RELATED REQUIREMENTS**

- .1 Section 03 30 00: Cast in Place Concrete.
- .2 Section 05 50 00: Metal Fabrications.
- .3 Section 09 91 00: Interior Painting.

**1.2 REFERENCE STANDARDS**

- .1 All referenced standards to be the current edition or the edition referenced by the applicable Building Code in force at the time of building permit application, as noted on Structural Drawings.
- .2 ASTM International Inc.
  - .1 ASTM A36/A36M, Standard Specification for Carbon Structural Steel.
  - .2 ASTM A193/A193M, Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature or High-Pressure Service and Other Special Purpose Applications.
  - .3 ASTM A307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
  - .4 ASTM A325, Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
  - .5 ASTM A325M, Standard Specification for Structural Bolts, Steel, Heat Treated 830 MPa Minimum Tensile Strength[Metric].
  - .6 ASTM A490M, Standard Specification for High-Strength Steel Structural Bolts, Classes 10.9 and 10.9.3, for Structural Steel Joints [Metric].
  - .7 ASTM F1554, Standard Specification for Anchor Bolts
- .3 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-85.10], Protective Coatings for Metals.
- .4 Canadian Institute of Steel Construction (CISC)/Canadian Paint Manufacturers Association (CPMA).
  - .1 Handbook of the Canadian Institute of Steel Construction.
  - .2 CISC/CPMA Standard 2-75, Quick-Drying Primer for use on Structural Steel.
- .5 Canadian Standards Association (CSA International)
  - .1 CSA G40.20/G40.21, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
  - .2 CAN/CSA-G164, Hot Dip Galvanizing of Irregularly Shaped Articles.
  - .3 CAN/CSA-S16, Limit States Design of Steel Structures.
  - .4 CAN/CSA-S136, North American Specifications for the Design of Cold Formed Steel Structural Members.
  - .5 CSA W47.1, Certification of Companies for Fusion Welding of Steel.
  - .6 CSA W48, Filler Metals and Allied Materials for Metal Arc Welding.
  - .7 CSA W55.3, Resistance Welding Qualification Code for Fabricators of Structural Members Used in Buildings.
  - .8 CSA W59, Welded Steel Construction (Metal Arc Welding).
- .6 Master Painters Institute
  - .1 MPI-INT 5.1, Structural Steel and Metal Fabrications.
  - .2 MPI-EXT 5.1, Structural Steel and Metal Fabrications.

- .7 The Society for Protective Coatings (SSPC) and National Association of Corrosion Engineers (NACE) International
  - .1 NACE No. 3/SSPC SP-6, Commercial Blast Cleaning.

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

- .1 Provide submittals in accordance with Section 01 33 00- Submittal Procedures.
- .2 Shop Drawings:
  - .1 Submit drawings stamped and signed by professional engineer registered or licensed in British Columbia, Canada.
- .3 Erection drawings:
  - .1 Submit erection drawings indicating details and information necessary for assembly and erection purposes including:
    - .1 Description of methods.
    - .2 Sequence of erection.
    - .3 Type of equipment used in erection.
    - .4 Temporary bracings.
- .4 Fabrication drawings:
  - .1 Submit fabrication drawings showing designed assemblies, components and connections are stamped and signed by qualified professional engineer licensed in the British Columbia, Canada.

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

- .1 Deliver, store and handle materials in accordance with Section 01 61 00- Common Product Requirements.
- .2 Deliver materials in manufacturer's original, undamaged containers with identification labels intact.

## **PART 2 PRODUCTS**

### **2.1 DESIGN REQUIREMENTS**

- .1 Design details and connections in accordance with requirements of CAN/CSA-S16 with CSA-S136.1 and CAN/CSA-S136 to resist forces, moments, shears and allow for movements indicated.
- .2 Shear connections:
  - .1 Select framed beam shear connections from an industry accepted publication such as "Handbook of the Canadian Institute of Steel Construction" when connection for shear only (standard connection) is required.
  - .2 Select or design connections to support reaction from maximum uniformly distributed load that can be safely supported by beam in bending, provided no point loads act on beam, when shears are not indicated.
- .3 For composite construction select or design minimum end connection to resist reaction resulting from factored movement resistance as tabulated in the "Handbook of the Canadian Institute of Steel Construction" assuming 100% shear connection with depth of steel deck and/or slab shown on drawings.
- .4 Submit sketches and design calculations stamped and signed by qualified professional engineer licensed in British Columbia, Canada for non standard connections.

## **2.2 MATERIALS**

- .1 Structural steel: to CAN/CSA-S136 and/or CSA-G40.20/G40.21.
- .2 Anchor bolts: to ASTM F1554, Steel 36, 55 and 105 ksi Yield Strength.
- .3 Bolts, nuts and washers: to ASTM A325/ A325M.
- .4 Welding materials: to CSA W59 and certified by Canadian Welding Bureau.
- .5 Shop paint primer: to CISC/CPMA2-75 solvent reducible alkyd, red oxide.
- .6 Hot dip galvanizing: galvanize steel, where indicated, to CAN/CSA-G164, minimum zinc coating of 600g/m2.
- .7 Shear studs: to CSA W59, Appendix H . Type C, min Fy = 350 MPa.

## **2.3 FABRICATION**

- .1 Fabricate structural steel in accordance with CAN/CSA-S16 and in accordance with reviewed shop drawings.
- .2 Install shear studs in accordance with CSA W59.
- .3 Continuously seal members by intermittent welds and plastic filler, unless noted otherwise. Grind smooth.

## **2.4 SHOP PAINTING**

- .1 Clean, prepare surfaces and shop prime structural steel in accordance with CAN/CSA-S16.
- .2 Clean members, remove loose mill scale, rust, oil, dirt and foreign matter. Prepare surface according to NACE No.3/SSPC-SP-6.
- .3 Apply one coat of primer in shop to steel surfaces except.
  - .1 Surfaces to be encased in concrete.
  - .2 Surfaces to receive field installed stud shear connections.
  - .3 Surfaces and edges to be field welded.
  - .4 Faying surfaces of slip-critical connections.
  - .5 Below grade surfaces in contact with soil.
- .4 Apply paint under cover, on dry surfaces when surface and air temperatures are above 5 degrees C.
- .5 Maintain dry condition and 5 degrees C minimum temperature until paint is thoroughly dry.
- .6 Strip paint from bolts, nuts, sharp edges and corners before prime coat is dry.

## **PART 3 EXECUTION**

### **3.1 APPLICATION**

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

### **3.2 GENERAL**

- .1 Structural steel work: in accordance with CAN/CSA-S16.
- .2 Welding: in accordance with CSA W59.
- .3 Companies to be certified under Division 1 or 2.1 of CSA W47.1 for fusion welding of steel structures and/or CSA W55.3 for resistance welding of structural components.



**3.3 MARKING**

- .1 Mark materials in accordance with CSA G40.20/G40.21. Do not use die stamping. When steel is to be left in unpainted condition, place marking at locations not visible from exterior after erection.

**3.4 ERECTION**

- .1 Erect structural steel, as indicated and in accordance with CAN/CSA-S16 and in accordance with reviewed erection drawings.
- .2 Field cutting or altering structural members: to approval of Departmental Representative.
- .3 Clean with mechanical brush and touch up shop primer to bolts, rivets, welds and burned or scratched surfaces at completion of erection.
- .4 Continuously seal members by continuous welds where indicated. Grind smooth.

**3.5 FIELD QUALITY CONTROL**

- .1 Refer to Section 01 29 83- Payment Procedures for Testing Laboratory Services.
- .2 Quality control including inspection and testing of materials and workmanship will be carried out and paid for by the Contractor.
- .3 Provide safe access and working areas for testing on site, as required by testing agency and as authorized by Departmental Representative.
- .4 Submit test reports to Departmental Representative within one week of testing
- .5 The Owner will pay costs of quality assurance tests as specified in Section 01 29 83- Payment Procedures for Testing Laboratory Services.
- .6 Test shear studs in accordance with CSA W59.

**3.6 FIELD PAINTING**

- .1 Paint in accordance with Section 09 91 23- Interior Painting.
  - .1 Touch up damaged surfaces and surfaces without shop coat with primer to NACE No.3/SSPC-SP-6 except as specified otherwise. Apply in accordance: MPI Architectural Painting Specification Manual.

**3.7 CLEANING**

- .1 Clean in accordance with Section 01 74 11- Cleaning.
- .2 Waste Management: separate waste materials for recycling and reuse in accordance with Section 01 74 21- Construction/Demolition Waste Management and Disposal.

**END OF SECTION**

**PART 1 GENERAL**

**1.1 RELATED WORK**

- .1 Section 03 30 00 - Cast-in-Place Concrete: Installation of anchors.
- .2 Section 04 05 00 – Common Work Results for Masonry: Installation of steel angle lintels.
- .3 Section 04 05 19 - Masonry Reinforcement and Connectors: Installation of anchors.
- .4 Section 09 91 00 - Painting.

**1.2 REFERENCES**

- .1 ASTM A307-14, Standard Specification for Carbon Steel Bolts, Studs and Threaded Rod 60,000 psi Tensile Strength.
- .2 ASTM F3125/F3125M, Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions.
- .3 CAN/CGSB-1.40-M97, Primer, Structural Steel, Oil Alkyd Type.
- .4 CAN/CGSB-1.108-M89, Bituminous Solvent Type Paint.
- .5 CAN/CGSB-1.181-99, Ready-Mixed, Organic Zinc-Rich Coating.
- .6 CAN/CSA-G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
- .7 ASTM A123/A123M, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- .8 CAN/CSA-S16-14, Design of Steel Structures.
- .9 CSA W47.2-11 (R2015), Certification of Companies for Fusion Welding of Aluminum.
- .10 CSA W59-13, Welded Steel Construction (Metal Arc Welding).
- .11 CSA W59.2-M1991 (R2008), Welded Aluminum Construction.
- .12 CSA S157-05 (R2015), Strength Design in Aluminum.
- .13 PIP STF 05501, Fixed Ladders and Cages.

**1.3 SHOP DRAWINGS**

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Indicate materials, core thicknesses, finishes, connections, joints, method of anchorage, number of anchors, supports, reinforcement, details, and accessories.
- .3 Drawings to bear the seal of a professional Engineer registered in the Province of Alberta for all fabricator designed assemblies, components and connections.

**1.4 PROTECTION**

- .1 Cover exposed stainless steel surfaces with pressure sensitive heavy protection paper or apply strippable plastic coating, before shipping to job site.
- .2 Leave protective covering in place until final cleaning of building. Provide instructions for removal of protective covering.

**1.5 QUALITY ASSURANCE**

- .1 Employ tradesman skilled in this trade and proficient in the use of various materials specified.
- .2 Perform work in accordance with material manufacturer's instructions.

## **PART 2 PRODUCTS**

### **2.1 MATERIALS**

- .1 Steel sections (W and HSS shapes): to CAN/CSA-G40.21, Grade 350W.
- .2 Steel pipe to ASTM A53.
- .3 Hollow Structural Sections to CSA-G40.21, Grade 350W.
- .4 Galvanizing to ASTM A123/A123M. Minimum coating 720 gm/m<sup>2</sup>.
- .5 Stainless Steel - ASTM A276 Type 304 or 316 as indicated.
- .6 Aluminum sections and plates to Type T6 unless shown.
- .7 Steel plates, and sections (channel and angle shapes): to CAN/CSA-G40.21, Grade 300W.
- .8 Welding materials: to CSA W59.
- .9 Welding electrodes: to CSA W48 Series.
- .10 Bolts and anchor bolts: to ASTM A307/A325.
- .11 Grout: non-shrink, non-metallic, flowable, 24h, MPa 15, pull-out strength 7.9 MPa.

### **2.2 FASTENINGS AND ANCHOR BOLTS**

- .1 Nuts, bolts, washers, rivets and screws for steel to steel - ASTM F3125, for steel to concrete ASTM A307. All materials to be galvanized.
- .2 Fastenings - Stainless steel and aluminum - stainless steel Type 316 ELC.
- .3 For structural steel use high strength bolts to ASTM F3125. Bolts to be galvanized.
- .4 All fasteners submerged in water - Stainless steel Type 316 ELC.
- .5 Concrete inserts - Hilti, HSL or HVA as manufactured by Hilti Inc. Type 316 stainless steel.

### **2.3 CHECKERED PLATES**

- .1 Frames shall be aluminum and of the dimensions shown on the drawings. Double bituminous coating to be applied to portion of frame which will be in contact with concrete.
- .2 Checkered plate shall be aluminum of the thickness and dimensions shown on the drawings.
- .3 Plate stiffeners to be aluminum of the dimensions shown on the drawings. Welding to be done in accordance with CSA W59.2 Welded Aluminum Construction.

### **2.4 FABRICATION**

- .1 Fabricate work square, true, straight and accurate to required size, with joints closely fitted and properly secured.
- .2 Use self-tapping shake-proof round headed screws on items requiring assembly by screws or as indicated.
- .3 Where possible, fit and shop assemble work, ready for erection.
- .4 Ensure exposed welds are continuous for length of each joint. File or grind exposed welds smooth and flush.
- .5 Fabricate ladders in accordance to CSA S157 and PIP STF 05501.

### **2.5 FINISHES**

- .1 Galvanizing: hot dipped galvanizing with zinc coating 600 g/m<sup>2</sup> to ASTM A123/A123M.
- .2 Chromium plating: chrome on steel with plating sequence of 0.009 mm thickness of copper 0.010 mm thickness of nickel and 0.0025 mm thickness of chromium.
- .3 Shop coat primer: to CAN/CGSB-1.40.
- .4 Zinc primer: zinc rich, ready mix to CAN/CGSB-1.181.

- .5 Bituminous paint: to CAN/CGSB-1.108.

## **2.6 SHOP PAINTING**

- .1 Apply one shop coat of primer to metal items, with exception of galvanized or concrete encased items.
- .2 Use primer unadulterated, as prepared by manufacturer. Paint on dry surfaces, free from rust, scale, grease. Do not paint when temperature is lower than 7°C.
- .3 Clean surfaces to be field welded; do not paint.

## **PART 3 EXECUTION**

### **3.1 ERECTION**

- .1 Do welding work in accordance with CSA W59 unless specified otherwise.
- .2 Erect metalwork square, plumb, straight, and true, accurately fitted, with tight joints and intersections.
- .3 Provide suitable means of anchorage acceptable to Consultant such as dowels, anchor clips, bar anchors, expansion bolts and shields, and toggles. Do not use self-drilling anchors where cast-in anchor bolts are specified.
- .4 Exposed fastening devices to match finish and be compatible with material through which they pass.
- .5 Provide components for building by other sections in accordance with shop drawings and schedule.
- .6 Make field connections with high tensile bolts to CAN/CSA-S16, stainless steel bolt Type 316 or weld.
- .7 Hand items over for casting into concrete or building into masonry to appropriate trades together with setting templates.
- .8 Touch-up rivets, field welds, bolts and burnt or scratched surfaces after completion of erection with primer.
- .9 Touch-up galvanized surfaces with two coats of zinc rich primer where damaged or burned by field welding.
- .10 Aluminum in contact with or embedded in concrete, mortar, plaster or other damp masonry shall be given two coats of alkali resistant bituminous paint. Do not allow aluminum and other metals or metallic finishes to come in direct contact.

### **3.2 CHANNEL FRAMES**

- .1 Install channel frames to openings as indicated.

**END OF SECTION**

## **PART 1 GENERAL**

### **1.1 RELATED REQUIREMENTS**

- .1 Section 06 10 00 Rough Carpentry
- .2 Section 06 17 53 Shop-Fabricated Wood Trusses
- .3 Section 06 20 00 Finish Carpentry

### **1.2 REFERENCE STANDARDS**

- .1 American Wood-Preservers' Association (AWPA)
  - .1 AWPA M2-01, Standard for Inspection of Treated Wood Products.
  - .2 AWPA M4-06, Standard for the Care of Preservative-Treated Wood Products.
- .2 Canada Green Building Council (CaGBC)
  - .1 LEED Canada-NC Version 1.0-2004, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Package For New Construction and Major Renovations (including Addendum 2007).
  - .2 LEED Canada-CI Version 1.0-2007, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Guide For Commercial Interiors.
- .3 Canadian Standards Association (CSA International)
  - .1 CSA O80 Series-97(R2002)- O80S2-05, Wood Preservation.
  - .2 CSA O80.20-1.1-M97(R2002), This Standard applies to the fire-retardant treatment of lumber by pressure processes..
  - .3 CSA O80.27-1.1-M97(R2002), This Standard covers the fire-retardant treatment of Douglas Fir, hardwood, softwood, and Poplar plywood by pressure processes.
  - .4 CSA O80.201-M89, This Standard covers hydrocarbon solvents for preparing solutions of preservatives.
  - .5 CSA O322-02, Procedure for Certification of Pressure-Treated Wood Materials for Use in Preserved Wood Foundations.
- .4 South Coast Air Quality Management District (SCAQMD), California State (SCAQMD)
  - .1 SCAQMD Rule 1113-04, Architectural Coatings.

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

- .1 Submit Submittal submissions: in accordance with Section 01 33 00- Submittal Procedures.
- .2 Sustainable Submittals:
  - .1 Co-ordinate submittal requirements and provide submittals required by Section 01 35 43 – Environmental Procedures.
- .3 LEED Submittals:
  - .1 Co-ordinate submittals requirements in accordance with Section 01 33 00- Submittal Procedures.
- .4 Quality assurance submittals:
  - .1 Submit certificates in accordance with Section 01 33 00- Submittal Procedures.
  - .2 For products treated with preservative or fire-retardant by pressure impregnation submit following information certified by authorized signing officer of treatment plant:
    - .1 Information listed in AWPA M2 and revisions specified in CSA O80 Series, Supplementary Requirement to AWPA M2 applicable to specified treatment.
    - .2 Moisture content after drying following treatment with fire-retardant or water-borne preservative.

- .3 Acceptable types of paint, stain, and clear finishes that may be used over treated materials to be finished after treatment.

#### **1.4 QUALITY ASSURANCE**

- .1 Plant inspection of products treated with fire-retardant or preservative by pressure impregnation will be carried out by designated testing laboratory to AWP M2, and revisions specified in CSA O80 Series, Supplementary Requirements to AWP M2.
- .2 Each piece of lumber and plywood for preserved wood foundations to be identified by CSA O322 certified stamp.
- .3 Inspection and testing of press-treated columns and custom trusses will be carried out by a Testing Laboratory designated by Departmental Representative.
- .4 Departmental Representative will pay for costs of tests.
- .5 Sustainable Requirements:
  - .1 Construction requirements: in accordance with Section 01 35 43- Environmental Procedures.
- .6 Regulatory Requirements:
  - .1 Each board or bundle of fire-retardant treated material to bear ULC label indicating Flame Spread Classification (FSC), and smoke developed.

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

- .1 Waste Management and Disposal:
  - .1 Separate waste materials for recycle and reuse in accordance with Section 01 74 21- Construction/Demolition Waste Management and Disposal.

### **PART 2 PRODUCTS**

#### **2.1 SUSTAINABLE REQUIREMENTS**

- .1 Materials and products in accordance with Section 01 35 43 - Environmental Procedures.

#### **2.2 MATERIALS**

- .1 Lumber to be CAN/CSA-Z809 or FSC or SFI certified as specified in Section 06 10 00 – Rough Carpentry.
- .2 Preservative: to CSA-O80 Series, odourless and water-borne, for clear finish.
  - .1 SCAQMD Rule #1113, Architectural Coatings.
- .3 Preservatives: maximum VOC limit 350 g/L.
- .4 Fire-Retardant: to CSA O80.20, to provide:
  - .1 Flame Spread Classification: FSC in accordance with manufacturer's recommendations for surface conditions
  - .2 Smoke developed of not more than recommended by manufacturer
- .5 Solvent: to CSA-O80.201, and in accordance with manufacturer's recommendations.

### **PART 3 EXECUTION**

#### **3.1 APPLICATION: PRESERVATIVE**

- .1 Treat timber columns and custom truss members to CSA O80 Series using fire- retardant and water-borne preservative.

- .2 Following water-borne preservative treatment, dry material to maximum moisture content of 19%.

**3.2 APPLICATION: FIRE-RETARDANT**

- .1 Treat timber columns and custom truss members by pressure impregnation with fire-retardant chemicals in accordance with CSA O80.20.
- .2 Following treatment, kiln-dry material to maximum moisture content of 19%.

**3.3 APPLICATION: FIELD TREATMENT**

- .1 Comply with AWP A M4 and revisions specified in CSA O80 Series, Supplementary Requirements to AWP A M2.
- .2 Remove chemical deposits on treated wood to receive applied finish.

**END OF SECTION**

## **PART 1        GENERAL**

### **1.1        RELATED SECTIONS**

- .1        Division 6

### **1.2        REFERENCES**

- .1        American National Standards Institute/National Particleboard Association (ANSI/NPA)
  - .1        ANSI/NPA A208.1-2009, Particleboard.
- .2        American Society for Testing and Materials International (ASTM)
  - .1        ASTM A123/A 123M-09, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
  - .2        ASTM A563M-07(R2013), Standard Specification for Carbon and Alloy Steel Nuts
  - .3        ASTM D1761-12, Standard Test Methods for Mechanical Fasteners in Wood.
  - .4        ASTM D5933-96(2001), Standard Specification for 25/8-in. and 4-in. Diameter Metal Shear Plates for Use in Wood Constructions
  - .5        ASTM F1167-15, Standard Specification for Driven Fasteners: Nails, Spikes, and Staples.
  - .6        ASTM F568M, Standard Specification for Carbon and Alloy Steel Externally Threaded Metric Fasteners
- .3        American Wood Preservers' Association (AWPA)
  - .1        AWPA M2-15, Standard for Inspection of Treated Wood Products.
  - .2        AWPA M4-11, Standard for the Care of Preservative-Treated Wood Products.
- .4        Canadian General Standards Board (CGSB)
  - .1        CAN/CGSB-11.3-M87, Hardboard.
  - .2        CAN/CGSB-51.32-M77, Sheathing, Membrane, Breather Type.
  - .3        CAN/CGSB-51.34-M86, Vapour Barrier, Polyethylene Sheet for Use in Building Construction and amendment.
  - .4        CAN/CGSB-71.26-M88, Adhesive for Field-Gluing Plywood to Lumber Framing for Floor Systems.
- .5        Canadian Standards Association (CSA International)
  - .1        CSA O80 Series-15 and O80S2-05, Wood Preservation.
  - .2        CSA O86-14, Engineering Design in Wood.
  - .3        CSA O112.9-10 (2014), Evaluation of Adhesives for Structural Wood Products (Exterior Exposure).
  - .4        CSA O121-08 (R2013), Douglas Fir Plywood.
  - .5        CAN/CSA O122-16, Structural Glued-Laminated Timber.
  - .6        CSA O141-05 (R2014), Softwood Lumber.
  - .7        CSA O151-09 (R2014), Canadian Softwood Plywood.
  - .8        CSA O153-13, Poplar Plywood.
  - .9        CSA O325-07 (R2012), Construction Sheathing.
  - .10        CSA O437 Series-93 (R2011), Standards on OSB and Waferboard.
  - .11        CAN/CSA-Z809-08 (R2013), Sustainable Forest Management.
- .6        National Lumber Grades Authority (NLGA)
  - .1        Standard Grading Rules for Canadian Lumber.
- .7        American Institute of Timber Construction (AITC)
  - .1        AITC 108, "Standard for Heavy Timber Construction."



### **1.3 SUBMITTALS**

- .1 Submit Submittal submissions: in accordance with Division 01.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 For connectors, include installation instructions.
  - .3 For products treated with preservative by pressure impregnation, submit following information certified by authorized signing officer of treatment plant:
    - .1 Information listed in AWPA M2 and revisions specified in CSA O80 Series, Supplementary Requirement to AWPA M2 applicable to specified treatment.
    - .2 Moisture content after drying following treatment with water-borne preservative.
    - .3 Acceptable types of paint, stain, and clear finishes that may be used over treated materials to be finished after treatment.
- .3 Shop Drawings: Submit drawings showing layout, dimensions of each member, and details of connections. Shop drawings to be stamped and signed by a Professional Engineer registered in the Province of British Columbia.
- .4 Material Certificates:
  - .1 Indicate species and grade selected for each use per National Lumber Grades Authority - Standard Grading Rules for Canadian Lumber.
- .5 Certificates of Inspection: Issued by lumber grading agency for exposed timber not marked with grade stamp.

### **1.4 QUALITY ASSURANCE**

- .1 Certification: Material certificate required per National Lumber Grades Authority - Standard Grading Rules for Canadian Lumber. Each section to be marked with grade identifying stamp.
- .2 Lumber by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.
- .3 Plywood, particleboard, OSB and wood based composite panels in accordance with CSA and ANSI standards.

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

- .1 Deliver, handle, store and protect materials of this section in accordance with Division 01.
- .2 Schedule delivery of lumber to avoid extended on-site storage and to avoid delaying the Work.
- .3 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .4 Storage and Handling Requirements:
  - .1 Store materials under cover and protected from weather and contact with damp or wet surfaces. Provide for air circulation within and around stacks and under temporary coverings.
  - .2 Store and protect wood from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.

### **1.6 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate and recycle waste materials in accordance with Division 01.

## **PART 2 PRODUCTS**

### **2.1 DESCRIPTION**

- .1 Sustainability Characteristics:
  - .1 Lumber to be CAN/CSA-Z809 or FSC or SFI certified.
- .2 Lumber: softwood, S4S, moisture content 19% (S-dry) or less in accordance with following standards:
  - .1 CSA O141.
  - .2 NLGA Standard Grading Rules for Canadian Lumber
- .3 Framing and board lumber: Douglas Fir-Larch No.1/No.2 Grade or S.P.F. No.1/No.2 Grade unless noted otherwise.
- .4 Furring, blocking, nailing strips, grounds, rough bucks, curbs, fascia backing and sleepers:
  - .1 Board sizes: "Standard" or better grade.
  - .2 Dimension sizes: "Standard" light framing or better grade.
  - .3 Post and timbers sizes: "Standard" or better grade.
- .5 Plywood, OSB and wood based composite panels: to CSA O325. Thickness as indicated on Drawings.
- .6 Douglas fir plywood (DFP): to CSA O121, standard construction.
- .7 Canadian softwood plywood (CSP): to CSA O151, standard construction.
- .8 Poplar plywood (PP): to CSA O153, standard construction.
- .9 All lumber materials in contact with concrete or soil to be pressure treated to CSA O80.

### **2.2 ACCESSORIES**

- .1 Nails, spikes and staples: to CSA B111.
- .2 Bolts: diameter as indicated on the Drawings or shop drawings, complete with nuts and washers.
- .3 Proprietary fasteners: toggle bolts, expansion shields and lag bolts, screws and lead or inorganic fibre plugs, explosive actuated fastening devices, recommended for purpose by manufacturer.
- .4 Joist hangers: minimum 1 mm thick sheet steel, galvanized coating designation unless noted otherwise.
- .5 Nailing discs: flat caps, minimum 25 mm diameter, minimum 0.4 mm thick, sheet metal, formed to prevent dishing. Bell or cup shapes not acceptable.
- .6 Roof sheathing H-Clips: formed "H" shape, thickness to suit panel material, extruded 6063-T6 aluminum alloy type approved by Departmental Representative.
- .7 Fastener Finishes:
  - .1 Galvanizing: to ASTM A123/A123M, use galvanized fasteners for exterior work, interior highly humid areas, pressure-preservative treated lumber and where noted on the Drawings.
  - .2 Black powder coated steel: for exposed connectors as shown on the Drawings.
- .8 Wood Preservative: to CSA O80 Series, in accordance with manufacturer's recommendations for surface conditions:
  - .1 Preservative: VOC limit 350 g/L maximum to SCAQMD Rule 1113.

### **2.3 FABRICATION**

- .1 Camber: Fabricate horizontal members and inclined members with a slope of less than 1:1, with natural convex bow (crown) up, to provide camber.

- .2 Shop fabricate members by cutting and restoring exposed surfaces to match specified surfacing. Finish exposed surfaces to remove planing or surfacing marks, and to provide a finish equivalent to that produced by machine sanding with No. 120 grit sandpaper.
- .3 Predrill for fasteners and assembly of units.
- .4 Coat crosscuts with end sealer.
- .5 Seal Coat: After fabricating and surfacing each unit, apply a saturation coat of penetrating sealer on surfaces of each unit except for treated wood where the treatment included a water repellent.

## **PART 3 EXECUTION**

### **3.1 INSTALLATION**

- .1 General: Erect lumber true and plumb. Provide temporary bracing to maintain lines and levels until permanent supporting members are in place.
  - .1 Install lumber to comply with Shop Drawings.
  - .2 Install horizontal and sloping members with crown edge up and provide not less than 102 mm of bearing on supports. Provide continuous members unless otherwise indicated; tie together over supports if not continuous.
  - .3 Handle and temporarily support lumber construction to prevent surface damage, compression, and other effects that might interfere with indicated finish.
- .2 Cutting: Avoid extra cutting after fabrication. Where field fitting is unavoidable, comply with requirements for shop fabrication.
- .3 Fit members by cutting and restoring exposed surfaces to match specified surfacing. Predrill for fasteners and assembly of units.
  - .1 Finish exposed surfaces to remove planing or surfacing marks, and to provide a finish equivalent to that produced by machine sanding with No. 120 grit sandpaper.
  - .2 Coat crosscuts with end sealer.
- .4 Install wall sheathing in accordance with manufacturer's printed instructions and as indicated on the Drawings.
- .5 Install roof sheathing in accordance with requirements of the NBCC and as indicated on the Drawings.
- .6 Install furring and blocking as required to space-out and support casework, wall and ceiling finishes, facings, fascia, soffit, siding, electrical equipment mounting boards, and other work as required.
- .7 Install furring to support siding applied vertically where there is no blocking and where sheathing is not suitable for direct nailing.
  - .1 Align and plumb faces of furring and blocking to tolerance of 1:600.
- .8 Install rough bucks, nailers and linings to rough openings as required to provide backing for frames and other work.
- .9 Install wood cants, fascia backing, nailers, curbs and other wood supports as required and secure using steel fasteners.
- .10 Install sleepers as indicated.
- .11 Use dust collectors and high quality respirator masks when cutting or sanding wood panels.
- .12 Frame, anchor, fasten, tie and brace members to provide necessary strength and rigidity.
- .13 Countersink bolts where necessary to provide clearance for other work.
- .14 Use nailing disks for soft sheathing as recommended by sheathing manufacturer.

- .15 Install connectors as indicated.
  - .1 Unless otherwise indicated, install bolts with same orientation within each connection and in similar connections.
  - .2 Install bolts with orientation as indicated or, if not indicated, as directed by Department Representative.

### **3.2 ADJUSTING**

- .1 Repair damaged surfaces and finishes after completing erection. Replace damaged lumber construction if repairs are not approved by Department Representative.

**END OF SECTION**

## **PART 1 GENERAL**

### **1.1 REFERENCE STANDARDS**

- .1 All referenced standards to be the current edition or the edition referenced by the applicable Building Code in force at the time of building permit application, as noted on Structural Drawings.
- .2 CSA International
  - .1 CAN/CSA O80 Series, Wood Preservation.
  - .2 CSA O86 Consolidation, Engineering Design in Wood.
  - .3 CSA O141, Softwood Lumber.
  - .4 CSA S307, Load Test Procedure for Wood Roof Trusses for Houses and Small Buildings.
  - .5 CSA S347, Method of Test for Evaluation of Truss Plates Used in Lumber Joints.
  - .6 CSA W47.1, Certification of Companies for Fusion Welding of Steel.
  - .7 CAN/CSA-Z809, Sustainable Forest Management.
- .3 Forest Stewardship Council (FSC)
  - .1 FSC-STD-01-001, FSC Principle and Criteria for Forest Stewardship.
- .4 National Lumber Grades Authority (NLGA)
  - .1 Standard Grading Rules for Canadian Lumber.
- .5 National Research Council Canada (NRC)
  - .1 National Building Code of Canada 2015 (NBC).
  - .2 Canadian Construction Materials Centre (CCMC)-, Registry of Product Evaluations.
- .6 Truss Plate Institute of Canada (TPIC)
  - .1 TPIC , Truss Design Procedures and Specifications for Light Metal Plate Connected Wood Trusses (Limit States Design).
- .7 Sustainable Forestry Initiative (SFI)
  - .1 SFI-Standard.

### **1.2 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 wood trusses and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
  - .1 Submit drawings stamped and signed by professional engineer registered or licensed in British Columbia, Canada.
  - .2 Include on drawings:
    - .1 Each shop drawing submission showing connection details.
    - .2 Indicate special structural application and specification as according to local authorities having jurisdiction.
    - .3 Indicate TPIC Truss Design Procedure and CSA O86 Engineering Design in Wood and specific CCMC Product Registry number of the truss plates
    - .4 Indicate species, sizes, and stress grades of lumber used as truss members. Show pitch, span, camber, configuration and spacing of trusses. Indicate connector types, thicknesses, sizes, locations and design value. Show bearing details. Indicate design load for members.

- .5 Submit stress diagram or print-out of computer design indicating design load for truss members. Indicate allowable load and stress increase.
- .6 Provide certification that trusses meet requirements of CSA S307 and CSA S347.
- .7 Instructions: submit manufacturer's installation instructions.
- .4 Sustainable Design Submittals:
  - .1 Construction Waste Management:
    - .1 Submit project Waste Management Plan highlighting recycling and salvage requirements.
    - .2 Wood Certification: submit manufacturer's / vendor's Chain-of-Custody Certificate number for CAN/CSA-Z809 or FSC or SFI certified wood.

### **1.3 QUALITY ASSURANCE**

- .1 Qualifications:
  - .1 Fabricator for trusses to show evidence of quality control program such as provided by regional wood truss associations, or equivalent.
  - .2 Fabricator for welded steel connections to be certified in accordance with CSA W47.1.
- .2 Sustainable Standards Certification:
  - .1 Certified Wood: submit listing of wood products and materials used in accordance with CAN/CSA-Z809 or FSC or SFI.

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

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials off ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect wood trusses from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.
  - .4 Provide bearing supports and bracings. Prevent bending, warping and overturning of trusses.

## **PART 2 PRODUCTS**

### **2.1 DESIGN REQUIREMENTS**

- .1 Design light metal plate connected wood trusses in accordance with TPIC truss design procedures for wood truss chords and webs in accordance with engineering properties in CSA O86.
- .2 Design light metal plate connected wood trusses in accordance with TPIC truss design procedures for truss joint designs to test engineering properties in accordance with CSA S347 and listed in CCMC Registry of Product Evaluations.
- .3 Design trusses, bracing and bridging in accordance with CSA O86.1 for loads indicated and minimum uniform and minimum concentrated loadings stipulated in NBC commentary for building locality as ascertained by Climatic Information for Building Design in Canada supplied by Environment Canada for the site specific location of the Kicking Horse Campground, as noted on the drawings

- .4 Limit live load deflection to 1/360th of span where gypsum board ceilings are hung directly from trusses.
- .5 Limit live load deflections to 1/240th of span unless otherwise specified or indicated.
- .6 Provide camber for trusses as indicated.

## **2.2 MATERIALS**

- .1 Lumber to following standards:
  - .1 CSA O141.
  - .2 NLGA (National Lumber Grading Association), Standard Grading Rules for Canadian Lumber.
  - .3 CAN/CSA-Z809 or FSC or SFI certified.
- .2 Fastenings: to CSA O86.
- .3 Preservative: creosote.

## **2.3 FABRICATION**

- .1 Fabricate wood trusses in accordance with reviewed shop drawings.
- .2 Provide for design camber and roof slopes when positioning truss members.
- .3 Connect members using metal connector plates, bolts and nuts, plywood gussets or metal gusset, as per the drawings.

## **2.4 SOURCE QUALITY CONTROL**

- .1 Identify lumber by grade stamp of an agency certified by Canadian Lumber Standards Administration Board.
- .2 Certify by agency accredited by Standards Council of Canada that preservative treated wood in accordance with CAN/CSA O80 Series.

# **PART 3 EXECUTION**

## **3.1 EXAMINATION**

- .1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for product 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 MANUFACTURER'S INSTRUCTIONS**

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

## **3.3 ERECTION**

- .1 Erect wood trusses in accordance with reviewed shop drawings.
- .2 Handling, installation, erection, bracing and lifting in accordance with manufacturers instructions.
- .3 Make adequate provisions for handling and erection stresses.

- .4 Exercise care to prevent out-of-plane bending of trusses.
- .5 Install temporary horizontal and cross bracing to hold trusses plumb and in safe condition until permanent bracing and decking are installed.
- .6 Install permanent bracing in accordance with reviewed shop drawings, prior to application of loads to trusses.
- .7 Do not cut or remove any truss material without approval of Departmental Representative and Truss Design Engineer.
- .8 Remove chemical and other surface deposits on treated wood, in preparation for applied finishes.

### **3.4 FIELD QUALITY CONTROL**

- .1 Manufacturer's Field Services:
  - .1 Have manufacturer of products supplied under this Section review work involved in handling, installation/application, protection and cleaning of its products, and submit written reports, in acceptable format, to verify compliance of work with Contract.
  - .2 Manufacturer's field services: 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 at stages listed:
    - .1 After delivery and storage of products, and when preparatory work on which work of this Section depends is complete, but before installation begins.
    - .2 Twice during progress of work at 25% and 100% complete.
- .2 Upon completion of work, after cleaning is carried out.
- .3 Obtain reports within three days of review and submit immediately to Departmental Representative.

### **3.5 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 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.

**END OF SECTION**



**PART 1        GENERAL**

**1.1        RELATED REQUIREMENTS**

- .1        Section 06 10 00 – Rough Carpentry

**1.2        REFERENCE STANDARDS**

- .1        American National Standards Institute (ANSI)
  - .1        ANSI A208.1, Particleboard.
  - .2        ANSI A208.2, Medium Density Fibreboard (MDF) for Interior Applications.
  - .3        ANSI/HPVA HP-1, American National Standard for Hardwood and Decorative Plywood.
  - .4        ANSI/BHMA A156.16 Auxiliary Hardware.
  - .5        ANSI/ASME 18.6.1 Wood Screws (Inch Series).
- .2        Architectural Woodwork Manufacturers Association of Canada (AWMAC) and Architectural Woodwork Institute (AWI)
  - .1        Architectural Woodwork Quality Standards.
- .3        ASTM International
  - .1        ASTM A 153/A 153M, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
  - .2        ASTM E1333 Standard Test Method for Determining Formaldehyde Concentrations in Air and Emission Rates from Wood Products Using a Large Chamber.
  - .3        ASTM F1667 Standard Specification for Driven Fasteners: Nails, Spikes and Staples.
- .4        Canadian General Standards Board (CGSB)
  - .1        CAN/CGSB-11.3, Hardboard.
- .5        CSA International
  - .1        CSA O121, Douglas Fir Plywood.
  - .2        CSA O151, Canadian Softwood Plywood.
  - .3        CSA O153, Poplar Plywood.
  - .4        CAN/CSA-Z809, Sustainable Forest Management.
- .6        Forest Stewardship Council (FSC)
  - .1        FSC-STD-01-001, FSC Principle and Criteria for Forest Stewardship.
- .7        Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1        Material Safety Data Sheets (MSDS).
- .8        South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards
  - .1        SCAQMD Rule 1168, Adhesives and Sealants Applications.
- .9        Sustainable Forestry Initiative (SFI)
  - .1        SFI Standard.
- .10      Underwriters Laboratories of Canada (ULC)
  - .1        CAN/ULC-S104, Standard Method for Fire Tests of Door Assemblies.
  - .2        CAN/ULC-S105, Standard Specification for Fire Door Frames.

**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, data sheets and catalogue pages for specified products. Include product characteristics, performance criteria, dimensions and profiles, finish and limitations on use.
  - .2 Submit two (2) copies of WHMIS MSDS.
- .3 Shop Drawings:
  - .1 Prepare and submit shop drawings in general accordance with AWMAC AWS manual.
  - .2 Indicate profiles and dimensions, assembly techniques, jointing, methods of fastening, terminations and other related details.
  - .3 Indicate materials, thicknesses, finishes and hardware.
  - .4 Include schedule or key plan.
  - .5 Show profiles, elevations and details at scales recommended by AWMAC AWS.
  - .6 Where necessary, show location and type of blocking and backing required within supporting assemblies.
- .4 Samples:
  - .1 Submit triplicate 300 mm long representative samples of each typical item of finish carpentry.
    - .1 Standing and running trim: 300 mm long.
    - .2 Panel materials: 300 mm x 300 mm.
  - .2 Shop applied coating samples:
    - .1 For transparent finish, submit triplicate (3) samples of each species and cut of wood to be used, finished as specified.
    - .2 For opaque finish, submit triplicate (3) samples for each colour selection, finished as specified.
  - .3 Decorative overlaid composite panels, complete with applied edge treatment and corner treatment, minimum 300 mm x 300 mm.
  - .4 Samples for site applied finish:
    - .1 Furnish four (4) samples of each finish carpentry item and composite panel material to Contractor for preparation of field applied finish samples.
    - .2 Submit duplicate (2) samples of each hardware item to be left exposed in final construction. Samples will [not] be returned for incorporation into the work.
- .5 Certifications: submit certificates signed by manufacturer certifying materials comply with specified performance characteristics, physical properties and requirements of referenced standards.
- .6 Test and Evaluation Reports: submit certified test reports for composite wood from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.

#### **1.4 QUALITY ASSURANCE**

- .1 Perform Work of this Section by finish carpentry contractor with minimum 5 years of current experience and having completed minimum one project in the past 5 years with value within 20% of the cost of the work of this Section.
- .2 Independent inspection/testing agency will be engaged by Departmental Representative for purpose of inspecting and/or testing Work of this Section.

- .3 Mock-ups:
  - .1 Shop prepare one typical example of each specified item of standing and running trim, complete with shop applied finishes, and install where directed by Departmental Representative.
  - .2 Allow 72 hours for inspection of mock-up by Departmental Representative before proceeding with Work.
  - .3 When accepted, mock-up will demonstrate minimum standard for Work.
  - .4 Do not proceed with work prior to receipt of written acceptance of mock-up by Departmental Representative.
  - .5 Accepted mock-up may remain as part of finished work.

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

- .1 Deliver, store and handle materials with AWS recommendations and as follows.
- .2 Deliver finish carpentry materials only when area of work is enclosed, plaster and concrete work is dry, area is broom clean and site environmental conditions are acceptable for installation.
- .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 Maintain indoor temperature and humidity within range recommended by AWS for location of the Work.
  - .3 Store products on site as specified for minimum 72 hours prior to installation.
  - .4 Store and protect finish carpentry products from moisture, nicks, scratches, and blemishes.
  - .5 Replace defective or damaged materials with new.

## **PART 2 PRODUCTS**

### **2.1 REGULATORY REQUIREMENTS**

- .1 Wood fire rated frames and panels: labelled and listed by an organization accredited by Standards Council of Canada in conformance with CAN4-S104, NFPA 252 for ratings specified or indicated.
- .2 Provide fire labelled frames for openings requiring fire protection ratings. Test products in conformance with CAN4-S104, NFPA 252 and listed by nationally recognized agency having factory inspection services.

### **2.2 QUALITY GRADE**

- .1 Provide all materials and perform all work of this Section in accordance with AWMAC AWS Custom Grade, except as follows:
  - .1 Economy Grade: janitor's closets, mechanical rooms and utility areas.
- .2 In case of conflict between Contract Documents and AWMAC AWS grade requirements, Contract Documents govern.

### **2.3 MATERIALS**

- .1 Softwood and hardwood lumber: Sound lumber to specified AWS grade requirements, kiln-dried to moisture content recommended for location of the Work.
  - .1 Machine stress-rated lumber is acceptable for all purposes.
- .2 MDF (medium density fibreboard) core: to ANSI A208.2

- .1 Use moisture resistant MR grade for countertops and splash-backs to receive plumbing fixtures.
- .3 Interior mat-formed wood particleboard: to ANSI/NPA A208.1
  - .1 Use moisture resistant grade 2-M-2 or 2-M-3 for countertops and splash-backs to receive plumbing fixtures.
- .4 Douglas fir plywood (DFP): to CSA O121, standard construction.
- .5 Canadian softwood plywood (CSP): to CSA O151, standard construction.
- .6 Hardwood plywood: to ANSI/HPVA HP-1.
- .7 Poplar plywood (PP): to CSA O153, standard construction.
- .8 Hardboard: to CAN/CGSB-11.3.
- .9 Low density fibreboard: to CSA-A247M.
- .10 Decorative overlaid composite panels.
  - .1 Overlay bonded to both faces where exposed two sides, and when panel material require surface on one side only, reverse side to be overlaid with a plain (buff) balancing sheet.
  - .2 Furniture finish: Selected by Departmental Representative.

## **2.4 MANUFACTURED SHELVING**

- .1 Softwood and poplar plywood per manufacturer's standard design
- .2 Hardwood plywood per manufacturer's standard design.
- .3 Particleboard, per manufacturer's recommendations
- .4 Solid wood: per manufacturer's recommendations
- .5 MDF per manufacturer's recommendations
- .6 Edge banding per manufacturer's recommendations

## **2.5 FASTENINGS**

- .1 Provide screws, bolts, expansion shields and other fastening devices required for satisfactory installation.
- .2 Exposed fasteners to match finish of hardware.
- .3 Nails and staples: to ASTM F1677
- .4 Wood screws: to ANSI/ASME 18.6.1, countersunk flush type unless indicated otherwise, in sizes to suit application, galvanized to ASTM A 153/A 153M for exterior work.
- .5 Panel adhesive: Type to suit application.

## **2.6 HARDWARE**

- .1 Use one manufacturer's product for all similar items.
- .2 Shelf Hardware: to ANSI/BHMA A156.16
- .3 Miscellaneous Hardware: to ANSI/BHMA A156.16
- .4 Hardware fastenings:
  - .1 Supply screws, bolts, expansion shields and other fastening devices required for satisfactory installation of hardware.
  - .2 Exposed fastening devices to match finish of hardware.
  - .3 Use fasteners compatible with material through which they pass.

## **2.7 FACTORY FINISHING**

- .1 Finish grade to match grade of product to be finished.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- .1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for wood products installation in accordance with AWS tolerances and requirements of Contract Documents.
  - .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 Back prime woodwork before installation, to AWS.

### **3.3 INSTALLATION**

- .1 Install items of finish carpentry in accordance with AWMAC AWS grade specified for respective items.
- .2 In case of conflict between Contract Documents and AWS grade requirements, Contract Documents govern.
- .3 Install items of finish carpentry at locations shown on drawings.
  - .1 Position accurately, level, plumb straight.
  - .2 Fasten and anchor securely.
- .4 Scribe and cut as required, fit to abutting walls, and surfaces, fit properly into recesses and to accommodate piping, columns, fixtures, outlets, or other projecting, intersecting or penetrating objects.
- .5 Form joints to conceal shrinkage.

### **3.4 CONSTRUCTION**

- .1 Fastening:
  - .1 Position items of finished carpentry work accurately, level, plumb, true and fasten or anchor securely.
  - .2 Design and select fasteners to suit size and nature of components being joined. Use proprietary devices as recommended by manufacturer.
  - .3 Set finishing nails to receive filler. Where screws are used to secure members, countersink screw in round smooth cut hole and plug with wood plug to match material being secured.
  - .4 Replace items of finish carpentry with damage to wood surfaces including hammer and other bruises.
- .2 Standing and running trim:
  - .1 Butt and cope internal joints of baseboards to make snug, tight, joint. Cut right angle joints of casing and base with mitred joints.
  - .2 Fit backs of baseboards and casing snugly to wall surfaces to eliminate cracks at junction of base and casing with walls.
  - .3 Make joints in baseboard, where necessary using a 45 degrees scarf type joint.
  - .4 Install door and window trim in single lengths without splicing.
- .3 Interior and exterior frames:

- .1 Set frames with plumb sides, level heads and sills and secure.
- .4 Panelling:
  - .1 Secure panelling and perimeter trim using adhesive recommended for purpose by manufacturer. Fill nail holes caused by temporary fixing with filler matching wood in colour.
  - .2 Secure panelling and perimeter trim using concealed fasteners.
  - .3 Secure panelling and perimeter trim using counter sunk screws plugged with matching wood plugs.
- .5 Stairs:
  - .1 Install stairs to location and details as indicated.
- .6 Handrails, wall rails and bumper rails:
  - .1 Install handrails, wall rails and bumper rails in locations indicated.
  - .2 Make joints hair line, dowelled and glued.
  - .3 Install support brackets [as indicated].
  - .4 Install brackets at ends and at manufacturer's recommended on centre minimum at intermediate spacings.
  - .5 Secure using counter sunk screws plugged with matching wood plugs.
- .7 Shelving:
  - .1 Install shelving on as indicated by manufacturer's drawings.
- .8 Hardware:
  - .1 Install in locations indicated on manufacturer's drawings.

### **3.5 CLEANING**

- .1 Progress Cleaning:
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

### **3.6 TOUCHUP AND PROTECTION**

- .1 Fill and retouch all nicks, chips and scratches in factory finishes and substrate materials to AWS standards. Replace damaged items that cannot be repaired to AWS standards.
- .2 Protect installed products and components from damage during construction.
- .3 Repair damage to adjacent materials caused by finish carpentry installation.
- .4 Leave work to be site finished ready for finishing.

**END OF SECTION**

**PART 1 GENERAL**

**1.1 RELATED REQUIREMENTS**

- .1 Section 06 10 00 Rough Carpentry
- .2 Section 06 20 00 Finish Carpentry
- .3 Section 07 92 00 Joint Sealants

**1.2 REFERENCE STANDARDS**

- .1 American National Standards Institute (ANSI)
  - .1 ANSI/ASME 18.6.1 Wood Screws (Inch Series).
  - .2 ANSI/BHMA A156.9, Cabinet Hardware.
  - .3 ANSI/BHMA A156.11, Cabinet Locks.
  - .4 ANSI/BHMA A156.16-, Auxiliary Hardware.
  - .5 ANSI/BHMA A156.18, Materials and Finishes.
  - .6 ANSI/BHMA A156.20-, Strap and Tee Hinges and Hasps.
  - .7 ANSI A208.1, Particleboard.
  - .8 ANSI A208.2, Medium Density Fiberboard (MDF) for Interior Applications.
  - .9 ANSI/HPVA HP-1, Standard for Hardwood and Decorative Plywood.
- .2 Architectural Woodwork Manufacturers Association of Canada (AWMAC)
  - .1 Architectural Woodwork Standards (AWMAC AWS).
- .3 ASTM International
  - .1 ASTM A 153/A 153M, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
  - .2 ASTM E 1333, Standard Test Method for Determining Formaldehyde Concentrations in Air and Emission Rates From Wood Products Using a Large Chamber.
  - .3 ASTM F1667 Standard Specification for Driven Fasteners: Nails, Spikes and Staples.
- .4 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-11.3, Hardboard.
  - .2 CAN/CGSB-71.20, Adhesive, Contact, Brushable.
  - .3 CAN/CGSB-71.19, Adhesive, Contact, Sprayable.
- .5 CSA International
  - .1 CSA O112-M Series Standards for Wood Adhesives.
  - .2 CSA O121, Douglas Fir Plywood.
  - .3 CSA O141, Softwood Lumber.
  - .4 CSA O151, Canadian Softwood Plywood.
  - .5 CSA O153, Poplar Plywood.
  - .6 CAN/CSA-Z809, Sustainable Forest Management.
- .6 Forest Stewardship Council (FSC)
  - .1 FSC-STD-01-001, FSC Principle and Criteria for Forest Stewardship.
- .7 Green Seal Environmental Standards (GS)
  - .1 GS-11, Paints, Coatings, Stains and Sealers.
  - .2 GS-36, Adhesives for Commercial Use.
- .8 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).
- .9 National Electrical Manufacturers Association (NEMA)

- .1 ANSI/NEMA LD-3, High-Pressure Decorative Laminates (HPDL).
- .10 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards
  - .1 SCAQMD Rule 1113, Architectural Coatings.
  - .2 SCAQMD Rule 1168, Adhesives and Sealants Applications.
- .11 Sustainable Forestry Initiative (SFI)
  - .1 SFI Standard and Rules.

### **1.3 PRE-INSTALLATION MEETING**

- .1 Prior to enclosing framing, convene a meeting of contractor, casework fabricator, casework installer, framing subcontractor and Departmental Representative.
  - .1 Review locations of backing required for casework installation as shown on shop drawings and as necessary for installation.
  - .2 Review method of attachment for backing to wall system.
  - .3 Review coordination with other affected sections.

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

- .1 Submit in accordance with Section 01 33 00- Submittal Procedures.
- .2 Product Data:
  - .1 Prepare and submit material list in accordance with AWMAC AWS, cross-referenced to specifications.
  - .2 Include manufacturer's instructions, printed product literature, data sheets and catalogue pages for all materials and products to be incorporated into architectural wood casework and include product characteristics, performance criteria, dimensions and profiles, finish and limitations on use.
  - .3 Submit two (2) copies of WHMIS MSDS.
- .3 Hardware List:
  - .1 Submit hardware list cross-referenced to specifications.
  - .2 Include manufacturer's specification sheets indicating name, model, material, function, finish, BHMA designations and other pertinent information.
- .4 Shop Drawings:
  - .1 Prepare and submit shop drawings in accordance with AWMAC AWS and as follows.
  - .2 Submit two (2) sets of shop drawings for initial review in accordance with Section 01 33 00- Submittal Procedures. Revise as directed, submit six (6) copies for final acceptance and distribution.
  - .3 Indicate details of construction, profiles, jointing, fastening and other related details.
    - .1 Scales: profiles full size, details half full size.
  - .4 Indicate materials, thicknesses, finishes and hardware.
  - .5 Indicate locations of service outlets in casework, typical and special installation conditions, and connections, attachments, anchorage and location of exposed fastenings.
  - .6 Show location on casework elevations of backing required in supporting structure for attachment of casework.
  - .7 Indicate AWMAC AWS quality grade where different from predominant grade specified.



- .8 Include color schedule of all casework items, including all countertop, exposed, and semi-exposed cabinet finishes, finish material manufacturer, pattern, and color.
- .9 Submit drawings stamped and signed by professional engineer registered or licensed in the province where the Work is to take place.
- .5 Samples:
  - .1 Prepare and submit samples in accordance with AWMAC AWS and as follows.
  - .2 Apply sample finishes to specified substrate or core material minimum 300 x 300 mm. For veneers with transparent finish submit three samples to illustrate range and colour of grain expected.
  - .3 Shop applied coatings:
    - .1 For transparent finish, submit triplicate (3) samples of each species and cut of wood to be used, finished to match project sample.
    - .2 For opaque finish, submit triplicate (3) samples for each colour selection, finished to match project sample.
  - .4 Submit duplicate (2) samples of laminated plastic for each specified colour selection.
  - .5 Submit duplicate (2) samples of laminated plastic joints, edging, cut-outs and post-formed profiles.
  - .6 Certifications: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
  - .7 Submit statement of experience and qualifications of architectural wood casework fabricator.

## **1.5 QUALITY ASSURANCE**

- .1 Perform Work of this Section by single architectural wood casework fabricator with minimum 5 years of current architectural casework production experience and having completed minimum one project in the past 5 years with value within 20% of the cost of the work of this Section.
- .2 Mock-ups:
  - .1 Shop prepare one shelving unit, wall cabinet, base cabinet unit, counter top, convactor cabinet, complete with hardware and shop applied finishes, and install where directed by Departmental Representative.
  - .2 Allow 72 hours for inspection of mock-up by Departmental Representative before proceeding with Work.
  - .3 When accepted, mock-up will demonstrate minimum standard for Work.
  - .4 Do not proceed with work prior to receipt of written acceptance of mock-up by Departmental Representative.
  - .5 Accepted mock-up may remain as part of finished work.

## **1.6 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions and in accordance with Section 01 61 00- Common Product Requirements.
- .2 Deliver wood casework only when area of work is enclosed, plaster and concrete work is dry, and area is broom clean and site environmental conditions are acceptable for installation.
- .3 Protect millwork against dampness and damage during and after delivery.
- .4 Store millwork in ventilated areas, protected from extreme changes of temperature and humidity, and within range recommended by AWMAC AWS for location of project.
- .5 Store materials indoors, in clean, dry, well-ventilated area.

- .6 Protect architectural woodwork and hardware from nicks, scratches, and blemishes.
- .7 Replace defective or damaged materials with new.

## **PART 2 PRODUCTS**

### **2.1 QUALITY GRADE**

- .1 Provide all materials and perform all fabrication in accordance with AWMAC AWS Custom Grade and as follows, except where specified otherwise:
  - .1 Economy Grade: mechanical rooms and utility areas, janitor's closets.
- .2 In case of conflict between Contract Documents and AWMAC AWS grade requirements, Contract Documents govern.

### **2.2 LUMBER**

- .1 Softwood and Hardwood Lumber: Sound lumber to specified AWMAC AWS quality grade requirements, kiln-dried to moisture content recommended by AWMAC AWS for location of the Work.
- .2 Machine stress-rated lumber is acceptable for all purposes.

### **2.3 PANEL MATERIALS**

- .1 Interior mat-formed wood particleboard: to ANSI/NPA A208.1
  - .1 Use moisture resistant grade 2-M-2 or 2-M-3 for countertops and splash-backs to receive plumbing fixtures.
- .2 MDF (medium density fibreboard) core: to ANSI A208.2
  - .1 Use moisture resistant MR grade for countertops and splash-backs to receive plumbing fixtures.
- .3 Douglas fir plywood (DFP): to CSA O121, standard construction.
- .4 Hardwood plywood: to CHPA grading rules, ANSI/HPVA HP-1.
- .5 Canadian softwood plywood (CSP): to CSA O151, standard construction.
- .6 Poplar plywood (PP): to CSA O153, standard construction.
- .7 Hardboard: To CAN/CGSB-11.3.

### **2.4 DECORATIVE VENEER FACED PLYWOOD**

- .1 Decorative hardwood plywood: to specified AWMAC AWS requirements.

### **2.5 DECORATIVE OVERLAID COMPOSITE PANELS**

- .1 Thermally Fused Laminate (TFL): to NEMA LD3 Grade VGL, High wear resistant thermofused melamine: equal or exceed 400 cycles (Minimum standard for HPL abrasion test).
- .2 Rigid thermoformable foil (RTF): Decorative overlay, heat and pressure laminated with suitable resin to [thickness indicated]
- .3 Overlay bonded to both faces where exposed two sides, and when panel material require surface on one side only, reverse side to be overlaid with a plain (buff) balancing sheet.

### **2.6 LAMINATED PLASTIC MATERIALS**

- .1 Laminated plastic for flatwork: to NEMA LD3.
  - .1 High pressure decorative laminated (HPDL) plastic.
  - .2 Laminated plastic for postforming work: to NEMA LD3.
  - .3 :

- .4 Laminated plastic liner sheet: CLS grade
- .5 Thermofused Melamine: to NEMA LD3 Grade LPDL
  - .1 High wear resistant thermofused melamine: equal or exceed 400 cycles (Minimum standard for HPL abrasion test).
- .6 Laminated plastic fire retardant: to NEMA LD3.

## **2.7 CASEWORK FABRICATION - GENERAL**

- .1 Fabricate casework of specified core and surface finish materials to specified AWMAC AWS quality grade.
- .2 Set nails and countersink screws apply wood filler to indentations, sand smooth and leave ready to receive finish.
- .3 Shop install cabinet hardware for doors, shelves and drawers. Recess shelf standards unless noted otherwise.
- .4 Shelving to cabinetwork to be adjustable unless otherwise noted.
- .5 Provide cutouts for plumbing fixtures, inserts, appliances, outlet boxes and other fixtures.
- .6 Shop assemble work for delivery to site in size easily handled and to ensure passage through building openings.
- .7 Obtain governing dimensions before fabricating items which are to accommodate or abut appliances, equipment and other materials.

## **2.8 LAMINATED PLASTIC CASEWORK FABRICATION**

- .1 Do laminated plastic fabrication in compliance with NEMA LD3, Annex A and specified AWMAC AWS quality grade.
- .2 Ensure adjacent parts of continuous laminate work match in colour and pattern.
- .3 Veneer laminated plastic to core material in accordance with adhesive manufacturer's instructions. Ensure core and laminate profiles coincide to provide continuous support and bond over entire surface. Use continuous lengths up to 3000 mm. Keep joints 600 mm from sink cutouts.
- .4 Form shaped profiles and bends as indicated, using post-forming grade laminate to laminate manufacturer's instructions.
- .5 Use straight self-edging laminate strip for flatwork to cover exposed edge of core material. Chamfer exposed edges uniformly at approximately 20 degrees. Do not mitre laminate edges.
- .6 Apply laminate backing sheet to reverse side of core of plastic laminate work.
- .7 Apply laminated plastic liner sheet to interior of cabinetry.
- .8 Drawer Construction: Per manufacturer's standard drawings

## **2.9 WOOD VENEER SURFACING**

- .1 Apply wood veneer to specified core material in accordance with AWMAC AWS requirements for grade specified.

## **2.10 WOOD CASEWORK FABRICATION**

- .1 Fabricate casework bodies of specified veneered plywood panel materials in accordance with AWMAC AWS requirements for grade specified.

## **2.11 SHOP APPLIED FINISH COATINGS**

- .1 Apply finish system component materials in accordance with manufacturer's instructions.

## **2.12 CABINET HARDWARE**

- .1 Cabinet hardware: to AWMAC AWS quality grade specified and to ANSI/BHMA A156.9.

**2.13 CABINET LOCKS**

- .1 Provide locks as requested by Departmental Representative.
- .2 Cabinet locks: to ANSI/BHMA A156.11
- .3 Keying: Provide keys as requested by Departmental Representative.

**2.14 ACCESSORIES**

- .1 Wood screws: type and size to suit application.
- .2 Nails and staples: to CSA B111 and ASTM F1667.
- .3 Sealant: in accordance with Section 07 92 00 - Joint Sealants.

**2.15 LAMINATED PLASTIC COUNTERTOPS**

- .1 Laminated plastic for flatwork: to NEMA LD3.
- .2 Laminated plastic for post-forming work: to NEMA LD3.

**PART 3 EXECUTION**

**3.1 EXAMINATION**

- .1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for architectural woodwork installation in accordance with manufacturer's 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 INSTALLATION**

- .1 Install architectural wood casework in accordance with AWMAC AWS grade for respective items.
- .2 In case of conflict between Contract Documents and AWMAC AWS grade requirements, Contract Documents govern.
- .3 Install prefinished millwork at locations shown on drawings.
  - .1 Position accurately, level, plumb straight.
- .4 Fasten and anchor millwork securely.
  - .1 Supply and install heavy duty fixture attachments for wall mounted cabinets.
- .5 Countersink mechanical fasteners at exposed and semi-exposed surfaces, excluding installation attachment screws and screws securing cabinets end to end.
- .6 Use draw bolts in countertop joints.
- .7 Scribe and cut as required to fit abutting walls and to fit properly into recesses and to accommodate piping, columns, fixtures, outlets or other projecting, intersecting or penetrating objects.
- .8 At junction of plastic laminate counter back splash and adjacent wall finish, apply small bead of sealant in accordance with Section 07 92 00 - Joint Sealants.
- .9 Apply moisture barrier between wood framing members and masonry or cementitious construction.
- .10 Fit hardware accurately and securely in accordance with manufacturer's written instructions.

- .11 Make cut-outs for inset equipment and fixtures using templates provided.

### **3.3 CLEANING**

- .1 Progress Cleaning:
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.
  - .1 Clean outside surfaces, cabinet work, millwork, inside cupboards and drawers.
  - .2 Remove excess glue, pencil and ink marks from surfaces.

### **3.4 PROTECTION**

- .1 Protect cabinet work, millwork from damage until final inspection.
- .2 Protect installed products and components from damage during construction.
- .3 Repair damage to adjacent materials caused by architectural woodwork installation.
- .4 Leave work to be site finished ready for finishing.

**END OF SECTION**

## **PART 1 GENERAL**

### **1.1 RELATED SECTIONS**

- .1 Section 06 20 00 Finish Carpentry.
- .2 Section 06 40 00 Architectural Woodwork.

### **1.2 REFERENCES**

- .1 American National Standards Institute (ANSI)
  - .1 ANSI 208.1-99, Particleboard.
  - .2 ANSI A208.2-02, Medium Density Fibreboard (MDF) for Interior Applications.
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-71.20-M88, Adhesive, Contact, Brushable.
- .3 Canadian Standards Association (CSA International)
  - .1 CSA O112-M1977(R2001, Standards for Wood Adhesives.
  - .2 CSA O112.7-1.1-Series M-1977(R2001), Resorcinol and Phenol-Resorcinol Resin Adhesives for Wood (Room- and Intermediate-Temperature Curing).
  - .3 CSA O121-M1978(R1998), Douglas Fir Plywood.
  - .4 CAN/CSA O141-91(R1999), Softwood Lumber.
  - .5 CSA O151-M1978(R1998), Canadian Softwood Plywood.
  - .6 CSA O153-M1980(R1998), Poplar Plywood.

### **1.3 SUBMITTALS**

- .1 Product Data:
  - .1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Samples:
  - .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
  - .2 Submit duplicate samples of joints, edging, and cut-outs.
- .3 Manufacturer's Instructions:
  - .1 Submit manufacturer's installation instructions.
- .4 Closeout Submittals:
  - .1 Provide maintenance data for laminate work for incorporation into manual specified in Section 01 78 00 – Closeout Submittals.

### **1.4 QUALITY ASSURANCE**

- .1 Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties.
- .2 Certificates: Product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

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

- .1 Storage and Protection:
  - .1 Deliver, handle, store and protect materials as recommended by the manufacturer.
  - .2 Maintain relative humidity between 25 and 60% at 22 degrees C during storage and installation.

## **PART 2 PRODUCTS**

### **2.1 MATERIALS**

- .1 Laminated plastic for flatwork: to AWMAC manual 1998.
  - .1 Type: General purpose.
  - .2 Size: 1.27 mm thick.
  - .3 Colour (Washroom & Shower Facility Vanities; Toilet Partitions): Solid Phenolic as selected by Departmental Representative.
  - .4 Colour (Entry Kiosk Millwork): Arborite as selected by Departmental Representative.
- .2 Laminated plastic for backing sheet: to AWMAC manual 1998.
  - .1 Type: Backer.
  - .2 Size: not less than 0.5 mm thick or same thickness as face laminate.
  - .3 Colour: where visible, back material to be same as face material. Where not visible, backer shall be either same as face material or black.
- .3 Laminated plastic for liner: to AWMAC manual 1998.
- .4 Particleboard core: to ANSI 208.1, sanded faces, of thickness indicated.
- .5 Laminated plastic adhesive: to AWMAC manual 1998.
- .6 Sealer: water resistant sealer or glue acceptable to laminate manufacturer.
- .7 Sealants: to AWMAC manual 1998.
- .8 Draw bolts and splines: as recommended by fabricator.

### **2.2 FABRICATION**

- .1 Comply with AWMAC manual 1998.
- .2 Obtain governing dimensions before fabricating items which are to accommodate or abut appliances, equipment and other materials.
- .3 Ensure adjacent parts of continuous laminate work match in colour and pattern.
- .4 Veneer laminated plastic to core material in accordance with adhesive manufacturer's instructions. Ensure core and laminate profiles coincide to provide continuous support and bond over entire surface. Use continuous lengths up to 2400 mm. Keep joints 300 mm from sink and waste receptacle cut-outs.
- .5 Use straight self-edging laminate strip for flatwork to cover exposed edge of core material. Chamfer exposed edges uniformly at approximately 20 degrees. Do not miter laminate edges.
- .6 Apply laminate backing sheet to reverse side of core of plastic laminate work.
- .7 Apply melamine finish to interior of cabinetry, where the interior is not normally visible.

## **PART 3 EXECUTION**

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

- .1 Compliance: Comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

### **3.2 INSTALLATION**

- .1 Install work plumb, true and square, neatly scribed to adjoining surfaces.
- .2 Make allowances around perimeter where fixed objects pass through or project into laminated plastic work to permit normal movement without restriction.
- .3 Use draw bolts and splines in countertop joints. Maximum spacing 450 mm on centre, 75 mm from edge. Make flush hairline joints.
- .4 Provide cut-outs for inserts, grilles, appliances, outlet boxes, sinks, waste receptacles and other penetrations. Round internal corners, chamfer edges and seal exposed core.
- .5 At junction of laminated plastic counter back splash and adjacent wall finish, apply small bead of sealant.

### **3.3 PROTECTION**

- .1 Cover finished laminated plastic veneered surfaces with heavy kraft paper or put in cartons during shipment. Protect installed laminated surfaces by approved means. Do not remove until immediately before final inspection.

### **3.4 CLEANING**

- .1 Perform cleaning after installation to remove construction and accumulated environmental dirt.
- .2 Perform care and cleaning with AWMAC manual 1998.
- .3 Remove traces of primer, caulking, epoxy and filler materials; clean doors and frames.

**END OF SECTION**



## **PART 1 GENERAL**

### **1.1 RELATED REQUIREMENTS**

- .1 Section 03 30 00 Cast-In-Place Concrete
- .2 Section 07 26 00 Air Barrier-Vapour Retardants

### **1.2 REFERENCE STANDARDS**

- .1 Canada Green Building Council (CaGBC)
  - .1 LEED Canada-NC Version 1.0-[2004], LEED (Leadership in Energy and Environmental Design): Green Building Rating System for New Construction and Major Renovations (including Addendum 2007).
  - .2 LEED Canada-NC-[2009], LEED (Leadership in Energy and Environmental Design): Green Building Rating System for New Construction and Major Renovations 2009.
  - .3 LEED Canada-CI Version 1.0-2007, LEED (Leadership in Energy and Environmental Design): Green Building Rating System for Commercial Interiors.
  - .4 LEED Canada-EB: O&M-2009, LEED (Leadership in Energy and Environmental Design): Green Building Rating System for Existing Buildings: Operations and Maintenance 2009.
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-37.2-M88, Emulsified Asphalt, Mineral-Colloid Type, Unfilled, for Dampproofing and Waterproofing and for Roof Coatings.
  - .2 CAN/CGSB-37.3-M89, Application of Emulsified Asphalts for Dampproofing or Waterproofing.
  - .3 CAN/CGSB-37.5-M89, Cutback Asphalt Plastic Cement.
  - .4 CGSB 37-GP-6Ma-83, Asphalt, Cutback, Unfilled, for Dampproofing.
  - .5 CGSB 37-GP-9Ma-83, Primer, Asphalt, Unfilled, for Asphalt Roofing, Dampproofing and Waterproofing.
  - .6 CGSB 37-GP-11M-76(R1984), Application of Cutback Asphalt Plastic Cement.
  - .7 CGSB 37-GP-12Ma-84, Application of Unfilled Cutback Asphalt for Dampproofing.
  - .8 CGSB 37-GP-15M-76(R1984), Application of Asphalt Primer for Asphalt Roofing, Dampproofing and Waterproofing.
  - .9 CAN/CGSB-37.16-M89, Filled, Cutback, Asphalt for Dampproofing and Waterproofing.
  - .10 CAN/CGSB-37.28-M89, Reinforced Mineral Colloid Type, Emulsified Asphalt for Roof Coatings and for Waterproofing.
  - .11 CGSB 37-GP-36M-76, Application of Filled Cutback Asphalts for Dampproofing and Waterproofing.
  - .12 CGSB 37-GP-37M-77, Application of Hot Asphalt for Dampproofing or Waterproofing.
- .3 CSA International
  - .1 CAN/CSA-A123.4-04(R2008), Asphalt for Construction of Built-Up Roof Coverings and Waterproofing Systems.
- .4 Health Canada
  - .1 Workplace Hazardous Materials Information System (WHMIS)
    - .1 Material Safety Data Sheets (MSDS).

### **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 bituminous dampproofing application and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 Submit 2 copies of WHMIS MSDS in accordance with Section 01 33 00 - Submittals.
- .3 Manufacturer's Instructions: provide to indicate special handling criteria, installation sequence, and cleaning procedures.
- .4 Sustainable Design Submittals:
  - .1 LEED Canada submittals: in accordance with Section 01 33 00- Submittal Procedures.
  - .2 Construction Waste Management:
    - .1 Submit project Waste Reduction Workplan highlighting recycling and salvage requirements.
    - .2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating that 75% of construction wastes were recycled or salvaged.
  - .3 Recycled Content:
    - .1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of post-industrial content, and total cost of materials for project.
    - .2 Submit evidence, when Supplementary Cementing Materials (SCMs) are used, to certify reduction in cement from Base Mix to Actual SCMs Mix, as percentage.
  - .4 Regional Materials: submit evidence that project incorporates required percentage 20% of regional materials and products, showing their cost, distance from project to furthest site of extraction or manufacture, and total cost of materials for project.
  - .5 Low-Emitting Materials:
    - .1 Submit listing of coatings and sealers used in building, showing compliance with VOC and chemical component limits or restriction requirements.

### **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 off ground and in a dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect dampproofing materials from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.
- .4 Develop Waste Reduction Workplan related to Work of this Section and in accordance with Section 01 35 43 – Environmental Procedures and Section 01 74 21- Construction-demolition Waste Management And Disposal.

- .5 Packaging Waste Management: remove for reuse by manufacturer of crates, pallets, padding, packaging materials as specified in Waste Reduction Workplan in accordance with Section 01 35 43 – Environmental Procedures and Section 01 74 21- Construction/Demolition Waste Management and Disposal.

## **1.5 SITE CONDITIONS**

- .1 Ambient Conditions: temperature, relative humidity, moisture content.
  - .1 Apply dampproofing materials only when surfaces and ambient temperatures are within manufacturers' prescribed limits.
  - .2 Do not proceed with Work when wind chill effect would tend to set bitumen before proper curing takes place.
  - .3 Maintain air temperature and substrate temperature at dampproofing installation area above 5 degrees C for 24 hours before, during and 24 hours after installation.
  - .4 Do not apply dampproofing in wet weather.
- .2 Safety: comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of asphalt, sealing compounds, primers and caulking materials.
- .3 Ventilation:
  - .1 Ventilate area of Work as directed by Departmental Representative by use of approved portable supply and exhaust fans. Departmental Representative will arrange for ventilation system to be operated during installation of dampproofing.
  - .2 Provide continuous ventilation during and after dampproofing application. Run ventilation system 24 hours per day during installation; provide continuous ventilation for 7 days after completion of dampproofing installation.

## **PART 2 PRODUCTS**

### **2.1 MATERIALS**

- .1 Asphalt:
  - .1 For application and curing at temperatures above 5 degrees C: to CGSB 37-GP-6Ma, CAN/CGSB-37.16, CAN/CGSB-37.2, CAN/CGSB-37.28, and CAN/CSA-A123.4 Type 1.
    - .1 Package label or bill of lading for bulk hot liquid asphalt must indicate type, flash point, equiviscous temperature range and final blowing temperature.
    - .2 Recycled material content: 75%.
  - .2 For application and curing at temperatures above 0 degrees C but below 5 degrees C: to CAN/CGSB-37.16, CGSB 37-GP-6Ma, and CAN/CSA-A123.4 Type 2.
    - .1 Package label or bill of lading for bulk hot liquid asphalt must indicate type, flash point, equiviscous temperature range and final blowing temperature.
    - .2 Recycled material content: 75%.
- .2 Sealing compound: plastic cutback asphalt cement to CAN/CGSB-37.5.
  - .1 Recycled material content: 75%.
- .3 Asphalt primer: to CGSB 37-GP-9Ma and CAN/CGSB-37.2.
  - .1 Recycled material content: 75%.

## **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 bituminous dampproofing application 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 WORKMANSHIP**

- .1 Keep hot asphalt:
  - .1 Below its flash point.
  - .2 At or below its final blowing temperature.
  - .3 Within its equiviscous temperature range at place of application.

### **3.3 PREPARATION**

- .1 Before applying dampproofing:
  - .1 Seal exterior joints between foundation walls and footings, joints between concrete floor slab and foundation and around penetrations through dampproofing with sealing compound.

### **3.4 APPLICATION**

- .1 Do dampproofing in accordance with CGSB 37-GP-12Ma, CGSB 37-GP-37M, CAN/CGSB-37.3, and CGSB 37-GP-36M.
- .2 Do sealing work in accordance with CGSB 37-GP-11M.
- .3 Do priming of surface in accordance with CGSB 37-GP-15M.
- .4 Apply primer to CGSB primer standard.
- .5 Apply dampproofing in accordance with applicable CGSB application standard.

Material	Application	
CAN/CGSB-37.2	use	CAN/CGSB-37.3
CGSB 37-GP-6Ma	use	CGSB 37-GP-12M
CAN/CGSB-37.16	use	CGSB 37-GP-36M
CAN/CGSB-37.28	use	CAN/CGSB-37.3
CSA A123.4	use	CGSB 37-GP-37M

### **3.5 SCHEDULE**

- .1 Apply continuous, uniform coating to entire exterior faces of foundation walls from 50 mm below finished grade level to and including tops of foundation wall footings.
- .2 Apply continuous, uniform coating to exterior side of foundation walls enclosing rooms below finished grade. Include exterior portion of interior walls where floors in adjacent rooms are at different elevations.
- .3 Apply two additional coats of dampproofing to vertical corners and construction joints for a minimum width of 230 mm on each side, and all around and for 230 mm along pipes passing through walls.

**3.6 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 and Section 01 35 43- Environmental Procedures.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

**3.7 PROTECTION**

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by dampproofing application.

**END OF SECTION**

## **PART 1 GENERAL**

### **1.1 RELATED SECTIONS**

- .1 Section 07 21 16 – Blanket Insulation.

### **1.2 SUBMITTALS**

- .1 In accordance with Section 01 33 00- Submittal Procedures.
- .2 Submit manufacturers' literature for insulation and fastening systems, indicating compliance with specifications.

### **1.3 CERTIFICATION**

- .1 Polystyrene insulation shall be tested, certified and labelled for conformance with CAN/ULC S701-01, Thermal Insulation, Polystyrene, Boards and Pipe Covering, in accordance with ULC, or other certification program accredited by Standards Council of Canada.

### **1.4 STORAGE**

- .1 Store to protect materials from wind, moisture, sunlight and accidental ignition.

### **1.5 ENVIRONMENTAL CONDITIONS**

- .1 Install insulation during dry weather conditions.

### **1.6 SEQUENCING AND SCHEDULING**

- .1 Schedule application of insulation to follow immediately after installation of sheet membrane air and vapour seal and to proceed concurrently with it.

## **PART 2 PRODUCTS**

### **2.1 INSULATION**

- .1 Polystyrene, Type 2: to CAN/ULC S701-01, Type 2.
- .2 Polystyrene, Type 4: to CAN/ULC S701-01, Type 4, tongue and groove as follows:
  - .1 Standard un-faced

### **2.2 BOARD DIMENSIONS AND SHAPE**

- .1 Minimum Width: 400 mm.
- .2 Minimum Length: 1200 mm.
- .3 Thickness: as indicated on drawings

### **2.3 CAVITY WALL INSULATION FASTENERS**

- .1 Fasteners shall be specifically designed to anchor insulation by frictional resistance within structurally adequate substrates. They shall be inserted into and compressed against surrounding substrates, either by being driven or screwed, and shall be one or a combination of the following types:
  - .1 Plastic: with integral shank and head of minimum 45 mm diameter to distribute stresses, of high density polyethylene to ASTM D1248-84 or high density polypropylene to ASTM D4101-95b.
  - .2 Carbon Steel or Stainless Steel: of nail, screw or expansion type, with separate hot-dip galvanized sheet steel or high density polyethylene or polypropylene stress distribution plates of minimum 50 mm diameter or width.

- .3 Masonry Connectors: as specified in Section 04 05 19- Masonry Anchorage and Reinforcing, designed, with or without optional insulation retainer plates, to function as insulation fasteners.
- .2 Performance requirements for installed insulation fasteners:
  - .1 Pullout Resistance: minimum 200 N, perpendicular to applicable substrates and within temperature range of -30°C to +40°C.
  - .2 Corrosion Resistance: carbon steel components shall show not more than 15% of the surface rusted, and coatings shall not blister, peel or crack, when tested to Corrosion Test Procedure of Factory Mutual Research Approval Standard, Class I Roof Covers (4470).

## **2.4 ADHESIVES**

- .1 Adhesive for Perimeter Insulation: Conforming to CGSB 71-GP-24M, Type 2. And compatible with membrane waterproofing specified in Section 07 13 00 - Sheet Membrane Waterproofing.

## **2.5 FILTER FABRIC**

- .1 Nilex 2000 or approved equal.

# **PART 3 EXECUTION**

## **3.1 INSTALLATION OF CAVITY WALL INSULATION**

- .1 Install insulation boards horizontally. Offset vertical joints minimum 300 mm.
- .2 Install tightly against dry substrate using adhesive approved by manufacturer. Provide continuity of thermal protection to building elements and spaces.
- .3 Cut and trim insulation neatly to fit around corners and penetrations.
- .4 Butt joints tightly. Deform board edges as required to maintain tight butt joints at insulation fasteners and other penetrations located at board joints.

## **3.2 INSTALLATION OF FASTENERS**

- .1 Secure all above grade and partially above grade insulation boards with fasteners, anchored to substrates capable of providing specified fastener pull-out performance. Do not anchor to gypsum sheathing.
- .2 Install fasteners following fastener manufacturer's recommendations for type of substrate, drill bits, edge distance, installation methods, and ambient and substrate temperature conditions.
- .3 Space fasteners horizontally at:
  - .1 Maximum 800 mm O.C., and
  - .2 Minimum 100 mm and maximum 200 mm from vertical board joints.
- .4 Space fasteners vertically:
  - .1 At all horizontal board joints and on centre line of board widths, or
  - .2 At 1/4 of board width from all horizontal joints.

### 3.3 INSULATION SCHEDULE

Location	Type	Thickness(mm)
Exterior masonry walls above grade (not including cast-in-place walls) - Washroom & Shower Facility	Polystyrene, Type 2	100 mm
Exterior cast-in-place concrete slab below grade – Washroom & Shower Facility	Polystyrene, Type 4	200 mm
Exterior cast-in-place concrete thickened end slab below grade – Entry Kiosk	Polystyrene, Type 4	200 mm
Exterior concrete foundation wall below grade – Washroom & Shower Facility	Polystyrene, Type 2	200 mm
Exterior continued insulation to 2000 mm away from foundation wall below grade – Washroom & Shower Facility	Polystyrene, Type 2	200 mm
Exterior concrete column below grade – Washroom & Shower Facility and Entry Kiosk	Polystyrene, Type 2	As indicated on Structural Drawings

**END OF SECTION**



**PART 1 GENERAL**

**1.1 PRODUCT DATA**

- .1 Comply with requirements of Division 1.
- .2 Submit duplicate copies of manufacturer's product data indicating that insulation materials comply with specified requirements.

**1.2 PRODUCT DELIVERY AND STORAGE**

- .1 Deliver insulation and accessories in original unopened packaging or cartons bearing manufacturer's seals and labels.
- .2 Store materials under cover on raised platforms, away from moisture. Keep dry at all times.

**PART 2 PRODUCTS**

**2.1 BATT INSULATION**

- .1 Fibrous Glass Batts: to CSA A101M, preformed insulation without a membrane, sized for friction fit between framing, thermal resistance (RSI) of 3.5.

**PART 3 EXECUTION**

**3.1 PREPARATION**

- .1 Ensure all in-wall construction is complete before beginning installation.
- .2 Install insulation after building substrate materials are dry.
- .3 Ensure substrate materials are properly installed and complete before beginning installation.

**3.2 INSTALLATION - GENERAL**

- .1 Install insulation materials in accordance with manufacturer's recommendations.
- .2 Install insulation to maintain continuity of thermal protection of building elements and spaces.
- .3 Fit insulation tightly around openings and protrusions in plane of insulation.

**3.3 INSTALLATION OF BATT INSULATION**

- .1 Batts between framing members, structural components and other items snug and tight.
- .2 Cut and trim batts neatly to fit spaces. Use batts free from ripped or damaged back and edges.
- .3 Do not compress insulation to fit into spaces.

**END OF SECTION**

**PART 1 GENERAL**

**1.1 RELATED REQUIREMENTS**

- .1 Section 07 21 13 Board Insulation
- .2 Section 07 21 16 Blanket Insulation
- .3 Section 08 50 00 Windows
- .4 Section 08 11 00 Steel Hollow Metal Doors and Frames

**1.2 REFERENCE STANDARDS**

- .1 Canada Green Building Council (CaGBC)
  - .1 LEED Canada-NC Version 1.0-2004, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Package For New Construction and Major Renovations (including Addendum 2007).
  - .2 LEED Canada-CI Version 1.0-2007, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Guide For Commercial Interiors.
  - .3 LEED Canada 2009 for Design and Construction-2010, LEED Canada 2009 for Design and Construction Leadership in Energy and Environmental Design Green Building Rating System Reference Guide.
  - .4 LEED Canada for Existing Buildings, Operations and Maintenance-2009, LEED Canada 2009 Leadership In Energy and Environmental Design Green Building Rating System Reference Guide.
- .2 Canadian Urethane Foam Contractors Association Inc. (CUFCA)
- .3 Green Seal (GS)
  - .1 GS-11-2013, Standard for Paints and Coatings.
- .4 South Coast Air Quality Management District (SCAQMD)
  - .1 SCAQMD Rule 1113-13, Architectural Coatings.
- .5 Underwriters Laboratories of Canada (ULC)
  - .1 CAN/ULC-S101-07, Standard Methods of Fire Tests of Building Construction and Materials.
  - .2 CAN/ULC-S102-10, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
  - .3 CAN/ULC-S705.1-01, Standard for Thermal Insulation - Spray Applied Rigid Polyurethane Foam, Medium Density, Material Specification. Includes Amendment 1.2.
  - .4 CAN/ULC-S705.2-05, Standard for Thermal Insulation - Spray Applied Rigid Polyurethane Foam, Medium Density, Application.

**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 polyurethane foam sprayed insulation and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 Submit 2 copies of WHMIS MSDS in accordance with Section 01 35 43- Environmental Procedures and Section 01 35 29.06- Health and Safety Requirements.

- .3 Test Reports:
  - .1 Submit certified test reports for insulation from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.
  - .2 Submit test reports in accordance with CAN/ULC-S101 for fire endurance and CAN/ULC-S102 for surface burning characteristics.
- .4 Manufacturer's Instructions:
  - .1 Submit manufacturer's installation instructions and special handling criteria, installation sequence, and cleaning procedures.
- .5 Manufacturer's Reports:
  - .1 Manufacturer's Field Reports: submit to manufacturer's written reports within 3 days of review, verifying compliance of Work, as described in PART 3 - FIELD QUALITY CONTROL.
- .6 Sustainable Design Submittals:
  - .1 LEED Canada submittals: in accordance with Section 01 35 43- Environmental Procedures.
  - .2 Construction Waste Management:
    - .1 Submit project Waste Reduction Workplan highlighting recycling and salvage requirements.
    - .2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating that 75% of construction wastes were recycled or salvaged.
  - .3 Recycled Content:
    - .1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of post-industrial content, and total cost of materials for project.
  - .4 Regional Materials: submit evidence that project incorporates required percentage of 20% locally resourced

#### **1.4 QUALITY ASSURANCE**

- .1 Applicators to conform to CUFCA Quality Assurance Program.
- .2 Qualifications:
  - .1 Installer: person specializing in sprayed insulation installations approved by manufacturer.
  - .2 Manufacturer: company with experience in producing of material used for work required for this project, with sufficient production capacity to produce and deliver required units without causing delay in work.
- .3 Mock-up:
  - .1 Construct mock-up in accordance with Section 01 45 00- Quality Control.
  - .2 Construct mock-up 10 m2 minimum, of sprayed insulation including one inside corner and one outside corner, windows, and doors/ frames.
  - .3 Mock-up may be part of finished work.
  - .4 Allow 24 hours for inspection of mock-up by Departmental Representative before proceeding with sprayed insulation work.
- .4 Health and Safety Requirements: worker protection:
  - .1 Protect workers as recommended by CAN/ULC-S705.2 and manufacturer's recommendations:

- .2 Workers must wear protective clothing, eye protection, gloves, and respirators when applying foam insulation.
- .3 Workers must not eat, drink or smoke while applying foam insulation.

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

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials off ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect specified materials from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.
- .4 Develop Waste Reduction Workplan related to Work of this Section and in accordance with Section 01 35 43- Environmental Procedures.
- .5 Packaging Waste Management: remove for reuse by manufacturer of packaging materials, crates, pallets, padding, as specified in Waste Reduction Workplan in accordance with Section 01 35 43- Environmental Procedures and Section 01 74 21- Construction/Demolition Waste Management and Disposal.

## **1.6 SITE CONDITIONS**

- .1 Ventilate area to receive insulation by introducing fresh air and exhausting air continuously during and 24 hour after application to maintain non-toxic, unpolluted, safe working conditions.
- .2 Provide temporary enclosures to prevent spray and noxious vapours from contaminating air beyond application area.
- .3 Protect adjacent surfaces and equipment from damage by overspray, fall-out, and dusting of insulation materials.
- .4 Apply insulation only when surfaces and ambient temperatures are within manufacturers' prescribed limits.

## **PART 2 PRODUCTS**

### **2.1 MATERIALS**

- .1 Insulation: spray polyurethane to CAN/ULC-S705.1.
- .2 Primers: in accordance with manufacturer's recommendations for surface conditions.
  - .1 Maximum VOC limit \100 g/L to GS-11 Standard

## **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 sprayed insulation application 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 APPLICATION**

- .1 Apply insulation to clean surfaces in accordance with manufacturer's printed instructions.
- .2 Use primer where recommended by manufacturer.
- .3 Apply sprayed foam insulation in thickness as indicated.

### **3.3 FIELD QUALITY CONTROL**

- .1 Manufacturer's Field Services:
  - .1 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.

### **3.4 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.
  - .1 Remove insulation material spilled during installation and leave work area ready for application of wall board.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 35 43- Environmental Procedures and 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.

**END OF SECTION**

## **PART 1 GENERAL**

### **1.1 DELIVERY/STORAGE**

- .1 Deliver to the site in original containers or wrappings with manufacturer's labels and seals intact.
- .2 Store materials clear from the ground and cover to protect from weather or deterioration.

## **PART 2 PRODUCTS**

### **2.1 SHEET MATERIALS**

- .1 Sheet Vapour Retardant: 150 micron (6 mil) thick, polyethylene film conforming to CAN/CGSB 51.34-M86.
- .2 Membrane Air Barrier: self-adhering membrane of rubberized asphalt integrally bonded to polyethylene sheeting, minimum thickness 1.0 mm.
  - .1 Acceptable products:
    - Bakor Blueskin SA
    - Grace Perm-a-Barrier
    - Meadows Air-Shield

### **2.2 ACCESSORIES**

- .1 Joint sealing tape: air resistant pressure sensitive adhesive tape, type recommended by vapour barrier manufacturer; 60 mm wide for lap joints and perimeter seals, 25 mm wide elsewhere, as manufactured by 3M or Tuck.
- .2 Acoustical Sealant: EcoLogo certified, not to contain total of volatile organic compounds in excess of 5% by weight, asbestos-free sealant, compatible with vapour retardant materials, recommended by vapour retardant manufacturer, gun applied. To Section 07 92 00 Joint Sealants.
- .3 Staples: minimum 6 mm leg.
- .4 Moulded box vapour barrier: 450 micron (18 mils) thick, polyethylene box for use with recessed electric switch and outlet device boxes, "Polypans" or equal.

## **PART 3 EXECUTION**

### **3.1 SHEET VAPOUR RETARDANT**

- .1 Ensure services are installed and inspected prior to installation of vapour retardant.
- .2 Install sheet vapour retardant on warm side of exterior wall/ceiling assemblies prior to installation of finish materials to form continuous vapour retardant.
- .3 Use sheets of largest practical size to minimize joints.
- .4 Vapour retardant joints shall occur over solid backing to enable stapling and taping or sealing. Space joints over a minimum of two trusses or studs.
- .5 Extend vapour retardant tight to full perimeter of adjacent window and door frames and other items interrupting the plane of membrane. Seal or fasten in place with tape or staples and acoustical sealant.
- .6 Extend wall vapour retardant between interior and exterior walls as described in Section 06 10 00 – Rough Carpentry.
- .7 Extend ceiling vapour retardant over all interior partitions as described in Section 06 10 00 – Rough Carpentry.
- .8 Seal perimeter of sheet vapour retardant as follows:

- .1 Apply continuous bead of sealant to substrate at perimeter of sheets.
- .2 Lap sheet over sealant and press into sealant bead.
- .3 Install staples through lapped sheets at sealant bead into wood substrate.
- .4 Ensure that no gaps exist in sealant bead. Smooth out folds and ripples occurring in sheet over sealant.
- .9 Seal lap joints of sheet vapour barrier as follows:
  - .1 Attach first sheet to substrate.
  - .2 Apply continuous bed of sealant over solid backing at joint.
  - .3 Lap adjoining sheet minimum 150 mm and press into sealant bead.
  - .4 Install staples through lapped sheets at sealant bead into wood substrate.
  - .5 Ensure that no gaps exist in sealant bead. Smooth out folds and ripples occurring in sheet over sealant.
- .10 Seal electrical switch and outlet device boxes that penetrate vapour barrier as follows:
  - .1 Install moulded box vapour barrier.
  - .2 Apply sealant to seal edges of flange to main vapour barrier and seal wiring penetration through box cover.
- .11 Inspect for continuity. Repair punctures and tears with sealing tape before work is concealed.
- .12 Press vapour retardant firmly into continuous bead of acoustical sealant along top and bottom of wall plates.

### 3.2 MEMBRANE AIR BARRIER

- .1 Preparation
  - .1 Surface Condition
    - .1 Ensure that surfaces to receive membrane air barrier are smooth, clean, dry and in good condition.
    - .2 Remove moisture, grease, machine oil, and other foreign materials.
  - .2 Concrete Surfaces
    - .1 Concrete surfaces shall be smooth, stable, free of voids, spalled areas, loose aggregate, or sharp protrusions. Concrete shall be cured for minimum 7 days, and shall be dry before application of membranes. Surface treatments shall not contain oil, wax, or pigments. Allow concrete to dry minimum 24 hours after rain. Use form release which will not transfer to concrete. Repair defects. Remove sharp protrusions and form match lines. If surface are rough, use well adhered parge coat to achieve smooth surface.
    - .2 Prime before application of membrane air barrier to ensure positive membrane adhesion. Apply primer in accordance with manufacturer's instructions.
- .2 Application of Installation – Walls
  - .1 Membrane Air Barrier
    - .1 Install membrane air barrier according to manufacturer's instructions on exterior wall assemblies to form continuous barrier, using propane torch for heat bonding. Use sheets of largest practical size to minimize joints. Inspect sheets for continuity. Repair punctures and tears before work is concealed.
  - .2 Exterior Surface Openings
    - .1 Cut membrane air barrier to form openings and ensure that material is lapped and sealed to frame.
  - .3 Perimeter Seals

- .1 Seal perimeter of membrane air barrier according to manufacturer's printed instructions.
- .4 Lap Joints Seals
  - .1 Seal side and end lap joints of membrane air barrier according to manufacturer's printed instructions, minimum 50 mm, and heat seal. Apply pressure to membrane with back of trowel to ensure positive adhesion at edge.
  - .2 Extend and seal to exterior window and door frames, and other wall penetrations.
  - .3 Lap wall air barrier and roof vapour retardant as indicated. Extend membrane air barrier over top plate of wall and lap minimum 150 mm over roof/ceiling vapour retardant.
- .5 Corners
  - .1 Use 300 mm wide reinforcing piece of expansion joint membrane at inside and outside corners prior to application of field membrane.
- .6 Gaps
  - .1 Fill gaps or joints wider than 6 mm with structural material as recommended by membrane manufacturer's and reinforce with 300 mm wide piece of expansion joint membrane prior to application of field membrane.
- .7 Roof/Wall/Foundation Junction
  - .1 Coordinate wall/concrete foundation junction to maintain continuity of membrane air barrier from wall to foundation.
- .3 Field Quality Control
  - .1 Inspection
    - .1 Carefully inspect for continuity of air barrier prior to placement of insulation. Repair deficient membrane areas.
  - .2 Deficient Areas
    - .1 Repair misaligned or inadequately lapped seams, punctures, and other damage with patch of membrane extending 50 mm in all directions from edge of damaged area.

### **3.3 VAPOUR RETARDANT UNDER SLAB**

- .1 Install vapour retardant under concrete floor slabs inside building and as indicated on drawings.
- .2 Place on granular fill before void form (where applicable) and reinforcement is installed.
- .3 Lap a minimum of 200 mm joints and seal with mastic or tape.
- .4 Seal punctures before placing concrete. Use material at least 150 mm larger than puncture and seal with mastic.

**END OF SECTION**



## **PART 1 GENERAL**

### **1.1 SECTION INCLUDES**

- .1 Pre-finished hardboard siding.

### **1.2 RELATED SECTIONS**

- .1 Section 04 22 00 Concrete Unit Masonry
- .2 Section 06 10 00 Rough Carpentry
- .3 Section 07 62 00 Metal Flashing and Trim

### **1.3 REFERENCES**

- .1 American Hardboard Association (AHA): AHA A135.6 - Hardboard Siding.
- .2 Canadian General Standards Board (CGSB): CGSB 11.5 - M87: Hardboard, Pre-coated, Factory Finished for Exterior Cladding.

### **1.4 SUBMITTALS**

- .1 Submit shop drawings in accordance with Section 01 33 00 – Submittals.
- .2 Submit Manufacturer's data sheets on each product to be used, including:
  - .1 Storage and handling requirements and recommendations.
  - .2 Installation methods.
- .3 Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) square representing actual product, color, and patterns.

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

- .1 Store products in manufacturer's unopened packaging with labels intact until ready for installation.
- .2 Store products in clean, dry area, under cover, and stacked on pallets. Do not store siding in heated buildings as it will make it susceptible to drying and buckling.

### **1.6 PROJECT CONDITIONS**

- .1 Weather Conditions: Do not install siding under environmental conditions outside manufacturer's absolute limits. Do not install siding over wet substrate.

### **1.7 WARRANTY**

- .1 Manufacturer's Warranty: Provide manufacturer's standard warranty document executed by authorized company official covering performance and finish, including color, fading, and chalking.
  - .1 Warranty Period, Paint Finish: 15 years from date of Substantial Completion; first 5 years: 100 percent of the cost of labor and materials required to refinish the affected siding or supply replacement material exclusive of installation labor.
  - .2 Warranty Period, Siding Material: 25 years from date of Substantial Completion; first 5 years 100 percent of the purchase price of the damaged siding exclusive of installation labor.

## **PART 2 PRODUCTS**

### **2.1 MANUFACTURERS**

- .1 Acceptable Manufacturer: James Hardie or approved equal.

## **2.2 SIDING**

- .1 General: Hardboard in accordance with AHA A135.6 and CGSB 11.5 - M87.
- .2 Horizontal Siding: HardiePlank lap siding.
  - .1 Size and Exposure: 7.25 inches (184 mm) wide, 5/16 inch (8 mm) thick, 12 feet (3658 mm) long or 16 feet (4877 mm) long; exposure: 6 inches (152 mm).
  - .2 Overlap: 1.25 inches (32 mm).
  - .3 Texture: Select Cedarmill® ColorPlus.
- .3 Vertical Siding: Hardie Panel vertical siding.
  - .1 Size and Exposure: Butt ends with H connector.
  - .2 Overlap: As per Manufacturer's installation recommendations.
  - .3 Texture / Color: As per the finish schedule.
- .4 Trim boards: Hardie Trim Boards.
- .5 Provide accessories recommended by siding manufacturer to match siding, as required including:
  - .1 Prefabricated outside corner trim.
  - .2 Prefabricated starter strips.
  - .3 Prefabricated joint moldings.
  - .4 Thermoplastic caulk.
  - .5 Prefabricated drip cap.
  - .6 Colored nails.
  - .7 J-molding.
  - .8 Touch-up paint.

## **PART 3 EXECUTION**

### **3.1 INSTALLATION**

- .1 Install in accordance with manufacturer's instructions, with uniform appearance and in proper relationship to adjacent materials.

### **3.2 PROTECTION**

- .1 Protect installed products until completion of project.
- .2 Touch-up, repair or replace damaged products before Substantial Completion.

**END OF SECTION**

## **PART 1        GENERAL**

### **1.1            REFERENCE STANDARDS**

- .1     ASTM A792 Specification for Steel Sheet, Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
- .2     CGSB 37-GP-29M Sealing Compound, Rubber-Asphalt.
- .3     ASTM E 330 Structural Performance.
- .4     ASTM E 283 Air Infiltration.
- .5     ASTM E 331 Water Penetration.
- .6     SMACNA (Sheet Metal and Air Conditioning Contractor's National Association) Architectural Sheet Metal Manual specifications.
- .7     ASHRAE Handbook of Fundamentals.
- .8     AAMA-605-1 Finish Standards.
- .9     ASTM E84 Flame Spread Rating.
- .10    CSSBI Canadian Sheet Steel Building Institute.

### **1.2            QUALITY ASSURANCE**

- .1     The work of this section shall be carried out by experienced and competent Subcontractors. Subcontractors for this work must be authorized by the manufacturer.

### **1.3            SHOP DRAWINGS**

- .1     Submit shop drawings in accordance with Division 01.
- .2     Indicate arrangement of roof sheets including joints, types, and location of supports, fasteners, any special shapes, and roof penetration details.
- .3     Submit a design brief for the metal roofing system including fastenings and anchorages on the Shop Drawings.
- .4     Each drawing submitted shall bear the signature and stamp of a qualified Professional Engineer registered in the Province of British Columbia, with the current date specific to this project.
- .5     Submit 3 - 75 x 100 mm samples of each type of sheet metal material, colour and finish at time of shop drawing submission.

### **1.4            DESIGN CRITERIA**

- .1     Design complete roof panel system to withstand dead loads, snow load and build-up, and wind loads including uplift, calculated in accordance with National Building Code of Canada, and as shown on the Drawings.
- .2     Deflection of the roof system under live loading shall not exceed 1/300th of the span.
- .3     Design roof panel system to allow for thermal movement of components caused by ambient temperature range of 80oC without causing buckling, failure to joint seals, undue stress on fasteners or other detrimental effects.

### **1.5            WARRANTY**

- .1     Contractor hereby warrants that the sheet metal roofing system will remain leak proof for two years. The warranty shall commence on the date of issuance of Certificate of Substantial Performance.

## **1.6 PROTECTION**

- .1 Protect prefinished steel during fabrication, transportation, Work Site storage, and erection in accordance with CSSBI Standards.

## **PART 2 PRODUCTS**

### **2.1 MATERIALS**

- .1 Sheet metal roofing: aluminum-zinc alloy coated (galvalume) steel sheet to ASTM A792M, minimum grade 230, coating designation AZ150, minimum 0.31 mm (30 ga) base metal thickness, profile: interlocking standing ribs at 406 mm o.c. factory pre-coat 8000+ Series, colour: charcoal black as approved by the Departmental Representative.
- .2 Roof panel support system: concealed fastener, purpose-made thermally responsive 2 piece clip system, designed to accommodate panel depth and allow full thermal expansion and contraction of roof sheet. Provide clips with minimum AZ150 aluminum – zinc alloy (galvalume) or Z275 zinc coating.
- .3 Underlaymen: high temperature roof underlayment, rubberized asphalt membrane, minimum thickness 1 mm (40 mils).
  - .1 Acceptable products
    - .1 Henry PE200HT
    - .2 Grace Ice and Water Shield HT
    - .3 Soprema Lastobond Shield HT
- .4 Flashings: material, thickness, coating and finish to match roof sheet.
- .5 Closures: as recommended by roofing system manufacturer.
- .6 Sealants: in accordance with Section 07 92 00 and as recommended by roofing system manufacturer.
- .7 Fasteners: galvanized steel, sized by the roofing system manufacturer to meet load requirements and to maintain a watertight installation. Heads of fasteners in areas exposed to view shall have matching colour to panel material being fastened.
- .8 Vents: Continuous ridge vent: of same material, thickness, coating and finish as sheet metal roofing, 3 m lengths, extending approximately 100 mm above roof line, complete with bug screen and fibre filling; VicWest Vented Ridge #1200 or approved equal.

### **2.2 FABRICATION**

- .1 Fabricate roofing system components to comply with dimensions, profiles, thicknesses, and details as shown on the design drawings and specified herein, factory-ready for field installation.
- .2 Form individual pieces in maximum practicable lengths. Make allowances for expansion at joints.
- .3 Hem exposed edges on underside 12 mm, miter and seal.
- .4 Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance and performance.
- .5 Apply minimum 0.2 mm dry film thickness coat of plastic cement to both faces of dissimilar metals in contact.

## **PART 3 EXECUTION**

### **3.1 INSTALLATION**

- .1 Use concealed fastenings except where approved by the Departmental Representative before installation.
- .2 Provide ice and water shield under sheet metal roofing installed in accordance with manufacturer's printed instructions. Lap joints 150 mm.
- .3 Extend ice and water shield continuous from eave edge of roof down outside face of fascia board.
- .4 Install sheet metal roof panels using concealed clips anchored to wood blocking, as recommended by manufacturer to resist uplift forces.
- .5 Secure clips with minimum two fasteners each.
- .6 Align transverse seams in adjacent panels.
- .7 Flash roof penetrations with material matching roof panels, and make watertight.
- .8 Form seams in direction of water-flow and make watertight.

### **3.2 V RIB ROOFING**

- .1 Form roofing with batten rib seams 405 mm (16") O.C. with straight runs of continuous full length of roof.
- .2 Install exterior prefinished roof panels on panel support clips, using manufacturer's proper construction procedure.
- .3 Provide notched and formed closures, sealed against weather penetration, at changes in pitch and at ridges.

### **3.3 FLASHING INSTALLATION**

- .1 Use concealed fasteners except where approved by the Departmental Representative before installation. Exposed fasteners to be same colour as roofing and flashing sheet.
- .2 Lock end joints and caulk to provide weathertight seal.

### **3.4 TOUCH-UP AND CLEANING**

- .1 Touch up minor paint abrasions with touch-up paint.
- .2 Clean roof by dry-wiping.

**End of Section**

**PART 1 GENERAL**

**1.1 QUALIFICATIONS**

- .1 Only competent and qualified tradesmen shall execute the work of this section, using adequate Work Site facilities and equipment.

**1.2 SHOP DRAWINGS**

- .1 Submit shop drawings in accordance with Section 01 33 00 – Submittal Procedures.

**1.3 DESIGN CRITERIA**

- .1 Design metal flashings and trim to allow for thermal movement of components caused by ambient temperature range of 80°C without causing buckling, failure to joint seals, undue stress on fasteners or other detrimental effects.

**1.4 WARRANTY**

- .1 Contractor hereby warrants that the sheet metal flashings and trim will remain leak-proof for two (2) years. The warranty shall commence on the date of issuance of Certificate of Substantial Performance.

**1.5 PROTECTION**

- .1 Protect prefinished steel during fabrication, transportation, Work Site storage, and erection in accordance with CSSBI Standards.

**PART 2 PRODUCTS**

**2.1 FLASHINGS AND TRIM**

- .1 Sheet metal flashings, fascia and trim: aluminum-zinc alloy coated steel (Galvalume) sheet to CSA S136-94, grade 230, coating designation AZ150, minimum 0.61 mm (24 ga.) base metal thickness, pre-painted 8000+ Series. Colour: as selected by the Departmental Representative.
- .2 Sheet metal soffits: aluminum-zinc alloy coated steel (Galvalume) sheet to ASTM CSA S136-94, grade 230, coating designation AZ150, minimum 0.46 mm (26 ga.) base metal thickness, vented, pre-painted 8000+ Series. Colour: as selected by the Departmental Representative.
- .3 Locking Strip: same material, thickness and finish as flashings.

**2.2 ACCESSORIES**

- .1 Isolation Coating: to CGSB 1-GP-108C.
- .2 Plastic Cement: to CGSB 1-GP-5M.
- .3 Slip Sheet Metal Flashing: heavy waxed Kraft paper.
- .4 Fasteners: of same material as sheet metal, to CSA 35.3, flat head roofing nails of lengths and thickness suitable for metal flashing application. Colour of head to match finish of flashing.
- .5 Washers: of same material as sheet metal, 1 mm thick with rubber packages.
- .6 Recessed Reglet: preformed galvanized steel or aluminum channel with face and ends covered with plastic tape.
- .7 Sealants: as recommended by flashings and trim manufacturer, applied in accordance with Section 07 92 00.

**2.3 FABRICATION**

- .1 Fabricate metal flashings and other sheet metal work as detailed on drawings.
- .2 Form pieces in 3000 mm maximum lengths. Make allowance for expansion at joints.
- .3 Hem exposed edges on underside 12 mm. Miter and seal corners with sealant.
- .4 Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.
- .5 Fabricate soffit panels with uniform perforations providing minimum effective vent area of 3% of soffit area.
- .6 Apply isolation coating to metal surfaces to be embedded in concrete or mortar.

**PART 3 EXECUTION**

**3.1 INSTALLATION**

- .1 Form and install flashings as detailed or as required.
- .2 Use concealed fastening except where approved before installation.
- .3 Joints shall be skip-seam type with extended leg for concealed fastening and allowing for expansion and contraction. Corners shall be square and surface shall be straight and in true planes and free from oil-canning or other defects.
- .4 Install continuous metal drips, cleats, clips and starter strips as shown or required to hold flashings in true planes without deformation.
- .5 Counter flash bituminous flashings at intersections of roof with vertical surfaces and curbs. Lock end joints and seal with sealant. Insert metal flashings into reglets and under cap flashing to form weathertight junction. Seal flashing at reglet with sealant.
- .6 Thoroughly back-paint, with isolation coating, all aluminum coming into contact with steel masonry or concrete to protect against galvanic action. Use slip sheets under coping flashings.
- .7 Provide and install, all sealant necessary to seal between work of this Section and dissimilar materials.

**END OF SECTION**

## **PART 1 GENERAL**

### **1.1 DESCRIPTION**

- .1 This Section specifies specific construction consisting of any device intended to close off an opening or penetration during a fire and/or materials that fill an opening in a wall or floor assembly where penetration is by cables, cable trays, conduits, ducts, pipes and any penetrate through termination device, such as electrical outlet boxes along with their means of support through the wall or the floor opening.

### **1.2 REFERENCES**

- .1 Underwriter's Laboratories of Canada (ULC)
  - .1 ULC-S115, Fire Tests of Fire stop Systems.

### **1.3 DEFINITIONS**

- .1 Fire Stop Material: device intended to close off opening or penetration during fire or materials that fill openings in wall or floor assembly where penetration is by cables, cable trays, conduits, ducts and pipes and poke-through termination devices, including electrical outlet boxes along with their means of support through wall or floor openings.
- .2 Single Component Fire Stop System: fire stop material that has Listed Systems Design and is used individually without use of high temperature insulation or other materials to create fire stop system.
- .3 Multiple Component Fire Stop System: exact group of fire stop materials that are identified within Listed Systems Design to create on site fire stop system.
- .4 Tightly Fitted: penetrating items that are cast in place in buildings of non-combustible construction or have "0" annular space in buildings of combustible construction.
  - .1 Words "tightly fitted" should ensure that integrity of fire separation is such that it prevents passage of smoke and hot gases to unexposed side of fire separation.

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

- .5 Submittals: in accordance with Section 01 33 00- Submittal Procedures.
- .6 Product Data:
  - .1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
- .7 Shop Drawings:
  - .2 Submit shop drawings to show proposed material, reinforcement, anchorage, fastenings and method of installation.
  - .3 Construction details should accurately reflect actual job conditions.
- .8 Quality Control:
  - .4 Test reports: in accordance with CAN-ULC-S101 for fire endurance and CAN-ULC-S102 for surface burning characteristics.
  - .5 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

### **1.5 QUALIFICATIONS**

- .1 Installer: company specializing in fire stopping installations with five years of experience and approved by manufacturer.

### **1.6 DELIVERY, STORAGE, AND HANDLING**

- .9 Packing, shipping, handling and unloading:



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

## **PART 2 PRODUCTS**

### **2.1 MATERIALS**

- .1 Fire stopping and smoke seal systems: in accordance with CAN-ULC-S115.
  - .1 Asbestos-free materials and systems capable of maintaining effective barrier against flame, smoke and gases in compliance with requirements of CAN- ULC-S115 and not to exceed opening sizes for which they are intended.
- .2 Service penetration assemblies: systems tested to CAN-ULC-S115.
- .3 Service penetration fire stop components: certified by test laboratory to CAN-ULC-S115.
- .4 Fire-resistance rating of installed fire stopping assembly in accordance with NBC.
- .5 Fire stopping and smoke seals at openings intended for ease of re-entry such as cables: elastomeric seal.
- .6 Fire stopping and smoke seals at openings around penetrations for pipes, ductwork and other mechanical items requiring sound and vibration control: elastomeric seal.
- .7 Primers: to manufacturer's recommendation for specific material, substrate, and end use.
- .8 Damming and backup materials, supports and anchoring devices: to manufacturer's recommendations, and in accordance with tested assembly being installed as acceptable to authorities having jurisdiction.
- .9 Sealants for vertical joints: non-sagging.

## **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 PREPARATION**

- .1 Examine sizes and conditions of voids to be filled to establish correct thicknesses and installation of materials.
  - .1 Ensure that substrates and surfaces are clean, dry and frost free.
- .2 Prepare surfaces in contact with fire stopping materials and smoke seals to manufacturer's instructions.
- .3 Maintain insulation around pipes and ducts penetrating fire separation.
- .4 Mask where necessary to avoid spillage and over coating onto adjoining surfaces; remove stains on adjacent surfaces.

### **3.3 INSTALLATION**

- .1 Install fire stopping and smoke seal material and components in accordance with manufacturer's certified tested system listing.
- .2 Seal holes or voids made by through penetrations, poke-through termination devices, and unpenetrated openings or joints to ensure continuity and integrity of fire separation are maintained.

- .3 Provide temporary forming as required and remove forming only after materials have gained sufficient strength and after initial curing.
- .4 Tool or trowel exposed surfaces to neat finish.
- .5 Remove excess compound promptly as work progresses and upon completion.

### **3.4 SEQUENCES OF OPERATION**

- .1 Proceed with installation only when submittals have been reviewed by Departmental Representative.
- .2 Install floor fire stopping before interior partition erections.
- .3 Metal deck bonding: fire stopping to precede spray applied fireproofing to ensure required bonding.
- .4 Mechanical pipe insulation: certified fire stop system component.
  - .1 Ensure pipe insulation installation precedes fire stopping.

### **3.5 FIELD QUALITY CONTROL**

- .1 Inspections: notify Departmental Representative when ready for inspection and prior to concealing or enclosing fire stopping materials and service penetration assemblies.

### **3.6 SCHEDULE**

- .1 Fire stop and smoke seal at:
  - .1 Penetrations through fire-resistance rated masonry, concrete, and gypsum board partitions and walls.
  - .2 Edge of floor slabs at curtain wall and precast concrete panels.
  - .3 Top of fire-resistance rated masonry and gypsum board partitions.
  - .4 Intersection of fire-resistance rated masonry and gypsum board partitions.
  - .5 Control and sway joints in fire-resistance rated masonry and gypsum board partitions and walls.
  - .6 Penetrations through fire-resistance rated floor slabs, ceilings and roofs.
  - .7 Openings and sleeves installed for future use through fire separations.
  - .8 Around mechanical and electrical assemblies penetrating fire separations.
  - .9 Rigid ducts: fire stopping to consist of bead of fire stopping material between retaining angle and fire separation and between retaining angle and duct, on each side of fire separation.

### **3.7 CLEANING**

- .1 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.
- .2 Remove temporary dams after initial set of fire stopping and smoke seal materials.

**END OF SECTION**

## **PART 1 GENERAL**

### **1.1 REFERENCE STANDARDS**

- .1 CAN/CGSB-19.24-M80: "Sealing Compound, Multi-Component, Chemical Curing".
- .2 CAN/CGSB-19.13-M87: "Sealing Compound, One Component, Elastomeric, Chemical Curing".
- .3 CAN/CGSB-19.17-M90: "One Component Acrylic Emulsion Base Sealing Compound".

### **1.2 SUPERVISION**

- .1 Materials and workmanship shall comply with the recommendations and directions of the Manufacturer whose materials are used. Manufacturer's technical representative shall be consulted and the following items shall be discussed and results confirmed in writing to the Departmental Representative by the Contractor:
  - .1 Weather conditions under which work will be done.
  - .2 Anticipated frequency of joint movement.
  - .3 Shape factor of the joint.
  - .4 Durometer hardness, slump and curing characteristics of materials specified.
  - .5 Joint characteristics as built.
  - .6 Sample of sealed joint to determine acceptable workmanship.

### **1.3 DELIVERY/STORAGE**

- .1 Receive and store materials as recommended by materials manufacturer.
- .2 Maintain containers and labels in undamaged condition.

### **1.4 PROJECT/SITE CONDITIONS**

- .1 Examine substrate materials, joint voids and note temperature/humidity conditions. Report unacceptable conditions to the Departmental Representative.
- .2 Commencement of work implies acceptance of conditions.
- .3 Sealant and substrate materials to be minimum 5oC.
- .4 Should it become necessary to apply sealants below 5oC, consult sealant manufacturer and follow his recommendations.

### **1.5 GUARANTEE/WARRANTY**

- .1 Provide a written guarantee endorsed and issued in the name of the Owner stating that all sealant and caulking work is guaranteed against leakage, cracking, deterioration, shrinkage, loss of cohesion, loss of adhesion, staining of adjacent surfaces, integral staining or failure to provide intended seal for a period of two (2) years from date of the issuance of Final Certificate of Completion and that any defects will be replaced including related materials at no cost to the Owner.
- .2 Submit in writing a report to the Departmental Representative stating that the sealants used are adequate for the intended use at the intended locations.

## **PART 2 PRODUCTS**

### **2.1 SEALANTS**

- .1 Sealants to expansion joints and control joints in concrete, steel, unit masonry and monolithic floorings: three-part polyurethane terpolymer, conforming to CAN/CGSB-19.24-M80.  
Acceptable products:

- .1 Sika Sikaflex 2C NS/SL
- .2 Tremco Dymeric
- .2 Primers for sealing: non-staining type recommended by sealant manufacturer.
- .3 Bond breaker: pressure sensitive polyethylene tape, not bondable to sealant.
- .4 Colours of sealant: to the approval of the Departmental Representative and matching the predominant material to which the sealant is applied.

## **2.2 JOINT BACKING**

- .1 Joint backing material and filler strips: round, closed cell extruded polyethylene filler as recommended by the manufacturer of the sealing materials. Joint backing material and filler strips shall not contain oils or solvent or other chemicals which will bleed and cause staining. Materials shall be 12 mm minimum wider than the joint width to ensure the material remains in the joint under compression without sagging.

## **2.3 CLEANING MATERIAL**

- .1 Cleaning material for surfaces to receive sealant: Xylol, Methylethylketone, Toluol or non-corrosive solvent type as recommended by the sealant manufacturer.

# **PART 3 EXECUTION**

## **3.1 JOINT PREPARATION AND CONDITIONS**

- .1 All surfaces to receive sealants shall be clean, dry, free of loose materials, dirt, dust, rust, oil, frost and other contaminants.
- .2 Concrete and masonry surfaces shall be cured, then cleaned by manual or power brushing or grinding, blast cleaning with oil free compressed air or vacuumed to remove dust of cleaning. Solvent shall not be used on concrete or other porous surfaces. Concrete surfaces must be free of release agents or curing compounds.
- .3 All non-porous surfaces which will be in contact with sealants shall be cleaned with new methylethylketone (MEK) or other approved solvent. Small areas shall be washed and then dried with clean cloth before solvent evaporates. This final cleaning shall be done after other necessary preparations have been completed.
- .4 Backer rod shall be of proper size to provide a thickness of sealant in the joint to comply with sealant manufacturer's recommendations.
- .5 Test applications shall be made in prepared joints, by the caulking contractor, to determine if preparation steps have been adequate for optimum sealant adhesions.
- .6 To prevent staining, mask adjacent surfaces with tape prior to priming.
- .7 Apply bond breaker tape in accordance with manufacturer's directions.
- .8 Prime sides of joints to manufacturer's directions immediately prior to caulking.

## **3.2 APPLICATION**

- .1 Apply sealants, primers, joint fillers and bond breakers to manufacturer's instructions. Apply sealant using gun with proper size nozzle. Use sufficient pressure to fill voids and joints solid creating weathertight, vapor tight installation. Superficial pointing with skin bead is not acceptable.
- .2 Form surface of sealant with full bead, smooth, free from ridges, wrinkles, sags, air pockets, embedded impurities. Neatly tool surface to a slight concave joint.
- .3 Clean adjacent surfaces immediately and leave work neat and clean. Remove excess sealant and droppings using recommended cleaners as work progresses. Remove masking after tooling of joints.

**3.3 LOCATIONS**

- .1 Seal where indicated or specified, unless sealant is included in work of other sections.
- .2 Sealing of joints shall be done from the face of exposed surface.
- .3 Seal control, construction and expansion joints in concrete.
- .4 Seal control and expansion joints in masonry.
- .5 Seal joints at top of non-load bearing masonry walls and underside concrete slabs.
- .6 Seal exterior and interior perimeters of openings between frame and wall/partition.
- .7 Seal around pipes, ducts, cables, conduits and all other protrusions through walls, floor and ceiling slabs, which are not designated fire separations.

**3.4 CLEANING**

- .1 Clean adjacent surfaces, which have been soiled or otherwise marred, to completely remove all evidence of material causing same.

**END OF SECTION**

## **PART 1 GENERAL**

### **1.1 WORK INCLUDED**

- .1 The following list generally describes the scope of this Section.
  - .1 Exterior Insulated Metal Doors and Frame.
  - .2 Interior Metal Doors and Frames.
  - .3 Door Preparation for Hardware.
  - .4 Installation of Doors, Frames and Hardware.

### **1.2 SHOP DRAWINGS**

- .1 Submit shop drawings in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Clearly indicate each type of door, material, steel core thickness, mortises, reinforcements, location of exposed fasteners, openings, arrangement of hardware, fire ratings, special features and finishes.
- .3 Clearly indicate each type of frame, material, steel core thickness, reinforcements, glazing stops, location of anchors and exposed fastenings, fire ratings and finishes.
- .4 Include schedule identifying each unit with door marks and numbers relating to numbering on drawings and door schedule.

## **PART 2 PRODUCTS**

### **2.1 MANUFACTURE**

- .1 Manufacture hollow metal doors and frames to standards published by the Canadian Steel Door and Frame Manufacturer's Association (CSDFMA).

### **2.2 MATERIALS**

- .1 Exterior Doors: Commercial grade steel to ASTM A568.81, Class 1, hot-dip galvanized to ASTM A527.80, coating designation to ASTM A527.81, ZF75, minimum base steel thickness 1.5 mm, mechanically interlocked adhesive sealed edges, completely filled with rigid extruded closed cell polystyrene insulation (minimum density 28 kg/m<sup>3</sup>). Door to be delivered to site clearly labelled "Polystyrene Insulated". Label to also show name of manufacturer. Labels to remain on doors until doors installed and inspected.
- .2 Interior Doors: Commercial grade steel to ASTM A568.81, Class 1, hot-dip galvanized to ASTM A527.80, coating designation to ASTM A527.81, ZF75, minimum base steel thickness 1.2 mm, mechanically interlocked adhesive sealed edges, stiffened with pre-expanded small cell 'honeycomb' core completely filling the inside of the door and laminated to the inside faces of panels with ULC approved adhesive. Refer to drawings for door details.
- .3 Door Window Glazing: in accordance with Section 08 80 50 - Glazing.
- .4 Reinforcement for hardware: carbon steel, welded in place, prime painted, to the following gauges:
  - .1 Hinge, pivot and panic bar reinforcement - 4.76 mm
  - .2 Lock face, flush bolts, concealed bolts - 2.78 mm
  - .3 Concealed or surface closer reinforcement - 2.78 mm
  - .4 Other surface hardware reinforcements - 2.78 mm
- .5 Glazing stops: 16 mm high formed channel, 0.95 mm steel galvanized, miter joints, counter sink for oval-head screws.

- .6 Frames for doors and interior windows: 1.6 mm thickness, welded type, commercial quality steel cold rolled to ASTM A366, zinc coated to ASTM A527 ZF075, frame depth to accommodate wall thickness. Refer to drawings for details.
- .7 Primer: to CGSB 1-GP-173a.
- .8 Door Silencers: single stud rubber/neoprene type.

## **2.3 FABRICATION**

- .1 Manufacture doors in accordance with details and approved shop drawings and ULC requirements.
- .2 Refer to drawings for required door types and other requirements.
- .3 Mortise, reinforce, drill and tap doors and reinforcements to receive hardware using templates provided.
- .4 Join door faces at intersecting edges with spot welds, fill and grind smooth. Finish door faces flush without visible joints or distortion.
- .5 Close top and bottom edges of door with recessed 18 gauge steel channel, full width welded. Provide flush closure channels at top and bottom edges of exterior doors. Provide weep holes in exterior door bottom channel.
- .6 Make provisions for glass. Provide glazing stops. Weld stops to door on security side.
- .7 Touch-up doors by priming areas where zinc coating is damaged.
- .8 Provide astragals for pairs of doors in accordance with ULC requirements.
- .9 Profile edge of doors as follows:
  - .1 Single acting swing doors - bevel 3 mm in 50 mm.
  - .2 Double acting swing doors – medium of 54 mm.
  - .3 Provide reverse bevel edges at meeting stiles on exterior double doors which are scheduled to receive interior and exterior weatherstrip/astragals.
- .9 Prepare frames for door silencers; 3 for single door, 2 at head for double door.

## **PART 3 EXECUTION**

### **3.1 INSTALLATION**

- .1 Install doors and frames to CSDFMA Installation Guide.
- .2 Install labeled steel fire rated doors and frames to NFPA 80 except where specified otherwise.
- .3 Install steel hollow metal frames plumb and square, in correct locations indicated on drawings and with a maximum diagonal distortion of 3 mm. Ensure frames are securely and rigidly anchored to adjacent construction.
- .4 Brace frames solidly to maintain in position while being built-in.
- .5 Coordinate grouting of frames solid to adjacent construction.
- .6 Fill dimples in frames and screw heads with metal paste and sand smooth.
- .7 Make allowances for deflection of structure to ensure structural loads are not transmitted to frames.
- .8 Fill metal frames in non-insulated masonry walls with mortar.
- .9 Fill metal frames in concrete walls with grout.
- .10 Fill metal frames in insulated masonry walls and wood-frame walls with polyurethane insulation.

- .11 Install doors, transom panels and hardware in accordance with templates and manufacturer's instructions. Maximum permissible warp of 3 mm measured diagonally across door.
- .12 Caulk perimeter of frames between frame and adjacent material.
- .13 After installation, touch up all scratched or damaged surfaces. Use a type of primer recommended for galvanized surfaces, as specified in Section 09 91 00 - Painting.
- .14 Adjust operable parts for correct function.
- .15 Install door silencers.
- .16 Coordinate the installation of glass and glazing in doors & frames.

**END OF SECTION**



**PART 1 GENERAL**

**1.1 SHOP DRAWINGS**

- .1 Submit Shop Drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Clearly indicate each type of window, screen and frame, extrusion profiles and wall thickness, method of assembly, section and hardware reinforcement, locations of fasteners, finishes, installation details and all other pertinent information.
- .3 Submit two (2) sample, 75 x 100 mm size, of specified colour and finish at time of Shop Drawing submission.

**1.2 MAINTENANCE DATA**

- .1 Provide maintenance data for cleaning and maintenance of vinyl finishes for incorporation into the Operation and Maintenance Manual specified in Section 01 78 00 – Closeout Submittals.

**1.3 CERTIFICATES**

- .1 Submit manufacturer's certificate, certifying compliance with specification requirements, for:
  - .1 Window and screen frames.
  - .2 Vinyl finish.
  - .3 Infiltration/exfiltration rates.
  - .4 Thermal transfer resistance of frames.
  - .5 Indicated design loads.

**1.4 PROTECTION**

- .1 Apply temporary protective coating to finished surfaces. Remove coating after erection. Do not use coatings that will become hard to remove or leave residue.

**1.5 WARRANTY**

- .1 Contractor hereby warrants vinyl windows and frames against leakage, defects and malfunctions under normal usage for three (3) years.
- .2 Contractor hereby warrants insulating glass units for five (5) years.
- .3 The warranties shall commence from the date of the issuance of the Certificate or Substantial Performance of the Contract.

**PART 2 PRODUCTS**

**2.1 MATERIALS**

- .1 Vinyl extrusions: to manufacturer's standards.
- .2 Sheet vinyl: to manufacturer's standards.
- .3 Steel reinforcement: to CAN3 G40.20M, hot dip galvanized after fabrication.
- .4 Steel primer: to manufacturer's standards.
- .5 Fasteners: No. 403 stainless steel. Vinyl finish to match adjacent material where exposed.
- .6 Isolation coating: alkali resistant bituminous paint or epoxy solution.
- .7 Glass and glazing materials: in accordance with Section 08 80 50 - Glazing.
- .8 Sealants: in accordance with Section 07 92 00- Joint Sealants; colour to match darkest adjacent material.

- .9 Glass stops: for 25 mm thick units.
- .10 Formed sills: 2.4 mm thick extruded vinyl, to profiles indicated, designed for two-point anchor system (at front and back of sill).
- .11 Include aluminum cover plates, bent plates, closure trim, drips, flashings and other components required to complete these installations.
- .12 Shimming material: continuous wood/plywood treated with one (1) full coat of wood preservative on all surfaces.

## **2.2 FINISH**

- .1 All exposed vinyl surfaces, unless noted otherwise, shall be finished to Departmental Representative's approval.

## **2.3 FABRICATIONS**

- .1 Construct windows and screens to profiles and maximum face sizes as shown. Provide minimum 16 mm bite for factory triple glazed units.
- .2 Design frames in exterior walls to:
  - .1 Accommodate expansion and contracting within service temperature range of minus 45oC to 75oC.
  - .2 Limit deflection to 1/175th of clear span tested to ASTM E330 79 under a wind load of 1.34 kPa (unfastened) acting in a plane perpendicular to the glazing, in either direction.
  - .3 Make allowances for deflection of structure. Ensure that structural loads are not transmitted to aluminum work.
  - .4 Provide structural steel reinforcement for strength, stiffness and connections.
  - .5 Fit intersecting members to flush hairline weathertight joints and mechanically fasten together.
  - .6 Conceal fastenings from view. Expose fastenings where indicated.
  - .7 Form cutouts, recesses, mortising or milling for finishing hardware to templates supplied. Reinforce with aluminum or galvanized steel plates.

## **2.4 VINYL FRAMES**

- .1 Frames for exterior windows: fixed windows and sliding windows by Supreme Windows (4705- 102 AVE SE, Calgary, AB, T2C 2X7).

# **PART 3 EXECUTION**

## **3.1 INSTALLATION**

- .1 Install work plumb, square, level, free from warp, twist and superimposed loads.
- .2 Secure work in required position. Do not restrict thermal movement.
- .3 Install hardware in accordance with templates.
- .4 Adjust operable parts for correct function.
- .5 Isolate from cementitious materials and dissimilar metals.

## **3.2 GLAZING**

- .1 Glaze vinyl windows, and screens in accordance with Section 08 80 50 - Glazing.

## **3.3 CAULKING**

- .1 Where required, seal between members of vinyl work and between vinyl work and adjacent materials.

- .2 Apply sealant in accordance with Section 07 92 00 – Joint Sealants. Conceal sealant within the vinyl work.

**3.4 CLEANING**

- .1 Clean glass and vinyl of surplus compounds, dirt and contaminants.
- .2 Final cleaning of glass shall be responsibility of the Contractor.

**END OF SECTION**

## **PART 1        GENERAL**

### **1.1            INTENT**

- .1 Door Hardware that complies with the referenced standards and the specifications herein.

### **1.2            SUMMARY**

- .1 Related Documents:
  - .1 Section 08 11 00        Steel Hollow Metal Doors and Frames
  - .2 Section 08 80 50        Glazing
- .2 Section Includes:
  - .1 Door hardware for doors specified in "Door Schedule." Section includes hinges, locksets, closers, cylinders, kick plates, door stops, thresholds, weather stripping, push/pull devices and other door-related accessories. Section also includes master and secondary keying systems.

### **1.3            REFERENCES**

- .1 General:
  - .1 The following document forms part of the Specifications to the extent stated. Where differences exist between codes and standards, the one affording the greatest protection shall apply. Unless otherwise noted, the referenced standard edition is the current one at the time of commencement of the Work.
- .2 Hardware Standards
  - .1 BHMA/ ANSI A156 Series
- .3 American National Standards Institute (ANSI) / Builders Hardware Manufacturers Association (BHMA)
  - .1 ANSI/BHMA A156.1, American National Standard for Butts and Hinges.
  - .2 ANSI/BHMA A156.2, Bored and Preamsembled Locks and Latches.
  - .3 ANSI/BHMA A156.3, Exit Devices.
  - .4 ANSI/BHMA A156.4, Door Controls - Closers.
  - .5 ANSI/BHMA A156.5, Auxiliary Locks and Associated Products.
  - .6 ANSI/BHMA A156.6, Architectural Door Trim.
  - .7 ANSI/BHMA A156.8, Door Controls - Overhead Stops and Holders.
  - .8 ANSI/BHMA A156.10, Power Operated Pedestrian Doors.
  - .9 ANSI/BHMA A156.12, Interconnected Locks and Latches.
  - .10 ANSI/BHMA A156.13, Mortise Locks and Latches Series 1000.
  - .11 ANSI/BHMA A156.15, Release Devices - Closer Holder, Electromagnetic and Electromechanical.
  - .12 ANSI/BHMA A156.16, Auxiliary Hardware.
  - .13 ANSI/BHMA A156.17, Self-closing Hinges and Pivots.
  - .14 ANSI/BHMA A156.18, Materials and Finishes.
  - .15 ANSI/BHMA A156.19, Power Assist and Low Energy Power - Operated Doors.
  - .16 ANSI/BHMA A156.20, Strap and Tee Hinges and Hasps.
- .4 Canadian Steel Door and Frame Manufacturers' Association (CSDMA)
  - .1 CSDMA Recommended Dimensional Standards for Commercial Steel Doors and Frames.

#### 1.4 SUBMITTALS

- .1 Supply templates to door and frame manufacturers to enable proper and accurate sizing and locations of cut-outs and reinforcements for hardware.
- .2 Shop Drawings: Hardware schedule shall be organized in table format. Include abbreviations and symbols page accordingly. Complete nomenclature of items required for each door opening as indicated in the "Door Schedule" on the drawings.
  - .1 Coordinate the final Door Hardware Schedule with doors, frames and related work to ensure proper size, thickness, hand, function, and finish of hardware.
- .3 Submit manufacturer's catalog sheet on design, grade and function of items listed in hardware schedule. Identify specific hardware item per sheet, provide index, and cover sheet.
- .4 Coordination: Distribute door hardware templates to related divisions within fourteen (14) days of receiving approved door hardware submittals.
- .5 Maintenance Tool and Instructions: Furnish a complete set of specialized tools and maintenance instructions for Owner's continued adjustment, maintenance, remove and replacement of door hardware.
- .6 Closeout Submittals: Submit to Departmental Representative in a three-ring binder or CD, if requested:
  - .1 Warranties
  - .2 Maintenance and operating manual including list of maintenance tools.
  - .3 Maintenance service agreement.
  - .4 Record documents
  - .5 Copy of approved hardware schedule.
  - .6 Copy of approved keying schedule with bitting list.
  - .7 Door hardware supplier name, phone number and email address.

#### 1.5 QUALITY ASSURANCE

- .1 Door hardware shall conform to ANSI A117.1. Handles, Pulls, Latches, Locks and operating devices: Shape that is easy to grasp with one hand and does not require tight grasping, tight pinching, or twisting of the wrist.
- .2 Fire Rated Door Assemblies: Where fire-rated door assemblies are indicated, provide door hardware rated for use in assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to UL 10C, unless otherwise indicated.
- .3 Fire Door Inspection: Prior to receiving certificate of occupancy, have fire rated doors inspected by a certified inspector. Doors failing inspection shall be adjusted, replaced or modified to be within appropriate code requirements.
- .4 Pre-installation Meeting: Comply with requirements in the Project Execution Plan (PEP)
  - .1 Convene meeting seven (7) days before installation. Participants required to attend:
    - Contractor
    - Installer
    - Material Supplier
    - Manufacturer Representatives
    - Security Consultant
    - Fire Alarm Consultant
  - .2 Include conference decisions regarding proper installation methods and procedures for receiving and handling hardware.

- .3 Review sequence of operation for each type of electrified door hardware, inspect and discuss electrical roughing-in and other preparatory work performed by other trades.
- .4 Review and finalize construction schedule and verify availability of materials, installer's personnel, equipment and facilities needed to make progress and avoid delays.
- .5 Within fourteen (14) days of receipt of approved door hardware submittals, contact Departmental Representative with representative from hardware supplier to establish a keying conference. Verify keyway, visual key identifications, number of master keys and keys per lock. Provide keying system per Departmental Representative's instructions.
- .6 Installer Qualifications: Specialized in performing installation of this Section and shall have documented experience.

#### **1.6 DELIVERY, STORAGE AND HANDLING**

- .1 All hardware items shall be delivered boxed in original factory containers labeled as to contents and scheduled use for this project.
- .2 Provide a clean, dry and secure room for hardware delivered to the Project.
- .3 Store hardware in a clean, well illuminated (500 lux minimum) securely locked storage room accessible only to authorized personnel.
- .4 Store all hardware items on shelves (not on floors) separated and packaged as group for each individual door with door number, and list of items for that door on each package. Maintain an itemized inventory list of each item, updated on daily basis, to show items in storage and items installed.
- .5 Furnish hardware with each unit marked and numbered in accordance with approved finish hardware schedule. Include door and item number for each type of hardware.
- .6 Pack each item complete with necessary parts and fasteners in manufacturer's original packaging.
- .7 Deliver permanent key, cores, access control credentials, software and related accessories directly to Owner. Instructions for delivery to Departmental Representative shall be established at "Keying Conference."
- .8 Waste Management and Disposal: Separate waste materials for reuse or recycling in accordance with the Waste Reduction Workplan and Section 01 74 21- Construction-Demolition Waste Management Plan.

#### **1.7 PROJECT CONDITIONS**

- .1 Maintain environmental conditions (temperature, humidity and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

#### **1.8 WARRANTY**

- .1 Submit written warranty/guarantee against defective materials and workmanship for:
  - .1 Locks, latches and cylinders: 1 year
  - .2 Closers: 10 years
  - .3 Hinges: 1 year
  - .4 Miscellaneous: 1 year

## **PART 2 PRODUCTS**

### **2.1 ACCEPTABLE MANUFACTURERS**

- .1 Assa Abloy
- .2 Stanley Hinges
- .3 Dorma Door Controls
- .4 Canadian Builder's Hardware
- .5 KN Crowder
- .6 Canaropa
- .7 Pride Barco Lock Co.

### **2.2 SUBSTITUTIONS**

- .1 No alternates or substitutions for any product specified in the Hardware Schedule will be acceptable. Any incorrect products found on the jobsite will be replaced with the correct products at the general contractor's expense.

### **2.3 MATERIALS**

- .1 General:
  - .1 Manufacturers and specific products are listed for each item in Hardware Schedule, organized by Hardware Group, as indicated on Drawings.

### **2.4 KEYING**

- .1 Provide Factory Controlled keying system.
- .2 Provide a formal written proposal of the complete key system using nomenclature and systems conforming to American Society of Architectural Hardware Consultants (ASAHC) Keying Handbook.
- .3 Provide key cabinets of sufficient size to accommodate all required keys, plus 50% expansion.
- .4 Cylinders and corresponding change keys to be stamped with three character visual code as indicated above.
- .5 Family Washroom and all Shower Room Door Locks to be keyed separately from all exterior door locks.
- .6 The master key to open all doors except for the Family Washroom and all Shower Rooms.

### **2.5 FINISHES**

- .1 Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if within range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within range of approved Samples.
- .2 Comply with base material and finish requirements indicated by ANSI/BHMA A156.18 designations in hardware schedule.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION AND PREPARATION**

- .1 Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance.

- .2 Proceed with installation only after unsatisfactory conditions have been corrected.
- .3 Do not proceed with installation in areas of discrepancy until all discrepancies have been fully resolved.
- .4 Ensure doors are properly matched to frames for which they are scheduled.
- .5 Ensure cut-outs in frames, or other built-in assemblies to receive hardware are clean and free of mortar, concrete, plaster or other foreign material.
- .6 Verify that all hardware may be installed in accordance with all pertinent codes and regulation, the original design, and the referenced standards.

### **3.2 INSTALLATION**

- .1 Install all hardware in strict accordance with manufacturer's printed instructions and to approved schedule locations.
- .2 Set all items and components level, plumb, true to line and location.
- .3 Install so that all hardware functions smoothly and properly.
- .4 Use proper fasteners for materials encountered. Flathead countersunk screws for hinges; oval head countersunk screws for all other work. Use machine screws for metal doors and frames.
- .5 Do not install surface-mounted items until finishes have been completed on substrates involved. Set unit level, plumb and true to line location. Adjust and reinforce attachment substrate as necessary for proper installation and operation.

### **3.3 FIELD QUALITY CONTROL**

- .1 Material supplier to schedule final walk-through to inspect hardware installation ten (10) business days before final acceptance of Departmental Representative. Material supplier shall provide a written report detailing discrepancies of each opening to General Contractor within seven (7) calendar days of walk-through.

### **3.4 PROTECTION**

- .1 Leave manufacturer's protective film intact and provide proper protection for all other finish hardware items that do not have protective material from the manufacturer until Owner accepts Project as complete.

### **3.5 ADJUSTING AND CLEANING**

- .1 Adjust and check each opening to ensure proper operation of each item of finish hardware. Replace items that cannot be adjusted to operate freely and smoothly or as intended for application at no cost to Owner.
- .2 During installation of hardware, and at completion, adjust hardware as necessary to ensure proper smooth and free operation.
- .3 If shimming is necessary, use only approved non-corrodible metal shims. Organic materials are not allowed.
- .4 Ensure key cylinders are properly installed in correct locations in accordance with approved keying schedule and that keys work properly.
- .5 Clean and polish all hardware. Remove any scratched, marred or damaged hardware and replace with new. Ensure all screws are fully set, secure and flush.
- .6 Provide the following:
  - .1 Supply wear and protection plates for automatic bolts and door bottoms.
  - .2 Screw location for protective edges and plates are to be a consistent location.
- .7 Clean adjacent surfaces soiled by hardware installation. Clean finished hardware per manufacturer's instructions after final adjustments have been made. Replace items that cannot be cleaned to manufacturer's level of finish quality at no cost to Departmental Representative.



- .8 Demonstration: Conduct a training class for building maintenance personnel demonstrating the adjustment, operation of mechanical and electrical hardware. Special tools for finished hardware to be turned over and explained usage at this meeting.

### 3.6 HARDWARE SCHEDULE

#### .1 Hardware Group 1:

- .1 Single Insulated Hollow Metal Doors #D1, D2, D12 (RHR/LHR/LHR)  
.2 900 x 2150 x 45 (D1) / 950 x 2150 x 45 (D2, D12)  
.3 Exterior door c/w 600 x 600 Borrowed Lite

BY HARDWARE SUPPLIER					
Mark	Qty.	Type	Manufacturer	Product Code	Finish
H1	3	Butt Hinge	Stanley Hinges	CB179- 114 x 102 x NRP	626
DB1	1	T-Series Tubular Deadbolt c/w Permanent Core	Best Access	8T c/w Best Coremax SFIC	626
LG1	1	Latchguard	Canaropa	311LP	628
PP1	1	Rockwood Door Pull c/w Push Plate	Assa Abloy	107 x 73B/73BL – 3.5" x 15" Pull Plate	626
KP1	1	Kickplate	Canadian Builders Hardware	CBH 903 – 203 x 860 (D1) / 910 (D2, D12) x 3M Tape	630
TH1	1	Threshold	KN Crowder	CT-10x1930	628
CL1	1	Closer	Dorma Door Controls	8616-AF86P	689
WS1	1	Weatherstrip	Assa Abloy	Pemko S771_Adhesive-Backed Fire/ Smoke Gasketing	S771C: C
DS1	1	Door Sweep	KN Crowder	W-13S x 900 (D1) / 950 (D2, D12)	628

- .4 Notes: Borrowed Lite in accordance with Section 08 81 50- Glazing.

#### .2 Hardware Group 2:

- .1 Single Hollow Metal Doors #D3, D6 (RH, LHR)  
.2 900 x 2150 x 45  
.3 Interior Washroom Doors c/w Washroom Signage

BY HARDWARE SUPPLIER					
Mark	Qty.	Type	Manufacturer	Product Code	Finish
H1	3	Butt Hinge	Stanley Hinges	CB179- 114 x 102	626
PP1	1	Rockwood Door Pull c/w Push Plate	Assa Abloy	107 x 73B/73BL – 3.5" x 15" Pull Plate	626
KP1	1	Kickplate	Canadian Builders Hardware	CBH 903 – 203 x 860 x 3M Tape	630
CL1	1	Closer	Dorma Door Controls	8616-AF86P	689

- .4 Note: Washroom Signage in accordance with Section 10 14 00 – Signage.

#### .3 Hardware Group 3:

- .1 Insulated Single Hollow Metal Door #D4 (RHR)

- .2 1000 x 2150 x 45
- .3 Exterior Door without Borrowed Lite

BY HARDWARE SUPPLIER					
Mark	Qty.	Type	Manufacturer	Product Code	Finish
H1	3	Butt Hinge	Stanley Hinges	CB179- 114 x 102 x NRP	626
DB1	1	T-Series Tubular Deadbolt c/w Permanent Core	Best Access	8T c/w Best Coremax SFIC	626
PP1	1	Rockwood Door Pull c/w Push Plate	Assa Abloy	107 x 73B/73BL – 3.5" x 15" Pull Plate	626
LG1	1	Latchguard	Canaropa	311LP	628
KP1	1	Kickplate	Canadian Builders Hardware	CBH 903 – 203 x 960 x 3M Tape	630
TH1	1	Threshold	KN Crowder	CT-10x1930	628
CL1	1	Closer	Dorma Door Controls	8616-AF86P	689
WS1	1	Weatherstrip	Assa Abloy	Pemko S771_Adhesive-Backed Fire/ Smoke Gasketing	S771 C: C
DS1	1	Door Sweep	KN Crowder	W-13S x 1000	628

- .4 **Hardware Group 4:**
  - .1 Single Hollow Metal Door #D5 (LHR)
  - .2 1000 x 2150 x 45
  - .3 45 min Fire- Rated Interior Door

BY HARDWARE SUPPLIER					
Mark	Qty.	Type	Manufacturer	Product Code	Finish
H1	3	Butt Hinge	Stanley Hinges	CB191- 114 x 102	630
L1	1	Storeroom Lockset c/w Permanent Core	Best Access	IE72 x C4 x Construction Core c/w Best Coremax SFIC	626
KP1	1	Kickplate	Canadian Builders Hardware	CBH 903 – 203 x 960 x 3M Tape	630
CL1	1	Closer	Dorma Door Controls	8616-AF86P	689

- .5 **Hardware Group 5:**
  - .1 Single Hollow Metal Door #D8, D9, D10, D11, D13, D14, D15, D16 (LHR, LHR, LHR, LHR, LHR, RHR, RHR, RHR)
  - .2 900 x 2150 x 45
  - .3 Shower Room and Family Shower Room Doors

BY HARDWARE SUPPLIER					
Mark	Qty.	Type	Manufacturer	Product Code	Finish
H1	3	Butt Hinge	Stanley Hinges	CB179- 114 x 102	626
DB1	1	T-Series Tubular Deadbolt c/w Permanent Core	Best Access	8T c/w Best Coremax SFIC	626
PP1	1	Rockwood Door Pull c/w Push Plate	Assa Abloy	107 x 73B/73BL – 3.5" x 15" Pull Plate	626
KP1	1	Kickplate	Canadian Builders Hardware	CBH 903 – 203 x 860 x 3M Tape	630
CL1	1	Closer	Dorma Door Controls	8616-AF86P	689
IL1	1	Universal Red & Green Indicator Lock	Pride Barco Lock Co.	K-300-RG (Red & Green)	SNICK EL (Satin Nickel)

**.6 Hardware Group 6:**

- .1 Insulated Single Hollow Metal Door # D17, D18 (LHR, RHR)
- .2 900 x 2150 x 45
- .3 Exterior Washroom Doors

BY HARDWARE SUPPLIER					
Mark	Qty.	Type	Manufacturer	Product Code	Finish
H1	3	Butt Hinge	Stanley Hinges	CB179- 114 x 102 x NRP	626
DB1	1	T-Series Tubular Deadbolt c/w Permanent Core	Best Access	8T c/w Best Coremax SFIC	626
LG1	1	Latchguard	Canaropa	311LP	628
PP1	1	Rockwood Door Pull c/w Push Plate	Assa Abloy	107 x 73B/73BL – 3.5" x 15" Pull Plate	626
KP1	1	Kickplate	Canadian Builders Hardware	CBH 903 – 203 x 860 x 3M Tape	630
TH1	1	Threshold	KN Crowder	CT-10x1930	628
CL1	1	Closer	Dorma Door Controls	8616-AF86P	689
WS1	1	Weatherstrip	Assa Abloy	Pemko S771_Adhesive-Backed Fire/ Smoke Gasketing	S771 C: C
DS1	1	Door Sweep	KN Crowder	W-13S x 900	628

- .4 Note: Washroom Signage in accordance with Section 10 14 00 – Signage.

**.7 Hardware Group 7:**

- .1 Single Hollow Metal Door #D7, (LH)
- .2 900 x 2150 x 45
- .3 Interior Family Washroom

BY HARDWARE SUPPLIER					
Mark	Qty.	Type	Manufacturer	Product Code	Finish
H1	3	Butt Hinge	Stanley Hinges	CB179- 114 x 102	626
DB1	1	T-Series Tubular Deadbolt c/w Permanent Core	Best Access	8T c/w Best Coremax SFIC	626
PP1	1	Rockwood Door Pull c/w Push Plate	Assa Abloy	107 x 73B/73BL – 3.5" x 15" Pull Plate	626
KP1	1	Kickplate	Canadian Builders Hardware	CBH 903 – 203 x 860 x 3M Tape	630
CL1	1	Closer	Dorma Door Controls	8616-AF86P	689

.4 Note: Family Washroom Signage in accordance with Section 10 14 00 – Signage.

**END OF SECTION**

## **PART 1 GENERAL**

### **1.1 WARRANTY**

- .1 Contractor hereby warrants insulating glass units against failure of seal of enclosed air space and deposits on inner faces of glass detrimental to vision for five years. The warranty shall commence from the date of the issuance of the Certificate of Substantial Performance.

## **PART 2 PRODUCTS**

### **2.1 GLASS MATERIALS**

- .1 Window Glazing: Outer pane of 6 mm clear anti-reflective coated glass, 12 mm air space, inner pane of 6 mm clear anti-reflective coated glass, double glazed unit 24 mm total thickness.

### **2.2 GLAZING AND SEALING COMPOUND MATERIALS**

- .1 Sealant compound: one component silicone base, to CGSB 19-GP-9M, gun grade, colour to match frames. "GE 1200".
- .2 Glazing tape: preformed butyl tape, 10-15 durometer hardness, paper release, grey colour. "Tremco 440".
- .3 Setting blocks: neoprene Shore "A" durometer hardness 70 – 90, 100 mm long x 6 mm thick x 9 mm high.
- .4 Spacer shims: neoprene, Shore "A" durometer hardness 50, 75 mm long x 2.4 mm thick x 9 mm high.
- .5 Primer-sealers and cleaners: to glass manufacturer's standard.
- .6 Glazing gasket: continuous extruded neoprene or vinyl to window manufacturer's standard, colour to match/complement colour of finish on aluminum.

## **PART 3 EXECUTION**

### **3.1 WORKMANSHIP**

- .1 Remove protective coatings and clean contact surfaces to manufacturer's specifications.
- .2 Apply primer-sealer to contact surfaces.
- .3 Place setting blocks as per manufacturer's instructions.
- .4 Install glass, rest on setting blocks, push against tape or compound with sufficient pressure to ensure full contact and adhesion at perimeter.
- .5 Install removable stops, avoiding displacement of tape or sealant, exert pressure for full continuous contact.
- .6 Provide edge clearance of 3 mm minimum unless indicated otherwise.
- .7 Insert spacer shims to center glass in space. Place shims at 600 mm O.C. and keep 6 mm below sightline.
- .8 Apply cap head of sealant at exterior void.
- .9 Apply sealant to uniform and level line, flush with sightline and tooled or wiped with solvent to smooth appearance.

### **3.2 DRY GLAZING**

- .1 Lock strip gasket method:
  - .1 Unpack and lay out gaskets on flat, warm area to permit recovery of shape.

- .2 Install gaskets under compression from corners inward.
- .3 Drain infiltrated moisture to exterior through drain holes in sill.
- .4 Install locking strip and gasket assembly to manufacturer's instructions.

**3.3 FINISHING**

- .1 Immediately remove sealant and compound droppings from finished surfaces.
- .2 Final clearing of glass including removal of labels shall be the responsibility of Contractor.

**END OF SECTION**

## **PART 1 GENERAL**

### **1.1 SUMMARY**

- .1 Section Includes: Fiberglass-mat faced, abuse, impact resistant, moisture and mold resistant gypsum boards.

### **1.2 RELATED SECTIONS**

- .1 Section 06 10 00 Rough Carpentry.

### **1.3 REFERENCE STANDARDS**

- .1 Do work to CSA A82.31-M and A82.27-M except where specified otherwise.

### **1.4 SUBMITTALS**

- .1 Product Data: Manufacturer's specifications and installation instructions for each product specified.

## **PART 2 PRODUCTS**

### **1.1 MOISTURE RESISTANT GYPSUM BOARD (13MM).**

- .1 Size: 13 mm (1/2") x 1220 mm wide x maximum permissible length, ends square cut, edges tapered.
- .2 Surfacing: Coated fiberglass mat on face, back and long edges.
- .3 Water Absorption (ASTM C630, ASTM C1396, ASTM C1658): Less than 5 percent of weight.
- .4 Mold Resistance: score of 10 as rated according to ASTM D 3273.
- .5 Microbial Resistance (ASTM D6329): Will not support microbial growth.
- .6 Acceptable Products:
  - .1 Sheetrock Brand Glass-Mat Panels Mold Tough by CGC Inc.
  - .2 ToughRock Mold-Guard Gypsum Board by Georgia-Pacific Gypsum.

### **2.2 FIRE AND MOISTURE RESISTANT GYPSUM BOARD (16 MM - TYPE 'X')**

- .1 Gypsum board panels to meet Type X requirements (per ASTM C1658) when tested in accordance with ASTM E119 and are UL and ULC Classified.
- .2 Size: 16 mm (5/8") x 1220 mm wide x maximum permissible length, ends square cut, edges tapered.
- .3 Surfacing: Coated fibreglass mat on face, back and long edges.
- .4 Water Absorption (ASTM C630, ASTM C1396, ASTM C1658): Less than 5 percent of weight.
- .5 Mold Resistance: score of 10 as rated according to ASTM D 3273.
- .6 Microbial Resistance (ASTM D6329): Will not support microbial growth.
- .7 Acceptable Products:
  - .1 Sheetrock Brand Glass-Mat Panels Mold Tough, Firecode X by CGC Inc.
  - .2 ToughRock Fireguard X Mold-Guard Gypsum Board Panels by Georgia-Pacific Gypsum.
  - .3 Protecta AR 100 Type X with mold defense by Lafarge.

## **2.3 FASTENERS**

- .1 Screws: 41 mm for single thickness to wood stud application, self-tapping, countersunk head, rust resistant type.
- .1 Screws: 63 mm for double thickness to wood stud application, self-tapping, countersunk head, rust resistant type.
- .2 Nails: to CSA B111, annular ring type, galvanized.

## **2.4 ACCESSORIES**

- .1 Control/Expansion Joint: back to back plaster stops plus polyethylene continuous air seal.
- .2 Polyethylene: to CAN/CGSB 51.34, 6 mil thick.
- .3 Metal accessories (corner beads, casing beads, stops, etc.) to CSA A82.30.

## **2.5 ADHESIVES AND SEALANTS**

- .1 Adhesive: waterproof organic type, gun applied, to ASTM C557,
- .2 Joint treatment materials (joint compound, joint type and topping compound): to ASTM C475.
- .3 Acoustic sealant: non-skinning, semi-elastic, + 5% deformation maximum, compound.

# **PART 3 EXECUTION**

## **3.1 WORKMANSHIP**

- .1 Do work to CSA A82.31 and as recommended by the manufacturer, except where specified otherwise herein.
- .2 Co-ordinate installation of service utilities, access panels, plaster rings and like items. Ensure items are properly located and sized.

## **3.2 CONTROL JOINTS**

- .1 Erect control joints consisting of back-to-back plaster stops as per manufacturer's recommendations.

## **3.3 METAL ACCESSORIES**

- .1 Erect accessories straight and rigid. Use full length pieces only. Mitre and fit corners accurately.
- .2 Install corner beads at all external angles. Rigidly secure to substrate.
- .3 Install casing beads where plaster terminates against surface having no rim concealing the junction.

## **3.4 WALLBOARD AND APPLICATION**

- .1 Erect wallboard and tape joints to CSA A82.31 except where specified otherwise.
- .2 Erect wallboard horizontally. All joints shall occur over framing members.

## **3.5 JOINT FINISHING**

- .1 Do not treat joints of laminated wallboard for at least 24 hours after lamination.
- .2 Mix and apply joint compound in accordance with manufacturer's specifications.
- .3 Fill all gaps and screw nail depressions with three coats of joint compounds.
- .4 Feather all coats of joint compound onto adjoining surfaces so that camber is 1.6 mm maximum.



**3.6 CUTTING AND PATCHING**

- .1 Do all cutting, patching, and making good, as required, to assure a satisfactory finish.
- .2 Remove and make good any work which, in the opinion of the Engineer, is defective at no additional cost.

**END OF SECTION**

## **PART 1 GENERAL**

### **1.1 DESCRIPTION OF SYSTEM**

- .1 Seamless, resinous, general service, 100% solids, epoxy floor coating.

### **1.2 SUMMARY**

- .1 Definitions: Resinous epoxy floor coating system includes a 100% solids, 0 VOC, two component, moisture-tolerant, pigmented, general service, epoxy primer and a 100% solids, 0 VOC, two component, moisture tolerant, pigmented, general service epoxy topcoat.

### **1.3 RELATED WORK**

- .1 Section 07 92 00 Joint Sealants.

### **1.4 QUALIFICATIONS**

- .1 Applicators: factory trained with a minimum of two (2) years proven experience for projects of similar size and complexity and approved by the manufacturer.
- .2 Manufacturer: use products and materials from same source for entire project.

### **1.5 QUALITY ASSURANCE**

- .1 Manufacturer: provide an experienced technical representative to review installation procedures and to regularly inspect the work during installation to verify compliance with specifications and details.
- .2 To ensure a high degree of quality control, representatives from the contractor, installer, manufacturer and the consultant convene a pre-installation conference at the job site to review material selections, substrate preparations, joint conditions and installation procedures.
- .3 Prior to commencement of work, the floor coating manufacturer's representative shall inspect and certify:
  - .1 That the surfaces on which the floor coating is to be applied are in good condition and suitable for the application of membrane;
  - .2 That environmental conditions for application of coating are within limits prescribed by the manufacturer; and
  - .3 That materials to be applied conform in all respects with the requirements of these specifications.

### **1.6 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver materials to the site in original containers with labels and seals intact and store in accordance with manufacturer's printed instructions and section 01500.
- .2 All materials used shall be factory blended and packaged in single, easy to manage batches to eliminate on site blending errors. Only the on-site weighing of catalyst will be allowed.
- .3 Material shall be stored in a dry, enclosed area protected from exposure to moisture. Temperature of storage area shall be maintained between 60 and 85oF/16 and 30oC.

### **1.7 PROJECT CONDITIONS**

- .1 Provide forced air circulation during curing period for enclosed applications to control dangerous vapour buildup, odours and fumes.
- .2 Job area to be free of other trades during, and for a period of 24 hours, after flooring system installation.
- .3 Environmental conditions for installation: within the limits prescribed by the manufacturer.

- .4 Protect finished flooring system from damage by subsequent trades until project is complete.

## **PART 2 PRODUCTS**

### **2.1 RESINOUS FLOORING SYSTEM**

- .1 Stonkote GS4 as distributed by Stonhard division, is a nominal 12-16 mil, 100% solids, 0 VOC, two-component, moisture tolerant, general service, epoxy floor coating. Stonkote GS4 is comprised of a 100% solids, 0 VOC, moisture tolerant, general service, epoxy primer and a 100% solids, 0 VOC, moisture tolerant, general service, epoxy topcoat.
- .1 Physical Properties: Provide flooring system in which minimum physical properties of the complete system, including primers, fillers, aggregates, and sealers, and when tested in accordance with standards or procedures referenced below, are as follows:
 

Hardness .....	80-85
(ASTM D-2240, Shore D)	
Abrasion Resistance .....	0.02 gm max. weight loss
(ASTM D-4060, CS-17, 1 kg Load, 1,000 cycles)	
Bond Strength.....	>400 psi
(ASTM D-7234) ..... (100% concrete failure)	
Heat Resistance Limitation .....	140oF/60oC
..... (for continuous exposure)	
..... 200oF/93oC	
..... (for intermittent spills)	
Cure Rate allow .....	8 hours for tack-free surface
(at 77oF/25oC) ..... 24 hours minimum for normal operations	
Fire Resistance of Dry Film .....	Class A
(CAN/ULC S102.2)	
	Flame Spread - 0
	Smoke Developed - 34

### **2.2 COLOURS**

- .1 Colour: as selected by the Departmental Representative from manufacturer's standard colours.

### **2.3 JOINT SEALANT MATERIALS**

- .1 Type produced by manufacturer of resinous flooring system for type of service and joint condition indicated.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- .1 Examine surfaces to receive coating to ensure they are smooth, dry, and free from conditions that will adversely affect execution, permanence, or quality of work.
- .2 Install coating after other work, which penetrates membrane, has been completed.

### **3.2 PREPARATION**

- .1 Prepare surfaces to receive epoxy coating in accordance with manufacturer's instructions.
- .2 Vigorously scrub surfaces contaminated with oil or grease with a power broom and a strong, non-sudsing detergent. Thoroughly wash, clean and dry.
- .3 Seal cracks using materials approved by the manufacturer.

### **3.3 INSTALLATION**

- .1 General: Apply each component of resinous flooring system in compliance with manufacturer's directions to produce a uniform monolithic surface of thickness indicated, uninterrupted except at expansion joints or other types of joints (if any), indicated or required.
- .2 Primer (1 coat): Mix and apply primer over properly prepared substrate with strict adherence to manufacturer's installation procedures and coverage rates. Primer shall be applied in one coat at 6-8 mils thickness immediately after mixing using high quality medium nap rollers. Coordinate timing of primer application with application of flooring system to ensure optimum inter-coat adhesion.
- .3 Topcoat (2 coats): Mix material according to manufacturer's recommended procedures. Topcoat material shall be applied in two coats at 6-8 mils per coat immediately after mixing using high quality medium nap rollers. Strict adherence to manufacturer's coverage rates shall be maintained.

### **3.4 CURING, PROTECTION AND CLEANING**

- .1 Cure resinous flooring materials in compliance with manufacturer's directions, taking care to prevent contamination during stages of application and prior to completion of curing process. Close area of application for a minimum of 4 hours after application.
- .2 Protect flooring system from damage and wear during construction operation. Where temporary covering is required for this purpose, comply with manufacturer's recommendations for protective materials and method of application. General Contractor shall be responsible for protection and cleaning of surfaces after final coats.
- .3 Cleaning: Remove temporary covering and clean resinous flooring system prior to final inspection. Use cleaning materials and procedures recommended by resinous flooring system manufacturer. General Contractor shall be responsible for cleaning of the surfaces prior to inspection.

**End of Section**

## **PART 1 GENERAL**

### **1.1 DESCRIPTION**

- .1 The work of this Section shall include all labour, materials, tools, scaffolds and other equipment, services and supervision required for preparation and painting of all surfaces scheduled herein.
- .2 Paint all new surfaces as per Schedule of Finishes. Include all field painting necessary to complete work shown, scheduled or specified, including back priming and surface preparation.
- .3 The work shall also include the painting of shop primed items and equipment installed under any other sections of the Specifications.
- .4 Ensure that surface preparation and shop primers comply with finishing paint system specified.
- .5 Prepare and touch up any damaged finish with same type, quality and colour of paint as originally used.
- .6 Do not paint aluminum, stainless steel or rubber surfaces and nameplates unless noted otherwise.

### **1.2 REFERENCE STANDARDS**

- .1 Master Painters Institute (MPI), Architectural Painting Specification Manual, latest edition.
- .2 Steel Structures Painting Council (SSPC), Steel Structures Painting Manual, Volume I & II.
- .3 Manufacturer's product and safety data sheets, and application instructions.

### **1.3 QUALIFICATIONS**

- .1 The work of this Section shall be performed by experienced applicators specializing in the surface preparation and application of the products specified herein.

### **1.4 SUBMITTALS**

- .1 Comply with Section 01 33 00 – Submittal Procedures.
- .2 Provide the Departmental Representative with the credentials of the applicators, who will be performing the work on Work Site, which clearly demonstrates compliance with the required qualifications, including:
  - .1 Key Work Site personnel;
  - .2 Equipment which will be used;
  - .3 Information on projects of similar scope with similar products, including references.
- .3 Submit three (3) copies of the manufacturer's product data sheets, application instructions and safety data sheets.

### **1.5 PRE-INSTALLATION CONFERENCE**

- .1 Contractor shall convene, at least one (1) week prior to commencing work of this Section, a meeting to discuss these Specifications and the scope of work, attended by the Contractor's Superintendent, Applicator's representative, product manufacturer's representative, and the Departmental Representative.

### **1.6 DELIVERY/STORAGE**

- .1 Deliver materials in sealed, original, labeled containers, bearing manufacturer's name, type, brand name, colour designation and instructions for mixing and/or reducing. No unsealed materials will be allowed onto the Work Site.

- .2 Provide adequate storage facilities. Store materials at a minimum ambient temperature of 7° C and in a well ventilated area.
- .3 Take all precautionary measures to prevent fire hazards and spontaneous combustion.

#### **1.7 COLOUR SCHEDULE/SAMPLES**

- .1 Paint colours shall be selected by the Departmental Representative.
- .2 Prior to commencement of work, the Departmental Representative will furnish six sets of the colour schedule.

#### **1.8 ENVIRONMENTAL CONDITIONS**

- .1 Measure moisture content of surfaces using an electronic "Moisture Meter". Do not apply finishes unless the moisture content of surfaces are below the maximums established on product data sheets.
- .2 Ensure surface temperatures and the surrounding air temperature are within the range established on product data sheets.
- .3 Provide adequate continuous ventilation and sufficient heating facilities to maintain temperatures established on product data sheets for 24 hours before, during, and 48 hours after interior application of finishes.
- .4 Provide minimum 325 lux (30 f.c.) of lighting on surfaces during application of finishes.
- .5 Do not apply finishes in areas where dust is being generated.

### **PART 2 PRODUCTS**

#### **2.1 MATERIALS**

- .1 Paints: technically appropriate first line products as listed in Schedule of Finishes.
- .2 Paint accessory materials: linseed oil, shellac, turpentine and other materials not specifically indicated herein but required to achieve the finishes specified shall be of highest quality product and approved manufacture.
- .3 Solvents: to be the odor free type where possible.
- .4 All markings and labeling of piping and equipment shall be black, stencil, spray coated, one quarter diameter of pipe or 25 mm for equipment. Stick- on markers not allowed.

#### **2.2 MIXING**

- .1 Paints shall be ready-mixed except for field catalyzed coating types.

### **PART 3 EXECUTION**

#### **3.1 CONDITION OF SURFACES**

- .1 Thoroughly examine all surfaces scheduled to be finished prior to commencement of work. Report in writing to the Departmental Representative any condition that may potentially affect proper application. Do not commence until all such defects have been corrected.
- .2 Be responsible for the condition of surfaces or for correcting defects and deficiencies in the surfaces which may adversely affect work of this section.
- .3 Commencement of work shall imply acceptance of surfaces.

#### **3.2 PREPARATION OF WORK SITE AREAS**

- .1 Thoroughly vacuum and wipe clean all surfaces within the area to be finished, prior to and during painting application.

### **3.3 PROTECTION**

- .1 Adequately protect other surfaces from paint and damage. Make good any damage as a result of inadequate or unsuitable protection.
- .2 Furnish sufficient drop cloths, shields and protective equipment to prevent spray or droppings from fouling surfaces not being finished and, in particular, surfaces within storage and preparation area.
- .3 Place cotton waste, cloths, empty containers and material which may constitute a fire hazard in closed metal containers and remove daily from Work Site.
- .4 Remove all electrical plates, surface hardware, fittings and fastenings, prior to finishing operations. These items are to be carefully stored, cleaned and replaced on completion of work in each area. Do not use solvent to clean hardware that may remove the permanent lacquer finish.

### **3.4 PREPARATION OF SURFACES**

- .1 Prepare surfaces to be painted or finished in accordance with MPI Architectural Painting Specification Manual, or the coating manufacturer's printed instructions, whichever is the more stringent.
- .2 Concrete surfaces which have been previously cured with conventional curing compounds or are contaminated with form oils must be completely cleaned by abrasive blasting. Acid etching is not acceptable, as it will not normally remove these contaminants. After surface is properly prepared, small holes or voids shall be filled in accordance with the coating manufacturer's recommendations.
- .3 Remove factory-applied bituminous coating from ductile iron piping, scheduled for painting, by shot-blast cleaning to SSPC method and degree specified in the applicable painting formula. Shop apply primer as specified, prior to installation of piping.
- .4 Touch up pre-primed steel and iron surfaces with a primer compatible with the shop applied primer. Remove dust, dirt and grease.
- .5 Previously painted surfaces scheduled for painting shall be cleaned using appropriate previously specified method. Check existing paint coatings for compatibility with paint with which they are to be over coated. If coatings are not compatible, submit recommendations for review by Departmental Representative.

### **3.5 APPLICATION**

- .1 Ensure that all testing of equipment and process and building systems has been successfully completed, before commencing painting of related surfaces.
- .2 Apply paint and other finishes in accordance with good trade practice, and manufacturers' printed instructions.
- .3 Cover surfaces satisfactorily with an even colour tone. Apply primer immediately after surface preparation, where recommended.
- .4 Apply each coat at the proper consistency.
- .5 Sand and dust between coats to remove defects visible from distance up to 1.5 m. Refer to paint manufacturer's technical sheets for coating and re-coating recommendations.
- .6 Do not apply finishes on surfaces that are not sufficiently dry.
- .7 Allow each coat of finish to dry before a following coat is applied, unless directed otherwise by manufacturer.
- .8 Back prime interior woodwork which is to receive a paint finish with enamel undercoat paint, immediately upon arrival at the Work Site.
- .9 Exterior and interior woodwork to be stained and/or varnished shall be back primed with gloss varnish reduced 25% with mineral spirits.
- .10 Prime top and bottom edges of wood and metal doors in accordance with applicable paint formula.

- .11 Use the following reference for contact surfaces.
  - .1 Steel surfaces in contact with aluminum shall receive one prime coat and one aluminum finish coat.
  - .2 Aluminum surfaces in contact with steel surfaces: prime coat with fast-dry modified alkyd primer.
  - .3 Wood surfaces in contact with other surfaces: prime coat (sealer).
  - .4 Aluminum surfaces in contact with concrete or masonry shall be prime coated with fast-dry modified alkyd primer, and painted with two coats of interior/exterior acrylic enamel.
  - .5 Any surfaces not in direct bonded contact but inaccessible after assembly shall receive either the full specified paint system or three coats of the specified primer before assembly.
- .12 Painting of previously painted surfaces touch-ups:
  - .1 Clean areas to be painted using appropriate previously specified method.
  - .2 Minimum coating requirements for spot-painting shall be as follows:
    - .1 No rusting, but prime coat exposed - Sand lightly and feather edges. Apply 1 to 2 finish coats to regain specified minimum dry film thickness.
    - .2 No rusting, but prime coat damaged - Clean area to base material, sand lightly and feather edges. Apply prime coat and two finish coats. Sand and feather edges between coats.
    - .3 Rust areas - Clean to original standard of surface preparation. Apply coats as per .2 above. Only apply additional spot finished coat, if required, to maintain appearance.
  - .3 Check existing paint coatings for compatibility with paint with which they are to be over-coated. If not compatible, submit recommendations for review by the Departmental Representative.

### **3.6 MECHANICAL AND ELECTRICAL EQUIPMENT**

- .1 Piping shall be identified by colour coding and descriptions. Identification colours and description shall be as directed by the Departmental Representative. Prior to commencement of the work of this Section, the Departmental Representative will furnish a schedule including identification/description legend, colours, and abbreviations referenced on the drawings. Identification shall be carried out on the following items:
  - .1 All new uninsulated and insulated piping, ducting and valves, flanges, couplings, etc.
  - .2 All new process and HVAC equipment.
  - .3 All new exposed electrical conduit as identified in Division 16.
- .2 Remove grilles, covers and access panels for mechanical and electrical systems from location and paint separately.
- .3 Finish paint primed equipment.
- .4 Paint interior surfaces of air ducts, convector and baseboard heating cabinets that are visible through grilles and louvres with one coat of flat dark grey paint, to limit of sight line. Paint dampers exposed immediately behind louvres, grilles, convector and baseboard cabinets to match face panels.
- .5 Paint exposed conduits, pipes, ducts, hangers and other mechanical and electrical equipment occurring in all areas. Colour and texture to match adjacent surfaces, except as noted for colour coded piping.
- .6 Paint both sides and edges of plywood backboards for equipment before installation.
- .7 Leave electrical equipment in original finish except for touch-up as required, and paint mounting accessories and other unfinished items.



- ### 3.7 CLEANING

- ### 3.8 INSPECTION

- ### 3.9 SCHEDULE OF FINISHES

- ## .1 Outdoor Finishes

Outdoor Finishes Surface	Protective Coating System	Minimum D.F. Thickness
Ferrous Metal	<p>Surface Preparation: Blast Clean New Steel to SSPC-SP10 Near White Blast, Surface Profile: 1-2 mils (25 – 50 microns).</p> <p>1st Coat: Zinc-rich epoxy primer, CAN/CGSB-1.181 Acceptable Products:</p> <ul style="list-style-type: none"> <li>- Ameron Amercoat 68HS</li> <li>- Devoe Catha-Coat 303H</li> <li>- International Interzinc 52</li> <li>- Carboline Carbozinc 859</li> </ul>	2.5 mils
	<p>2nd Coat: High-build epoxy, CAN/CGSB-1.153-M Acceptable Products:</p> <ul style="list-style-type: none"> <li>- Ameron Amercoat 385</li> <li>- Devoe Bar Rust 236</li> <li>- International Interseal 670HS</li> <li>- Carboline Carboguard 890</li> </ul>	6-8 mils

Outdoor Finishes Surface	Protective Coating System	Minimum D.F. Thickness
	3rd Coat: Low V.O.C. polyurethane, CAN/CGSB-1.177-M Acceptable Products: <ul style="list-style-type: none"> <li>- Ameron Amercoat 450 H.S.</li> <li>- Devoe Devthane 369</li> <li>- International Interthane 990 H.S.</li> <li>- Carboline Carbothane 134 HG</li> </ul>	2-3 mils
Galvanized Metal	Surface Preparation: Clean to SSPC-SP1 Solvent Wash, as per Manufacturer's instructions. Welds must be neutralized.  1st Coat: Vinyl etch primer, CAN/CGSB-1.121 Acceptable Products: <ul style="list-style-type: none"> <li>- General Paint 39103/104 Metaprime</li> <li>- Glidden 27301/302 Vinyl Wash Primer</li> <li>- International Interprime VTA528/529</li> </ul> 2nd Coat: High-build epoxy, CAN/CGSB-1.153-M Acceptable Products: <ul style="list-style-type: none"> <li>- Ameron Amercoat 385</li> <li>- Devoe Bar Rust 236</li> <li>- International Interseal 670HS</li> </ul> 3rd Coat: Low V.O.C. polyurethane, CAN/CGSB-1.177-M Acceptable Products: <ul style="list-style-type: none"> <li>- Ameron Amercoat 450 H.S.</li> <li>- Devoe Devthane 369</li> <li>- International Interthane 990 H.S.</li> </ul>	0.3 - 0.5 mils      5-6 mils      2-3 mils
Wood Stained	1st Coat: Alkyd/Oil stain, CAN/CGSB-1.145 Acceptable Products: <ul style="list-style-type: none"> <li>- General Paint 01-line</li> <li>- Glidden 4710</li> <li>- Porter Pittsburgh 1819 Series</li> </ul> 2nd Coat: Alkyd/Oil stain, CAN/CGSB-1.145 Acceptable Products: <ul style="list-style-type: none"> <li>- General Paint 01-line</li> <li>- Glidden 4710</li> <li>- Porter Pittsburgh 1819 Series</li> </ul>	

Outdoor Finishes Surface	Protective Coating System	Minimum D.F. Thickness
Wood Painted	<p>1<sup>st</sup> Coat: Acrylic bonding primer, CAN/CGSB-1.203 Acceptable Products:</p> <ul style="list-style-type: none"> <li>- General Paint 70-002</li> <li>- Glidden 95310</li> <li>- Porter Pittsburgh 515 Series</li> </ul> <p>2nd Coat: Acrylic exterior paint, CAN/CGSB-1.138 Acceptable Products:</p> <ul style="list-style-type: none"> <li>- General Paint 70 - line</li> <li>- Glidden 94300 Series</li> <li>- Porter Pittsburgh 519 Series</li> </ul> <p>3rd Coat: Acrylic exterior paint, CAN/CGSB-1.138 Acceptable Products:</p> <ul style="list-style-type: none"> <li>- General Paint 70 - line</li> <li>- Glidden 94300 Series</li> <li>- Porter Pittsburgh 519 Series</li> </ul>	

.2 Indoor Finishes

Surface	Protective Coating System	Minimum D.F. Thickness
Galvanized Metal	<p>Surface Preparation: Clean to SSPC-SP1 Solvent Wash, as per Manufacturer's instructions. Welds must be neutralized.</p> <p>1st Coat: Vinyl etch primer, CAN/CGSB-1.121 Acceptable Products:</p> <ul style="list-style-type: none"> <li>- General Paint 39103/104 Metaprime</li> <li>- Glidden 27301/302 Vinyl Wash Primer</li> <li>- International Interprime VTA528/529</li> </ul> <p>2nd Coat: High-build epoxy, CAN/CGSB-1.153-M Acceptable Products:</p> <ul style="list-style-type: none"> <li>- Ameron Amercoat 385</li> <li>- Devoe Bar Rust 236</li> <li>- International Interseal 670HS</li> </ul> <p>3rd Coat: Low V.O.C. polyurethane, CAN/CGSB-1.177-M Acceptable Products:</p> <ul style="list-style-type: none"> <li>- Ameron Amercoat 450 H.S.</li> <li>- Devoe Devthane 369</li> <li>- International Interthane 990 H.S.</li> </ul>	<p>0.3 - 0.5 mils</p> <p>5-6 mils</p> <p>2-3 mils</p>

Surface	Protective Coating System	Minimum D.F. Thickness
Wood Painted	1st Coat: Enamel undercoat or Waterborne epoxy (thinned) as per manufacturer's recommendations.	1.5 mils
	2nd Coat: Waterborne epoxy (semi-gloss finish) Acceptable products: - Ameron Amercoat 335 - Devoe Tru-Glaze-WB 4408 - International Intergard 735	2 - 3 mils
	3rd Coat: Waterborne epoxy (semi-gloss finish) Acceptable products: - Ameron Amercoat 335 - Devoe Tru-Glaze-WB 4408 - International Intergard 735	2 - 3 mils
Gypsum Board	Surface Preparation: skim coat joint compound over entire surface of fiberglass mat gypsum panels to reduce highlighting.	
	1st Coat: Vinyl acrylic sealer, CAN/CGSB-1.119 Acceptable products: - General Paint 51-087 Superseal - Glidden 36600 Ultra - Porter Pittsburgh 426	1.2 mils
	2nd Coat: Waterborne epoxy Acceptable products: - PPG Aquapon WB - DevoeTru-Glaze-WB 4408 - International Intergard 735	2 - 3 mils
	3rd Coat: Waterborne epoxy Acceptable products: - PPG Aquapon WB - DevoeTru-Glaze-WB 4408 - International Intergard 735	2 - 3 mils

Surface	Protective Coating System	Minimum D.F. Thickness
Concrete Block	<p>1st Coat: Latex block filler, CAN/CGSB-1.188</p> <p>Acceptable products</p> <ul style="list-style-type: none"> <li>- General paint 70-224 Shur-fill</li> <li>- Glidden 36250 Ultra</li> <li>- Porter International 9203 Quik-Fil</li> </ul> <p>2nd Coat: Waterborne epoxy</p> <p>Acceptable products:</p> <ul style="list-style-type: none"> <li>- PPG Aquapon WB</li> <li>- Devoe Tru-Glaze-WB 4408</li> <li>- International Intergard 735</li> </ul> <p>3rd Coat: Waterborne epoxy</p> <p>Acceptable products:</p> <ul style="list-style-type: none"> <li>- PPG Aquapon WB</li> <li>- Devoe Tru-Glaze-WB 4408</li> <li>- International Intergard 735</li> </ul>	<p>Completely fill surface</p> <p>2 - 3 mils</p> <p>2 - 3 mils</p>
Existing Painted Surfaces (walls)	<p>Surface Preparation: as per Manufacturer's instructions to achieve optimum performance.</p> <p>1st Coat: Primer</p> <ul style="list-style-type: none"> <li>- as recommended by manufacturer for specific substrate conditions.</li> </ul> <p>2nd Coat: Waterborne epoxy (semi-gloss finish)</p> <p>Acceptable products:</p> <ul style="list-style-type: none"> <li>- PPG Aquapon WB</li> <li>- Devoe Tru-Glaze-WB 4408</li> <li>- International Intergard 735</li> </ul> <p>3rd Coat: Waterborne epoxy (semi-gloss finish)</p> <p>Acceptable products:</p> <ul style="list-style-type: none"> <li>- PPG Aquapon WB</li> <li>- Devoe Tru-Glaze-WB 4408</li> <li>- International Intergard 735</li> </ul>	<p>Completely cover surface.</p> <p>3 mils</p> <p>3 mils</p>
Floor	Refer to Section 09700 Epoxy Flooring	3 coats

**END OF SECTION**

**PART 1        GENERAL**

**1.1        RELATED REQUIREMENTS**

- .1        Section 09 25 00        Gypsum Board

**1.2        REFERENCE STANDARDS**

- .1        Aluminum Association (AA)
  - .1        DAF 45-[03], Designation System for Aluminum Finishes.
- .2        American National Standards Institute (ANSI)
  - .1        ANSI A135.4-2004, Hardboard Standard.
  - .2        ANSI A208.1-2009, Particleboard.
  - .3        ANSI A208.2-2009, Medium Density Fiberboard for Interior Use.
- .3        Canada Green Building Council (CaGBC)
  - .1        LEED Canada-NC Version 1.0-2004, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Package For New Construction and Major Renovations (including Addendum 2007).
  - .2        LEED Canada-CI Version 1.0-2007, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Guide For Commercial Interiors.
  - .3        LEED Canada 2009 for Design and Construction-2010, LEED Canada 2009 for Design and Construction Leadership in Energy and Environmental Design Green Building Rating System Reference Guide.
  - .4        LEED Canada for Existing Buildings, Operations and Maintenance-2009, LEED Canada 2009 Leadership In Energy and Environmental Design Green Building Rating System Reference Guide.
- .4        Canadian General Standards Board (CGSB)
  - .1        CGSB 41-GP-30M-[82], Wall coverings, Vinyl-Coated Fabrics.
- .5        CSA International
  - .1        CSA O121-08, Douglas Fir Plywood.
  - .2        CSA O151-09, Canadian Softwood Plywood.
  - .3        CAN/CSA-Z809-08, Sustainable Forest Management.
- .6        Environmental Choice Program (ECP)
  - .1        CCD-046-95, Adhesives.
- .7        Forest Stewardship Council (FSC)
  - .1        FSC-STD-01-001-2004, FSC Principle and Criteria for Forest Stewardship.
- .8        Green Seal Environmental Standards (GS)
  - .1        GS-11-11, Standard for Paints and Coatings.
  - .2        GS-36-11, Standard for Adhesives for Commercial Use.
- .9        South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards
  - .1        SCAQMD Rule 1113-A2011, Architectural Coatings.
  - .2        SCAQMD Rule 1168-A2005, Adhesives and Sealants Applications.
- .10       Sustainable Forestry Initiative (SFI)
  - .1        SFI-2010-2014Standard.
- .11       Underwriters' Laboratories of Canada (ULC)
  - .1        CAN/ULC-S102-2010, Standard Method of Test for Surfaces Burning Characteristics of Building Materials and Assemblies.
  - .2        CAN/ULC-S706-09, Standard for Wood Fibre Insulating Boards for Buildings.

### **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 tackboards and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Installation Drawings:
  - .1 Submit installation drawings.
  - .2 Indicate location, type, size, panel arrangement, backing, hardware, anchor or mounting details, frame or trim and accessories.
- .4 Samples:
  - .1 Submit duplicate 300 x 300 mm sample of each type of tackboard and each type of trim.
- .5 Sustainable Design Submittals:
  - .1 LEED Canada submittals: in accordance with Section 01 35 43- Environmental Procedures.
  - .2 Construction Waste Management:
    - .1 Submit project Waste Reduction Workplan highlighting recycling and salvage requirements.
    - .2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating that 75% of construction wastes were recycled or salvaged.
  - .3 Recycled Content:
    - .1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of post-industrial content, and total cost of materials for project.
  - .4 Regional Materials: submit evidence that project incorporates required percentage 20% of regional materials and products, showing their cost, distance from project to furthest site of extraction or manufacture, and total cost of materials for project.
  - .5 Low-Emitting Materials:
    - .1 Submit listing of adhesives and sealants and paints and coatings used in building, comply with VOC and chemical component limits or restriction requirements.
  - .6 Wood Certification: submit manufacturer's Chain-of-Custody Certificate number for CAN/CSA-Z809 or FSC or SFI certified wood.

### **1.4 QUALITY ASSURANCE**

- .1 Regulatory Requirements:
  - .1 Surface burning characteristics of materials: listed and labelled by an organization accredited by Standards Council of Canada.
- .2 Test Reports: submit certified test reports showing compliance with specified performance characteristics and physical properties.
- .3 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

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

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials off ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect tackboards from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.
- .4 Develop Waste Reduction Workplan related to Work of this Section and in accordance with Section 01 35 43- Environmental Procedures.
- .5 Packaging Waste Management: remove for reuse by manufacturer of pallets, packaging materials, padding, crates, as specified in Waste Reduction Workplan in accordance with Section 01 35 43- Environmental Procedures and Section 01 74 21- Construction/Demolition Waste Management and Disposal.

## **PART 2 PRODUCTS**

### **2.1 MATERIALS**

- .1 Utility sheet aluminum: plain, matte finish.
- .2 Laminating adhesive: to manufacturer's standard.
- .3 Mounting adhesive: to manufacturer's standard.
- .4 Joint reinforcement: concealed mechanical jointing system to provide straight, rigid, continuously supported, tight butt, flush joints at surface.
- .5 Anchor clips, brackets and fasteners: concealed type selected by Departmental Representative for interchangeable mounting.
- .6 Facings:
  - .1 Composition cork tackboards: resilient smooth surface, uniform density composition cork with an anti-soil, washable surface finish which is resistant to fading under artificial or natural light, selected by Departmental Representative
  - .1 Surface burning characteristics in accordance with CAN/ULC-S102
- .7 Core:
  - .1 Fibreboard: to CAN/ULC-S706, Type II.
  - .2 Particle board: to ANSI A208.1, Grade R.
  - .3 Plywood: to CSA O121
  - .4 Hardboard: to ANSI A135.4
  - .5 Medium Density Fibreboard (MDF): to ANSI A208.2.
  - .6 CAN/CSA-Z809 or FSC or SFI certified.
  - .7 Urea-formaldehyde free.
- .8 Backing:
  - .1 Vinyl film.
- .9 Recycled content: post-industrial: 75% minimum in accordance with Section 01 74 21- Construction-Demolition Waste Management And Disposal.

### **2.2 COMPONENTS**

- .1 Extruded aluminum: aluminum Association alloy AA6063-T5. Minimum 1.5 mm wall thickness.
- .2 Extruded vinyl: rigid PVC, integral, 1.5 mm minimum wall thickness.
- .3 Wood: stain and grade species, to requirements of Section 06 20 00- Finish Carpentry.
  - .1 Primer: VOC limit 250g/L maximum to GS-11.



- .2 Enamel Finish: VOC limit 250g/L maximum to GS-11.
- .3 Paint: VOC limit 250g/L maximum to GS-11.
- .4 Tackboard trim and framing: perimeter trim or frame, map rail with cork, bottom rail with integral chalk trough end closures, movable panel frames, guides, tracks and housing, and of manufacturer's standard sections appropriate for installation conditions.

## **2.3 ACCESSORIES**

- .1 Manufacturer's standard.

## **2.4 FABRICATION**

- .1 Fabricate tackboard panels to sizes indicated.
- .2 Factory laminate tackboards
- .3 Wrap around edges and fasten to back face.
- .4 Make finished panels flat and rigid and fit with joint reinforcement.
- .5 Install trim on panels in factory.
  - .1 Make mitres and joints to hair-line fit, free of rough edges.
  - .2 No exposed fasteners permitted.
- .6 Overlap trim 6 mm onto panels.
- .7 Factory fit assemblies too large for shipment to site in one piece, disassemble for delivery and site assembly.

## **2.5 FINISHES**

- .1 Aluminum trim finishes:
  - .1 Finish exposed surfaces of aluminum components in accordance with Aluminum Association Designation System for Aluminum Finishes.
    - .1 Clear anodic finish
  - .2 Appearance and properties of anodized finishes designated by the Aluminum Association as Architectural Class 1, Architectural Class 2, and Protective and Decorative.
- .2 Wood trim finishes:
  - .1 Finish for wood components: in accordance with Section 06 20 00- Finish Carpentry.

# **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 tackboard 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 MANUFACTURER'S INSTRUCTIONS**

- .1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

### **3.3 INSTALLATION**

- .1 Install tackboards in accordance with manufacturer's instructions, parallel to floor with uniform vertical surface, plumb and level, to provide rigid, secure surface.
- .2 Install trim and framing around tackboard panels. Make mitres and joints to hair-line fit, free of rough edges. Use concealed brackets to reinforce and hold joints tight and flush. No exposed fasteners permitted. Overlap trim 6 mm onto panels.
- .3 Mechanical attachment:
  - .1 To concrete or solid masonry use lag screw and expansion bolts or screws and fibre plugs as appropriate for stresses involved.
  - .2 To hollow masonry use toggle bolts or equivalent.
  - .3 To wood or sheet metal use screws. Secure into framing members in stud walls.
- .4 Adhesive attachment:
  - .1 Apply self-stick adhesive foam tape strips over back surface at maximum 300mm on centre. Keep tape minimum 6 mm from edges.
  - .2 Use recommended adhesive applied using spot method with daubs 40 mm diameter x 25 mm high at 200 mm on centre each way to adhere tackboard to wall. Press firmly into adhesive to ensure adhesion.

### **3.4 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 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.

### **3.5 PROTECTION**

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

**END OF SECTION**

**PART 1 GENERAL**

**1.1 WORK INCLUDED**

- .1 Manufacturing and installation of signs.

**1.2 SHOP DRAWINGS**

- .1 Submit shop drawings and/or catalogue cuts in accordance with Section 01300.
- .2 Shop drawings shall clearly show and describe in detail all items of this section. Indicate details of assembly, fastening, letter size, and overall size of sign.

**PART 2 PRODUCTS**

**2.1 WASHROOM SIGNS**

- .1 Washroom door signs
  - .1 Women's Washroom W102 (Door D3): Provide one (1) sign. Minimum Size 9" wide x 9" high. Sign to include wording "WOMEN" with female graphics, wheelchair symbol and Braille.
  - .2 Men's Washroom W105 (Door D6): Provide one (1) sign. Minimum Size 9" wide x 9" high. Sign to include wording "MEN" with male graphics, wheelchair symbol and Braille.
  - .3 Family Washroom W106 (Door D7): Provide one (1) sign. Minimum Size 9" wide x 9" high. Sign to include wording "FAMILY RESTROOM" with male & female graphics, wheelchair symbol and Braille.
  - .4 Men's Washroom P100 (Door D17): Provide one (1) sign. Minimum Size 9" wide x 9" high. Sign to include wording "MEN" with male graphics, wheelchair symbol and Braille.
  - .5 Women's Washroom P101 (Door D18): Provide one (1) sign. Minimum Size 9" wide x 9" high. Sign to include wording "WOMEN" with female graphics, wheelchair symbol and Braille.
- .2 Mount signs 1550 mm from floor to center of sign.

**PART 3 EXECUTION**

**3.1 INSTALLATION**

- .1 Erect and secure signs plumb and level in locations indicated on drawings and as specified herein.

**3.2 CLEANING**

- .1 Clean sign and surrounding areas of all dirt, smudges, etc.

**END OF SECTION**

## **PART 1 GENERAL**

### **1.1 SHOP DRAWINGS**

- .1 Submit shop drawings or catalogue illustrations in accordance with Section 01 33 00- Submittal Procedures.
- .2 Clearly indicate size and description of components, base material, surface finish inside and out, hardware and locks, attachment devices, description of rough in frame.

### **1.2 DELIVERY/STORAGE/HANDLING**

- .1 Do not deliver fixtures or accessories to site until rooms in which they are to be installed are ready to receive them.
- .2 Pack fixtures individually in a manner to protect the fixture and its finish.

## **PART 2 PRODUCTS**

### **2.1 TOILET AND BATH ACCESSORIES**

- .1 Waste Receptacle: Satin-finish stainless steel. Open top. Vinyl wall bumper, rubber feet. Liner hooks. 13-gal. (49.2-L) capacity. 340 x 340 x 553 mm. Bobrick B-2260.
- .2 Toilet Tissue Dispenser: double roll, control flow model designed for dispensing standard or jumbo roll toilet tissue. Fabricated of aluminum casting, satin finish, with molded plastic spindles, Bobrick B-2740.
- .3 Surface-Mounted Paper Towel Dispenser: Satin-finish stainless steel. Dispenses 400 C-fold or 525 multifold towels. 275 x 355 x 100mm. Bobrick B-2620.
- .4 Countertop-Mounted Circular Waste Chute: Rolled flange and exposed surfaces bright-polished stainless steel. Outside Diameter 175 mm. Rough Countertop Cutout: 140 mm. Bobrick B-529.
- .5 Surface-Mounted Hand Dryer: Dryer with chrome cover. No-touch operation, electronic sensor automatically turns on dryer. Remove hands from path of sensor and dryer stops. Size: Approximately 10.5" x 12". Bobrick B-778 115V.
- .6 Sanitary Napkin Disposal: Surface Mounted, Satin-finish stainless steel. Capacity: 3.8-L, 190 x 255 x 95mm. Bobrick B-270.
- .7 Soap Dispenser: surface mounted, Satin-finish stainless steel. Capacity: 1.2-L. Soap refill window. Concealed wall fastening, Bobrick B-2111.
- .8 Shelf: 600 long x 125mm and 900 x 125mm wide, 18-gauge, type 304 stainless steel, satin finish. Bobrick B-296 x 18.
- .9 Coat Hooks: Bobrick B 211, or approved equal.
- .10 Mirrors: stainless steel channel frame with satin finish and concealed fixing devices the full width of the mirror Bobrick Model 290. Size: 600 x 900 mm and 900 x 900mm.
- .11 Grab Bar: Type 304 stainless steel tubing, 1.2 mm (18 ga.) thickness, 32 mm diameter, peened grip surface, stainless steel 1.2 mm (18 ga.) concealed mounting flange, Bobrick B-5806.99 x length as noted on drawings. L shaped grab bar Bobrick B-58616.99.
- .12 Bench: Pedestal Bench, Bench top material 1.5" thick HDPE plastic, with matte texture finish. Pedestal material black anodized aluminum with welded aluminum flanges top and bottom. Colour: as selected by the Departmental Representative from manufacture's standard colors. Basis of Design: Bradley LENOXPEDESTAL.
  - .1 Size – Adult Change Bench (Family Shower): Length=60", Width=24", Height=18.5".
  - .2 Size – Bench (Lobby): Length=72", Width=18", Height=18.5".
- .13 H/A Shower Bench (Seat): Folding Shower Seat, satin stainless steel frame. Overall dimensions approximately 33" x 21" x 1/2" thick. Bobrick B-5191 or Bradley 9569.

- .14 Shower change seat: Folding dressing area seat, satin stainless steel frame. Dimensions approximately 18" x 15" x 3/8" thick. Bobrick B-5191 or Bradley 9591.
- .15 Baby Change Station: ADA Compliant, surface mounted, made of polyethylene or polypropylene with steel to steel support hinges. Color: Grey. Approximately 35" long. Bobrick KB200-01 or Bradley 9631.
- .16 Toilet Partitions / Urinal Screen: Phenolic solid-core construction - solidly fused plastic laminate with matte-finish melamine surfaces; integrally bonded colored face sheets and black phenolic-resin core, 3/4" doors/stiles and 1/2" panels. Concealed stainless steel hardware. Bobrick - DuraLineSeries – Compact Laminate (CL phenolic) 1080/1180.
  - .1 Partition Mounting: Floor Anchored.
  - .2 Urinal Screen Mounting: Wall hung.

### **PART 3 EXECUTION**

#### **3.1 INSTALLATION**

- .1 Deliver inserts and rough in frames to job site at appropriate time for build in. Provide templates and/or rough in measurements as required.
- .2 Before commencing work notify the Engineer in writing of any conflicts detrimental to installation or operation of units.
- .3 Verify with the Engineer exact location of all units.
- .4 Install and secure fixtures rigidly in place where shown on the drawings.
- .5 Fill units with necessary supplies shortly before final acceptance of building.
- .6 Install all accessories in accordance with the manufacturer's written instructions.
- .7 Install true, plumb and level, securely and rigidly anchored to substrate in a manner consistent with the intended use of the fixture.
- .8 Use tamper proof fasteners for installation of all work of this section.

#### **3.2 SCHEDULE OF ACCESSORIES:**

##### Men's Washroom W105

2 – Hand Dryer  
2 - Waste Receptacle  
2 - Circular Waste Chute  
2 - Soap dispenser  
2 - Toilet Tissue Dispenser  
2 – 600 x 900 Mirror  
2 – 600 Shelf  
1 – L Shaped Grab Bar  
2 – Vertical Grab Bars  
2 – Urinal Screen  
Toilet Partitions

##### Women's Washroom W102

2 – Hand Dryer  
2 - Waste Receptacle  
2 - Circular Waste Chute  
2 - Soap dispenser  
4 - Toilet Tissue Dispenser

4 - Sanitary Napkin Disposal  
1 – 900 x 900 Mirror  
1 – 900 Shelf  
1 – L Shaped Grab Bar  
Toilet Partitions

Family Washroom W106

1 – Hand Dryer  
1 - Circular Waste Chute  
1 - Soap dispenser  
1 – Mirror  
1 – 600 x 900 Mirror  
1 – 600 Shelf  
1 – Waste Receptacle  
1 – L Shaped Grab Bar  
2 – Coat Hooks  
1 – Baby Change Station

Shower W107 – W109 & W112 - W114

2 - Coat Hooks  
1 – Shower Change Seat

Family Shower Room W110 & W111

2 – Coat Hooks  
1 – L Shaped Grab Bar  
1 – H/A Shower Bench  
1 – Adult Change Bench – 60" x 24"

Lobby W100

1 – Bench – 72" x 18"  
1 – Phone charging locker station – The Boxter by Growcharge

Kiosk K100

1 – Paper Towel Dispenser  
1 - Waste Receptacle

**END OF SECTION**

**PART 1 GENERAL**

**1.1 RELATED SECTIONS**

- .1 Section 01 33 00 Submittal Procedures.
- .2 Section 01 77 00 Closeout Procedures.

**1.2 REFERENCES**

- .1 American National Standards Institute (ANSI)
  - .1 ANSI/NFPA 10-1998, Portable Fire Extinguishers.
- .2 Underwriters' Laboratories of Canada (ULC)
  - .1 CAN/ULC-S508-M90(R1995), Rating and Fire Testing of Fire Extinguishers and Class "D" Extinguishing Media.

**1.3 SHOP DRAWINGS AND PRODUCT DATA**

- .1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.

**1.4 CLOSEOUT SUBMITTALS**

- .1 Provide maintenance data for incorporation into manual specified in Section 01 77 00 - Closeout Procedures.

**PART 2 PRODUCTS**

**2.1 MULTI-PURPOSE DRY CHEMICAL EXTINGUISHERS**

- .1 Stored pressure rechargeable type with hose and shut-off nozzle, ULC labelled for A, B and C class protection. Size 4.5 kg.

**2.2 EXTINGUISHER BRACKETS**

- .1 Type recommended by extinguisher manufacturer.

**2.3 IDENTIFICATION**

- .1 Identify extinguishers in accordance with recommendations of CAN/ULC-S508.
- .2 Attach tag or label to extinguishers, indicating month and year of installation. Provide space for service dates.

**PART 3 EXECUTION**

**3.1 INSTALLATION**

- .1 Install or mount extinguishers on brackets as indicated.

**END OF SECTION**

## **PART 1 GENERAL**

### **1.1 REFERENCES**

- .1 CAN/CGSB-44.40-92, Steel Clothing Locker.

### **1.2 SUBMITTALS**

- .1 Submit Shop Drawings in accordance with Section 01 33 00 – Submittal Procedures.
- .1 Indicate type and class of locker, thicknesses of metal, fabricating and assembly methods, assembled banks of lockers, tops, hooks, shelves, bases, trim, numbering, filler panels, end/back panels, doors, handles, locking method, ventilation method, finishes.
- .2 Provide colour chart of all available finishes.

## **PART 2 PRODUCTS**

### **2.1 MANUFACTURED UNITS**

- .1 Lockers: to CAN/CGSB-44.40, Type 1-Single full-height locker, Class 1 - One (1) complete locker of two (2) or more lockers, freestanding.
  - .1 Size: 305 mm wide x 457 mm deep x 1829 mm high, steel thickness No.20 MSG.
  - .2 Assembly: welded construction.
  - .3 Top: sloped.
  - .4 Doors: one-piece double-wall envelope construction, steel thickness No.20 MSG, door swing as noted on Drawings.
  - .5 Door handle: recessed handle steel with bright chromium finish.
- .2 Acceptable manufacturers:
  - .1 Shanahan's Manufacturing Ltd., Deluxe 20.
  - .2 Hadrian Manufacturing Inc., Emporer.
  - .3 General Storage Systems, Decor Tri-Lok Corona.

### **2.2 ACCESSORIES**

- .1 Options: to CAN/CGSB-44.40, steel base, steel end panels, steel trim including corner angles, jamb trim fillers, number plates manufacturer's standards, coat hooks, metal chromium finish.

### **2.3 FINISHING**

- .1 Lockers to receive two (2) coats of baked enamel over enamel primer.
- .2 Locker frame and doors shall be one colour throughout.
- .3 Colour: as selected by the Departmental Representative.

## **PART 3 EXECUTION**

### **3.1 INSTALLATION**

- .1 Assemble and install lockers in accordance with manufacturer's written instructions.
- .2 Securely fasten lockers to grounds and nailing strips.
- .3 Install wall trim around recessed locker banks.
- .4 Install finished end panels to exposed ends of locker banks.
- .5 Install locker numbers.

**END OF SECTION**



**PART 1 GENERAL**

**1.1 SHOP DRAWINGS**

- .1 Submit shop drawings in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Clearly indicate size and description of components, base material, surface finishes, hardware, anchor or mounting details, accessories, location and quantities.

**1.2 DELIVERY/STORAGE**

- .1 Do not deliver furniture or accessories to the site until rooms in which they are to be installed are ready to receive them.
- .2 Pack components individually in a manner to protect the component and its finish.
- .3 Deliver all components to the site with the manufacturer's labels and seals intact.
- .4 Reject and remove damaged materials from the site.

**PART 2 PRODUCTS**

**2.1 GENERAL**

- .1 Manufacturer's catalogue numbers specified, denote quality, style and function of items required. All furniture and accessories shall be as specified or approved equal.
- .2 All upholstered furniture shall be treated with Scotchgard protective spray, as manufactured by 3M, applied in accordance with manufacturer's instructions.

**2.2 ENTRY KIOSK CHAIR**

- .1 Chair: Ergonomic Task Chair, High-back, Center-Tilt, Adjustable Arms, fabric seat. Multifunctional office chair with arms. 50.5" H x 24.5" W x 23" D. Offices to Go Format High-Back Simple Synchro-Tilt Chair by Grand & Toy Model Number: MVL3191F-1.
- .2 Two (2) required in Kiosk Room.

**2.3 MICROWAVE**

- .1 Minimum 0.7 cu. ft. microwave, 1-door design.
- .2 Acceptable products:
  - .1 Whirlpool Energy Star 0.7 cu. ft. Countertop Microwave Oven (WMC10007AW).
- .3 One (1) required in Kiosk Room.

**2.4 UNDER COUNTER FRIDGE**

- .1 Minimum 3.5 cu. ft. fridge, 1-door design.
- .2 Acceptable products:
  - .1 Whirlpool 3.5 cu. ft. Mini Refrigerator - Stainless Steel (072-01-0104).
- .3 One (1) required in Kiosk Room.

**2.5 UNDER COUNTER SAFE**

- .1 Maximum 2 cu. ft. safe, 1-door, fireproof, and combination lock
- .2 Acceptable products:
  - .1 SentrySafe 2 cu. ft. Combination Fire Safe (SF205CV)
- .3 One (1) required in Kiosk Room.

**2.6 WATER COOLER**

- .1 Maximum 5 gallon water cooler, bottom-loading and self-cleaning design

- .2 Acceptable products:
  - .1 Whirlpool Self-Cleaning Stainless Steel Bottom Load Water Cooler with LED Indicators (444190)
- .3 One (1) required in Kiosk Room.

### **PART 3 EXECUTION**

#### **3.1 INSTALLATION - GENERAL**

- .1 Installation of all furniture and accessories specified in this Section shall be in accordance with the drawings and the manufacturer's printed instructions.
- .2 Install furniture and accessories in locations indicated and as directed by the Departmental Representative.
- .3 Adjust operating hardware for smooth and proper operation.
- .4 On completion, touch up marred or abraded finished surfaces.
- .5 Wipe down surfaces to remove fingerprints and markings, and leave in clean condition.

**END OF SECTION**

## **PART 1        GENERAL**

### **1.1            INTENT**

- .1        The intent of this specification and the drawings is to provide a complete and fully operating mechanical system in complete accord with applicable codes. The Mechanical Contractor shall make provisions for labour, material, and equipment necessary to complete the mechanical work.
- .2        Drawings and specifications are complementary to each other and what is called for in one is binding as if called for by both. Should any discrepancy appear between drawings and specifications which leaves doubt as to the true intent and meaning, obtain a ruling from the Departmental Representative ten (10) days before submitting tender. Failing this, allow for most expensive alternative.
- .3        Contract documents are diagrammatic only. They are to establish scope, material and quality. They are not detailed installation drawings. Minor details usually not shown or specified and any incidental accessories required for proper installation of the system are to be included in the work.
- .4        Contractor is to ensure that all intended equipment will fit within given spaces. Make reference to the electrical, mechanical, architectural and structural drawings, when setting out work and before ordering equipment.
- .5        The Contractor shall visit the site prior to tender and verify existing conditions.
- .6        This is a shower building and Entry Kiosk for the Kicking Horse Camp ground in Yoho National Park. This building is intended to provide washing and toilet facilities to the patrons of the camp ground and surrounding areas. All fixtures should be rated for public use and of durable quality. All equipment intended to facilitate maintenance should be tamper proof or otherwise non-accessible to the public.

### **1.2            CODE COMPLIANCE**

- .1        All work shall conform to the most current edition of National, Provincial and Municipal Codes, Standards and Acts; and will meet the requirements of Authorities having jurisdiction.

### **1.3            LIABILITY**

- .1        Assume responsibility for layout of work; and for any damage caused to the Owner or other Tenants by improper execution of work.
- .2        Protect finished and unfinished work from damage.
- .3        Take responsibility for condition of materials and equipment supplied and protect until work is completed and accepted. Coordinate deliveries with the general contractor.

### **1.4            CERTIFICATES & PERMITS**

- .1        Give notices, obtain permits and approvals, and pay fees so work specified may be carried out. Furnish certificates if requested, as evidence that work conforms with laws and regulations of the authorities having jurisdiction.

### **1.5            CUTTING AND PATCHING**

- .1        All work shall be coordinated with other trades especially that related to cutting and patching of required openings; and locations and installation of sleeves, inserts, support, curbs, frames and access doors.

**1.6 ALTERNATIVE MATERIALS AND EQUIPMENT**

- .1 Contract price shall be based on materials and equipment specified. Review or acceptance by Departmental Representative of equipment submitted by the mechanical trade as equal to that specified does not relieve the mechanical trade of any responsibility.
- .2 Revisions required to adapt accepted equals and alternatives shall be included in the contract price. No increase in the contract price will be considered to accommodate the use of equipment other than that specified.
- .3 Certain items of equipment and items of work (such as balancing, water treatment) may not have an approved equal due to the need to have a consistent type or source of maintenance. Refer to specific clauses in this specification.

**1.7 SHOP DRAWINGS**

- .1 Submit PDF format copies of shop drawings to Departmental Representative for all equipment specified in the specification or drawings for Departmental Representative's review. Do not order equipment or materials until Departmental Representative has reviewed provided comment on the shop drawings.

**1.8 GUARANTEE**

- .1 Provide the Owner with a written guarantee that the equipment installed and work performed shall remain in serviceable condition for a period of one (1) year from the date of final acceptance by the Owner. The warranty shall cover material as well as labour.

**1.9 STANDARD OF MATERIALS AND WORKMANSHIP**

- .1 Make and quality of materials used are subject to approval by the Departmental Representative. Remove unacceptable materials and install suitable materials in their place.
- .2 Materials shall be new and of uniform pattern throughout, unless noted otherwise.
- .3 Employ only tradesmen properly licensed to perform the specific work.

**1.10 OWNER'S STOCK**

- .1 Following items of mechanical equipment is available from the Owner's stock. Prior to submitting the tender price, review these items to ensure their usability for the project. The tender price shall include the cost of servicing, moving in place, and installing to make these items completely operational.
- .2 Where equipment is removed and not re-used it shall be handed over to the Owner, or disposed of if directed by the Owner.

**1.11 RECORD DRAWINGS**

- .1 Keep on site an extra set of white prints and specifications, recording changes and deviations daily.
- .2 Upon completion of work, submit final record drawings to the Departmental Representative. These must be submitted within two (2) weeks after acceptance of work. Failure to submit drawings will result in the work being done by the Owner and the cost deducted from the final payment.
- .3 The final record drawings shall be prepared by a qualified draftsman on sepia to the same drafting standards as the original drawings. The sepia may be purchased from the Departmental Representative at cost.

**1.12 SUBSTANTIAL COMPLETION INSPECTION**

- .1 Advise Departmental Representative five (5) days prior to the date inspection is desired. All systems to be fully operational and any deficiencies should be noted to the Departmental Representative.
- .2 All deficiencies shall be completed within two (2) weeks after substantial completion and letter submitted to Departmental Representative within that time advising that the work is complete. Failure to complete work will result in work being done by the Owner and the costs deducted from final payment.

**1.13 EXAMINATION OF WORK**

- .1 This project involves construction of new facilities on an existing site, therefore, examine the site and local conditions to determine the difficulties in carrying out the work indicated and specified prior to submitting final price. Extras will not be considered based on the grounds of differences on site.

**1.14 COORDINATION WITH OTHERS**

- .1 Contractor shall review all equipment requiring electrical hook-up with Electrical Contractor and electrical drawings prior to ordering equipment. Ensure proper electrical characteristics are determined for all affected and related work.
- .2 Contractor shall review all equipment with Base Building Contractor and drawings prior to ordering equipment. Ensure proper characteristics are determined for all affected and related work.

**1.15 COORDINATION OF SERVICES**

- .1 Coordinate with proper utilities for services such as water, sewer, natural gas/propane, and assume all charges.
- .2 Coordinate with the owner to shutdown, disconnect, reroute, or make connection to existing services.

**1.16 PERFORMANCE TESTS**

- .1 Operate each mechanical system after mechanical and electrical work has been completed, to demonstrate that each system fulfills the requirements of the contract and operates satisfactorily. These are performance tests and must be completed before work can be finally accepted.

**1.17 OPERATION AND MAINTENANCE MANUALS**

- .1 Provide one (1) hard and one (1) digital copy of manuals prepared by qualified and experienced personnel for use by Owner. Manuals form part of the contract and must be delivered to the Departmental Representative before work will be considered complete. Each manual shall provide the following:
  - .1 Layman's description of all mechanical systems including operating maintenance and lubrication instructions,
  - .2 Certification of all equipment where required by local codes and authorities,
  - .3 Shop drawings and maintenance bulletins,
  - .4 List address and telephone numbers of all equipment suppliers and contractors.

- .5 Performance details for all equipment including curves for fans and pumps with actual operating points noted.

#### **1.18 SYSTEM CLEANING AND CHEMICAL TREATMENT**

- .1 Employ services of the firm which currently performs water treatment in the building or if there isn't any then a firm specializing in pipe cleaning and hydronic system chemical treatment. This firm shall submit a schedule of work to be performed, chemical types and quantity to be used. At the completion of the chemical treatment a report shall be submitted to outline the work performed, quality of water before and after the chemical treatment, amount and types of chemicals added. The report shall also include the details of procedures to be used by the building operator for water quality testing and chemical treatment.
- .2 Provide test kits as required along with adequate chemicals and reagents for one year of testing. Appropriate test kits will be provided to properly test each system installed under this contract.
- .3 Flush and disinfect all domestic cold, hot and recirculation water systems.

#### **1.19 PAINTING AND IDENTIFICATION**

- .1 Paint all exposed pipes with colors to match interior finishes or in colors as directed by the Architect.
- .2 Identify piping with labels and flow arrows. Provide identification at 50 ft. 15 m maximum intervals, before and after pipes passing through walls, at all sides of tees, behind access doors. Use Brady B-500 vinyl cloth labels for non insulated pipes and B-350 for insulated pipes.
- .3 Provide 3/4" 20 mm diameter brass tags, secure to valve stems with key chain. Provide typed valve directories.
- .4 Identify electric starting switches, thermostats controlling motors and equipment supplied under this division with lamacoid plates having 1/4" 6 mm minimum letter size.

#### **1.20 FLASHING AND ROOF CURBS**

- .1 Provide curbs, flash and counter flash where mechanical equipment passes through weather or waterproofed walls, floors and roofs. Install roof mounted equipment on factory supplied roof curbs.

#### **1.21 SEISMIC CONTROL**

- .1 Provide seismic restraint on all piping, ductwork and equipment to satisfy all codes and authorities having jurisdiction.
- .2 Submit shop drawings of all seismic restraint details prepared and sealed by a professional engineer. Prior to substantial completion, this professional engineer for seismic design shall visit the site to verify seismic restraint installation and provide a letter of conformance in accordance with the applicable Building Code.
- .3 Piping ductwork and equipment shall be restrained in accordance with the latest edition of the Seismic Restraints Manual for Mechanical Systems produced by SMACNA, and the latest edition of the ASHRAE Application Handbook Chapter 49, Seismic Restraints.
- .4 The contractor shall obtain approval for the location of all restraint fixing points from the structural engineer, on site, prior to installation.

- .5 Where equipment is mounted on spring or R.I.S. mounts for vibration isolation it shall be the responsibility of the manufacturer of the mount to incorporate seismic restraint. These restraints shall be multi-directional as described in the guidelines specified above. Provide steel frame bases where necessary to achieve this and also avoid overturning. The manufacturer shall supply certificates, signed by a Professional Engineer registered within the jurisdiction, verifying the design of the seismic restraints in accordance with this section.
- .6 Where equipment is located without vibration isolation fittings all such equipment shall be rigidly fixed with holding down bolts of sufficient strength to restrain seismic action. Holding down bolts shall be packed within slots to prevent movement prior to restraint commencing. Bolts shall be of sufficient strength to withstand overturning of the equipment during seismic disturbance.

## **PART 2 PIPING**

### **2.1 PIPE MATERIAL**

- .1 Service: Sanitary and Storm Drainage, and Vent (above grade).  
Material: DWV Copper; Cast Iron.
- .2 Service: Sanitary and Storm Drainage and Vent (below grade inside building).  
Material: PVC-DWV or ABS.
- .3 Service: Sanitary and Storm Drain (outside service).  
Material: PVC SDR-35 or ABS
- .4 Service: Domestic Water (above grade inside building).  
Material: Type "L" Hard Copper; No steel piping permitted for Domestic Hot Water. All domestic hot water shall be type 'K' hard copper.
- .5 Service: Domestic Water (buried, inside building).  
Material: Type "K" Soft Copper.
- .6 Service: Propane.  
Material: Steel Schedule 40, A53 Grade B.
- .7 Service: Condensate;  
Material: DWV Copper; Cast Iron.
- .8 Service: Equipment drains and overflows.  
Material: Steel Schedule 40, Galvanized, A53

### **2.2 PIPE CONNECTIONS**

- .1 Screwed joint steel piping up to and including 1½" 40 mm. Weld piping 2½" 65 mm and larger including branch connections. Screw 2" 50 mm piping for liquid systems, weld 2" 50 mm piping for air or gas systems. Use dielectric type couplings when joining dissimilar metal pipes.
- .2 Use lead free solder for soldering domestic water copper pipe.

### **2.3 PIPE HANGERS AND SUPPORTS**

- .1 All piping shall be firmly supported and securely braced. Provide copper plated hangers and supports for copper piping and galvanized hangers and supports for galvanized piping.
- .2 Use of perforated straps is not permitted for pipe hangers.

- .3 Provide ring type hangers for piping up to 1½" 40 mm and clevis type hangers for piping over 1½" 40 mm.

## 2.4 PIPE SUPPORT SPACING

Pipe Size (in.) (mm)	Rod Diameter (in.) (mm)	Spacing (ft.) (m)
1/2 15	3/8 9	6 1.8
3/4 to 1½ 20-40	3/8 9	8 2.4
2 to 2½ 50-65	3/8 9	10 3.0
3 to 4 75-100	5/8 16	12 3.6
6 to 12 150-300	7/8 22	14 4.3

## 2.5 GAS DISTRIBUTION

- .1 Install gas piping in open or ventilated spaces. Pitch lines and provide drip legs at condensation collection points. Where gas piping is run in concealed space provide ventilation grilles, as required.
- .2 Propane Gas Pipe and Fittings
- .3 Jointing Material
  - .1 Screwed Fittings: pulverized lead paste
- .4 Pipe fittings:
  - .1 Malleable iron Screwed Fittings (banded): Class 150 to ANSI B16.3
  - .2 Unions, malleable iron, brass to iron, ground seat: to ANSI B16.3
  - .3 Nipples, Schedule 40: to ASTM A53
- .5 Valves
  - .1 Code approved, lubricated plug valves
- .6 Regulators
  - .1 First stage regulator attached to tank shall discharge at a fixed pressure of 10 psi with a fluctuating inlet supply. Shall meet all requirements of CAN.1-B149.2-MBO and authority having jurisdiction
  - .2 Second stage regulator shall be enclosed in a cage or otherwise tamperproof. Discharge pressure shall be set at 11" water column or 7 oz and provide 450,000 BTU/h of heating capacity. Shall meet all requirements of CAN.1-B149.2-MBO and authority having jurisdiction

## PART 3 VALVES

### 3.1 DOMESTIC HOT AND COLD WATER SYSTEM VALVES

- .1 Ball Valves up to 2" 50 mm; 2-piece forged brass class 150 rated, chrome plated, bronze ball, threaded or solder ends, TFE seat and packing. Adjustable packing nut, blowout proof stem. M.A Stewart Model B2F or approved equal.
- .2 Gate valves up to 2" 50 mm shall be bronze, solid wedge disk, non-rising stem, 125 psi 860 KPag or 150 psi 1000 KPag W.O.G., threaded ends, Crane 438.



- .3 Inside hose bibbs shall be bronze body, globe valve, renewable disc, garden hose outlet, 300 psi 2070 KPag rating Jenkins Fig. 1112-A, provided with tamper proof enclose.
- .4 Outside hose bibb shall be non-freeze type with bronze recessed box and polished bronze cover, hose thread spout vacuum breaker, removable key. ROTO-TECH-SMITH-RS-5500VB.
- .5 Check valves up to 2" 50 mm shall be bronze swing check with bronze disc capable of being reground, Class 150, threaded ends, Red-White No.238. Solder ends, Jenkins Fig. 4093.
- .6 Thermostatic Mixing Valves shall be sized to meet minimum and maximum flows of branches they serve with a pressure drop of 20 psi 138 KPag across the valve. The valve serving the showers shall be a Symmons Thermixer 5-130 or approved equal. If a second valve is installed for lavatories, it shall be a Symmons Thermixer 5-120 or approved equal.
- .7 Backflow Preventers: Provide 75mm dia. reduced pressure backflow preventer with cast iron body, bronze pressure relief valve pilot, two full port bronze isolating ball valves, and 4 test cocks. Rated for 1035 KPag and provided with 75mm NPT connections and integral unions. Watts Model 909 or approved equal.
- .8 Y-Strainers: Bronze body, class 150, screwed, Y-pattern, stainless steel screen c/w 0.8mm (1/32") perforations connection c/w ball valve. Mueller Steam Speciality No. 351, Watts Regulator Series 777. Do not use size smaller than 19mm; use increasers for smaller lines.

#### **PART 4 SPECIALITIES**

##### **4.1 MANUAL AIR VENTS**

- .1 Provide manual air vents from short vertical section of line diameter pipe to form air chamber. Provide 1/8" 3 mm brass needle valve at top of chamber.

##### **4.2 RELIEF VALVES**

- .1 Provide ASME rated direct spring loaded type, lever operated non-adjustable factory set, discharge pressure as indicated.
  - .1 System Relief Pressure: 15 psi                      101 KPag
- .2 Straight or angle globe, threaded or union ends, positive back seating.
  - .1 Dahl Series 11040.

##### **4.3 PRESSURE REDUCING VALVES**

- .1 3/4" 20 mm pressure reducing valve complete with low inlet pressure check valve, removable strainer. Brass body and adjustable pressure of 27 psi to 66 psi 175 KPag to 415 KPag. Bell & Gossett.
  - .1 System Operating Pressure:    10 psi                      66 KPag

## **PART 5 INSULATION**

### **5.1 PIPING INSULATION**

- .1 All hot and tempered water piping and DCW piping within 3m of an exterior wall to be insulated with fine fibrous glass insulation with factory applied general purpose jacket, molded to conform to piping, "K" value at 75°F 24°C maximum 0.24 btu.in/ft² hr°F 0.035 w/m°C. Recover with ULC labeled thermo canvas.

## **PART 6 PLUMBING**

### **6.1 PLUMBING GENERAL**

- .1 Bury outside sewer and water piping minimum 8 ft 2.5 m or at the local frost line depth.
- .2 Install vacuum breakers, vents and backflow preventers on plumbing lines as required by code.
- .3 Check invert elevations prior to sanitary and drainage connections.
- .4 Grade drainage lines 1% per foot, unless noted otherwise.

### **6.2 PLUMBING FIXTURES**

- .1 Water Closet Type (WC-1)
  - .1 Bowl: Elongated bowl, Wall hung and provided with carrier, vitreous china, colour selected by Architect, Static load rating in excess of 750 lbs. close-coupled closet combination with regular rim, and china bolt caps, Bowl shall be ADA compliant and mounted 18"457 mm high. Sloan Model ST-2469 or approved equal.
  - .2 Seat: Solid plastic, same colour as fixture, with open front, top mounted hinge with built-in check. Bemis – 1955CT or approved equal.
  - .3 Flush Valve: Exposed chrome plated, diaphragm type, with hardwired powered hands free operation, escutcheon, integral screw driver stop and vacuum breaker with mechanical override. Provide with UL listed 24V step down transformer from same manufacturer. Sloan Royal Optima 152-1.28 ESS TMO GJ L/Stop or approved equal
- .2 Lavatories
  - .1 Lavatory Type (LAV-1): Handicapped Self-rimming countertop, porcelain on steel, colour selected by Architect, single faucet for tempered water, overflow, seal of sealant or concealed vinyl gasket. Single station Integrated Sink system complete with Faucet and soap dispenser. All trim shall be offset to allow handicapped access, Sloan AER-DEC AD-81000 or approved equal.
  - .2 Lavatory Type (LAV-2): Handicapped Self-rimming countertop, porcelain on steel, colour selected by Architect, stations on 31" 785 mm centres, overflow, seal of sealant or concealed vinyl gasket. Two (2) station Integrated Sink system complete with Faucet and soap dispenser. All trim shall be offset to allow handicapped access, Sloan AER-DEC AD-82000 or approved equal.
  - .3 Lavatory Type (LAV-3): Floor mount Single compartment Scullery Sink made from 16 gauge 304 Stainless Steel with buffed satin finish. Center Drain placement. To be outfitted with Chicago Faucets 540-LD317ABCP Wall mounted Faucet with 8" swing arm.

- .4 Faucet: Chrome plated, cast brass combination supply fitting with indirect lift waste aerator, hard wired hands free operation.
- .3 Urinal
  - .1 Urinal (UR-1): Vitreous china, wash out, wall hung urinal with flushing rim, extended shields, integral trap, wandel resistant stainless steel strainer, 3/4"20 mm top spud, and steel support hangers. Slaon SU-7009 or approved equal.
  - .2 Flush Valve: Concealed sensor activated, diaphragm type, with hardwired powered hands free operation with true mechanical override, escutcheon, integral screw driver stop and vacuum breaker. Sloan Optima Plus Model 195-0.5 2-10 ¾ LDIM ESS TMO or approved equal.
- .4 Stainless Steel Sinks (SK-1)
  - .1 Outdoor dish sink shall be Elkay Rigidbilt Stainless Steel Scullery sink complete with materials as required to affix sink to exterior wall Sink is floor mounted.
  - .2 Outdoor dish sink faucets shall be wall mounted, manual faucets with 8" swing spout and vandal-resistant flow control aerator. Chicago Faucets 540-LD317ABCP or approved equal.
- .5 Showers (SH-1)
  - .1 Shower trim shall be push button with limiter valve and integral stop. All publicly assessable components shall be vandal resistant. Sloan MCR-224 or approved equal.
- .6 Hot Water Heater
  - .1 Provide and install new condensing modulating hot water heater to be A.O.Smith Cyclone Mxi BTH-250 or approved equal. 100 gallon storage capacity, powered direct exhaust, with remote monitoring and submerged combustion chamber with heat exchanger coil. Unit shall be equipped with powered non-sacrificial anodes. Unit shall be UL listed with CSA certified relief valve. 250,000 BTU/hr Input compatible with Propane gas and a recovery rate of a minimum 1835 LPH with 33 degree C temperature rise. Unit will be installed with an expansion tank to maintain warranty
  - .2 Heaters to be set to heat incoming domestic cold water to 140°F.
- .7 Floor Drains
  - .1 Floor drains shall have lacquered cast iron body with double drainage flange, weep holes, combined two piece body reversible clamping device and adjustable nickel-bronze strainer. Wade 1103-STD-6", shower and washroom floor drains shall have a removable perforated sediment bucket.
  - .2 Floor drains in equipment rooms shall have polished bronze funnel type strainer.
- .8 Expansion Tank
  - .1 Expansion tank shall be rated for maximum line pressure and sized to accommodate the thermal expansion of the system. Prior to activation of the system precharge the expansion tank to expected system pressure. Amtrol Therm-X-Trol ST-5or approved equal.

**END OF SECTION**

## **PART 1 GENERAL**

### **1.1 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.
- .3 Shop Drawings:
  - .1 Submit drawings stamped and signed by professional engineer registered or licensed in British Columbia, Canada.
  - .2 Indicate on drawings:
    - .1 Mounting arrangements.
    - .2 Operating and maintenance clearances.
  - .3 Shop drawings and product data accompanied by:
    - .1 Detailed drawings of bases, supports, and anchor bolts.
    - .2 Acoustical sound power data, where applicable.
    - .3 Points of operation on performance curves.
    - .4 Manufacturer to certify current model production.
    - .5 Certification of compliance to applicable codes.
  - .4 In addition to transmittal letter referred to in Section 01 33 00- Submittal Procedures: use MCAC "Shop Drawing Submittal Title Sheet". Identify section and paragraph number.
- .4 Sustainable Design Submittals:
  - .1 Construction Waste Management:
    - .1 Submit project Waste Reduction Workplan 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.
  - .2 Building Energy and Water Consumption: for monitoring end-uses as follows:
    - .1 Lighting systems and controls.
    - .2 Constant and variable motor loads.
    - .3 Air distribution static pressures and ventilation air volumes.
    - .4 Indoor water systems.
  - .3 Recycled Content:
    - .1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of post-consumer content, and total cost of materials for project.

### **1.2 CLOSEOUT SUBMITTALS**

- .1 Submit in accordance with Section 01 78 00- Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data,
  - .1 Operation and maintenance manual approved by, and final copies deposited with, Departmental Representative before final inspection.
  - .2 Operation data to include:
    - .1 Description of systems and their controls.
    - .2 Operation instruction for systems and component.
    - .3 Description of actions to be taken in event of equipment failure.

- .4 Valves schedule and flow diagram.
- .5 Colour coding chart.
- .3 Maintenance data to include:
  - .1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.
  - .2 Data to include schedules of tasks, frequency, tools required and task time.
- .4 Performance data to include:
  - .1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.
  - .2 Equipment performance verification test results.
  - .3 Testing, adjusting and balancing reports as specified in Section 23 05 93- Testing, Adjusting and Balancing for HVAC.
- .5 Approvals:
  - .1 Submit 2 copies of draft Operation and Maintenance Manual to Departmental Representative for approval. Submission of individual data will not be accepted unless directed by Departmental Representative.
  - .2 Make changes as required and re-submit as directed by Departmental Representative.
- .6 Additional data:
  - .1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.
- .7 Site records:
  - .1 Departmental Representative will provide 1 set of reproducible mechanical drawings. Provide sets of prints as required for each phase of work. Mark changes as work progresses and as changes occur.
  - .2 Transfer information to reproducibles, revising reproducibles to show work as actually installed.
  - .3 Use different colour waterproof ink for each service.
  - .4 Make available for reference purposes and inspection.
- .8 As-built drawings:
  - .1 Prior to start of Testing, Adjusting and Balancing for HVAC, finalize production of as-built drawings.
  - .2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).
  - .3 Submit to Departmental Representative for approval and make corrections as directed.
  - .4 Perform testing, adjusting and balancing for HVAC using as-built drawings.
  - .5 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.
- .9 Submit copies of as-built drawings for inclusion in final TAB report.

### **1.3 MAINTENANCE MATERIAL SUBMITTALS**

- .1 Submit in accordance with Section 01 78 00- Closeout Submittals.
- .2 Furnish spare parts as follows:

- .1 One set of packing for each pump.
- .2 One casing joint gasket for each size pump.
- .3 One filter cartridge or set of filter media for each filter or filter bank in addition to final operating set.
- .3 Provide one set of special tools required to service equipment as recommended by manufacturers.
- .4 Furnish one commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings.

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

- .1 Deliver, store and handle materials in accordance with Section 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 and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Replace defective or damaged materials with new.

### **PART 2 PRODUCTS**

#### **2.1 MATERIALS**

### **PART 3 EXECUTION**

#### **3.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable.
  - .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 PAINTING REPAIRS AND RESTORATION**

- .1 Do painting in accordance with Section 09 91 23- Interior Painting.
- .2 Prime and touch up marred finished paintwork to match original.
- .3 Restore to new condition, finishes which have been damaged.

#### **3.3 SYSTEM CLEANING**

- .1 Clean interior and exterior of all systems including strainers. Vacuum interior of ductwork and air handling units.

#### **3.4 FIELD QUALITY CONTROL**

- .1 Site Tests: conduct following tests in accordance with Section 01 45 00- Quality Control and submit report as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.

- .2 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 - ACTION AND INFORMATIONAL 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.

### **3.5 DEMONSTRATION**

- .1 Departmental Representative will use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.
- .2 Trial usage to apply to following equipment and systems:
  - .1 Furnace
  - .2 Water Heater
  - .3 Recirculation Pump
  - .4 All Plumbing Fixtures (Showers, Lavatories, Sinks, Urinals, and Water Closets)
- .3 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.
- .4 Use operation and maintenance manual, as-built drawings, and audio visual aids as part of instruction materials.
- .5 Instruction duration time requirements as specified in appropriate sections.
- .6 Departmental Representative may record these demonstrations on for future reference.

### **3.6 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 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**

- .1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

**END OF SECTION**

**PART 1 GENERAL**

**1.1 REFERENCE STANDARDS**

- .1 ASTM International
  - .1 ASTM A125 (Latest Version), Standard Specification for Steel Springs, Helical, Heat-Treated.
  - .2 ASTM A307 (Latest Version), Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
  - .3 ASTM A563 (Latest Version), Standard Specification for Carbon and Alloy Steel Nuts.
- .2 Factory Mutual (FM)
- .3 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)
  - .1 MSS SP58 (Latest Version), Pipe Hangers and Supports - Materials, Design and Manufacture.
  - .2 MSS SP69 (Latest Version), Pipe Hangers and Supports - Selection and Application.
  - .3 MSS SP89 (Latest Version), Pipe Hangers and Supports - Fabrication and Installation Practices.
- .4 National Research Council Canada (NRC)
  - .1 National Plumbing Code of Canada 2015 (NPC).
- .5 Underwriter's Laboratories of Canada (ULC)

**1.2 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00- Submittal Procedures.
- .2 Product Data:
  - .1 Provide manufacturer's printed product literature and data sheets for hangers and supports and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
  - .1 Submit drawings stamped and signed by professional engineer registered or licensed in British Columbia, Canada.
  - .2 Submit shop drawings for:
    - .1 Bases, hangers and supports.
    - .2 Connections to equipment and structure.
    - .3 Structural assemblies.
- .4 Certificates:
  - .1 Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .5 Manufacturers' Instructions:
  - .1 Provide manufacturer's installation instructions.
    - .1 Departmental Representative will make available 1 copy of systems supplier's installation instructions.

**1.3 CLOSEOUT SUBMITTALS**

- .1 Provide maintenance data for incorporation into manual specified in Section 01 78 00- Closeout Submittals.



#### **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:
  - .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .3 Packaging Waste Management: in accordance with Section 01 74 21- Construction/Demolition Waste Management and Disposal.

### **PART 2 PRODUCTS**

#### **2.1 SYSTEM DESCRIPTION**

- .1 Design Requirements:
  - .1 Construct pipe hanger and support to manufacturer's recommendations utilizing manufacturer's regular production components, parts and assemblies.
  - .2 Base maximum load ratings on allowable stresses prescribed by ASME B31.1 or MSS SP58.
  - .3 Ensure that supports, guides, anchors do not transmit excessive quantities of heat to building structure.
  - .4 Design hangers and supports to support systems under conditions of operation, allow free expansion and contraction, prevent excessive stresses from being introduced into pipework or connected equipment.
  - .5 Provide for vertical adjustments after erection and during commissioning. Amount of adjustment in accordance with MSS SP58.
- .2 Performance Requirements:
  - .1 Design supports, platforms, catwalks, hangers to withstand seismic events as specified.

#### **2.2 SUSTAINABLE REQUIREMENTS**

- .1 Materials and products in accordance with Section 01 47 15- Sustainable Requirements: Construction.

#### **2.3 GENERAL**

- .1 Fabricate hangers, supports and sway braces in accordance with MSS SP58. ANSI B31.1 and
- .2 Use components for intended design purpose only. Do not use for rigging or erection purposes.

#### **2.4 PIPE HANGERS**

- .1 Finishes:
  - .1 Pipe hangers and supports: galvanized after manufacture.
  - .2 Use hot dipped galvanizing process or electro-plating galvanizing process.
  - .3 Ensure steel hangers in contact with copper piping are epoxy coated.
- .2 Upper attachment structural: suspension from lower flange of I-Beam:
  - .1 Cold piping NPS 2 maximum: malleable iron C-clamp with hardened steel cup point setscrew, locknut.
    - .1 Rod: 9 mm UL listed.

- .2 Cold piping NPS 2 1/2 or greater, hot piping: malleable iron beam clamp, eye rod, jaws and extension with carbon steel retaining clip, tie rod, nuts and washers, UL listed.
- .3 Upper attachment structural: suspension from upper flange of I-Beam:
  - .1 Cold piping NPS 2 maximum: ductile iron top-of-beam C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip, UL listed.
  - .2 Cold piping NPS 2 1/2 or greater, hot piping: malleable iron top-of-beam jaw-clamp with hooked rod, spring washer, plain washer and nut UL listed.
- .4 Upper attachment to concrete:
  - .1 Ceiling: carbon steel welded eye rod, clevis plate, clevis pin and cotters with weldless forged steel eye nut. Ensure eye 6mm minimum greater than rod diameter.
  - .2 Concrete inserts: wedge shaped body with knockout protector plate UL listed.
- .5 Hanger rods: threaded rod material to MSS SP58:
  - .1 Ensure that hanger rods are subject to tensile loading only.
  - .2 Provide linkages where lateral or axial movement of pipework is anticipated.
  - .3 Do not use 28mm rod.
- .6 Pipe attachments: material to MSS SP58:
  - .1 Attachments for steel piping: carbon steel galvanized.
  - .2 Attachments for copper piping: copper plated black steel.
  - .3 Use insulation shields for hot pipework.
  - .4 Oversize pipe hangers and supports.
- .7 Adjustable clevis: material to MSS SP69 UL listed, clevis bolt with nipple spacer and vertical adjustment nuts above and below clevis.
  - .1 Ensure "U" has hole in bottom for rivetting to insulation shields.
- .8 Yoke style pipe roll: carbon steel yoke, rod and nuts with cast iron roll, to MSS SP69.
- .9 U-bolts: carbon steel to MSS SP69 with 2 nuts at each end to ASTM A563.
  - .1 Finishes for steel pipework: galvanized].
  - .2 Finishes for copper, glass, brass or aluminum pipework: galvanized , with formed portion plastic coated.
- .10 Pipe rollers: cast iron roll and roll stand with carbon steel rod to MSS SP69.

## **2.5 RISER CLAMPS**

- .1 Steel or cast iron pipe:galvanized carbon steel to MSS SP58, type 42, UL listed.
- .2 Copper pipe: carbon steel copper plated to MSS SP58, type 42.
- .3 Bolts: to ASTM A307.
- .4 Nuts: to ASTM A563.

## **2.6 INSULATION PROTECTION SHIELDS**

- .1 Insulated cold piping:
  - .1 64 kg/m3density insulation plus insulation protection shield to: MSS SP69, galvanized sheet carbon steel. Length designed for maximum 3 m span.
- .2 Insulated hot piping:
  - .1 Curved plate 300 mm long, with edges turned up, welded-in centre plate for pipe sizes NPS 12 and over, carbon steel to comply with MSS SP69.

## **2.7 CONSTANT SUPPORT SPRING HANGERS**

- .1 Springs: alloy steel to ASTM A125, shot peened, magnetic particle inspected, with +/-5% spring rate tolerance, tested for free height, spring rate, loaded height and provided with Certified Mill Test Report (CMTR).
- .2 Load adjustability: 10% minimum adjustability each side of calibrated load. Adjustment without special tools. Adjustments not to affect travel capabilities.
- .3 Provide upper and lower factory set travel stops.
- .4 Provide load adjustment scale for field adjustments.
- .5 Total travel to be actual travel + 20%. Difference between total travel and actual travel 25 mm minimum.
- .6 Individually calibrated scales on each side of support calibrated prior to shipment, complete with calibration record.

## **2.8 VARIABLE SUPPORT SPRING HANGERS**

- .1 Vertical movement: 13 mm minimum, 50 mm maximum, use single spring pre-compressed variable spring hangers.
- .2 Variable spring hanger complete with factory calibrated travel stops
- .3 Steel alloy springs: to ASTM A125, shot peened, magnetic particle inspected, with +/-5 % spring rate tolerance, tested for free height, spring rate, loaded height and provided with CMTR.

## **2.9 EQUIPMENT SUPPORTS**

- .1 Fabricate equipment supports not provided by equipment manufacturer from structural grade steel meeting requirements of Section 05 12 23- Structural Steel for Buildings. Submit calculations with shop drawings.

## **2.10 EQUIPMENT ANCHOR BOLTS AND TEMPLATES**

- .1 Provide templates to ensure accurate location of anchor bolts.

## **2.11 HOUSE-KEEPING PADS**

- .1 Provide 100 mm high concrete housekeeping pads for base-mounted equipment; size pads 50mm larger than equipment; chamfer pad edges.
- .2 Concrete: to Section 03 30 00- Cast-in-Place Concrete.

## **2.12 OTHER EQUIPMENT SUPPORTS**

- .1 Fabricate equipment supports from structural grade steel meeting requirements of Section 05 12 23- Structural Steel for Buildings.
- .2 Submit structural calculations with shop drawings.

# **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 datasheet.

### 3.2 INSTALLATION

- .1 Install in accordance with:
  - .1 Manufacturer's instructions and recommendations.
- .2 Vibration Control Devices:
  - .1 Install on piping systems at pumps, boilers, chillers, cooling towers, and as indicated.
- .3 Clamps on riser piping:
  - .1 Support independent of connected horizontal pipework using riser clamps and riser clamp lugs welded to riser.
  - .2 Bolt-tightening torques to industry standards.
  - .3 Steel pipes: install below coupling or shear lugs welded to pipe.
  - .4 Cast iron pipes: install below joint.
- .4 Clevis plates:
  - .1 Attach to concrete with 4 minimum concrete inserts, one at each corner.
- .5 Provide supplementary structural steelwork where structural bearings do not exist or where concrete inserts are not in correct locations.
- .6 Use approved constant support type hangers where:
  - .1 Vertical movement of pipework is 13 mm or more,
  - .2 Transfer of load to adjacent hangers or connected equipment is not permitted.
- .7 Use variable support spring hangers where:
  - .1 Transfer of load to adjacent piping or to connected equipment is not critical.
  - .2 Variation in supporting effect does not exceed 25 % of total load.

### 3.3 HANGER SPACING

- .1 Plumbing piping: to National Plumbing Code of Canada (NPC).
- .2 Fire protection: to applicable fire code.
- .3 Gas and fuel oil piping: up to NPS 1/2: every 1.8 m.
- .4 Copper piping: up to NPS 1/2: every 1.5 m.
- .5 Flexible joint roll groove pipe: in accordance with table below for steel, but not less than one hanger at joints. Table listings for straight runs without concentrated loads and where full linear movement is not required.
- .6 Within 300mm of each elbow.

Maximum Pipe Size : NPS	Maximum Spacing Steel	Maximum Spacing Copper
up to 1-1/4	2.4 m	1.8 m
1-1/2	3.0 m	2.4 m
2	3.0 m	2.4 m
2-1/2	3.7 m	3.0 m
3	3.7 m	3.0 m
3-1/2	3.7 m	3.3 m
4	3.7 m	3.6 m

- .7 Pipework greater than NPS 12: to MSS SP69.

### 3.4 HANGER INSTALLATION

- .1 Install hanger so that rod is vertical under operating conditions.
- .2 Adjust hangers to equalize load.

- .3 Support from structural members. Where structural bearing does not exist or inserts are not in suitable locations, provide supplementary structural steel members.

### **3.5 HORIZONTAL MOVEMENT**

- .1 Angularity of rod hanger resulting from horizontal movement of pipework from cold to hot position not to exceed 4 degrees from vertical.
- .2 Where horizontal pipe movement is less than 13 mm, offset pipe hanger and support so that rod hanger is vertical in the hot position.

### **3.6 FINAL ADJUSTMENT**

- .1 Adjust hangers and supports:
  - .1 Ensure that rod is vertical under operating conditions.
  - .2 Equalize loads.
- .2 Adjustable clevis:
  - .1 Tighten hanger load nut securely to ensure proper hanger performance.
  - .2 Tighten upper nut after adjustment.
- .3 C-clamps:
  - .1 Follow manufacturer's recommended written instructions and torque values when tightening C-clamps to bottom flange of beam.
- .4 Beam clamps:
  - .1 Hammer jaw firmly against underside of beam.

### **3.7 FIELD QUALITY CONTROL**

- .1 Site Tests: conduct following tests in accordance with Section 01 45 00- Quality Control and submit report as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
- .2 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 - ACTION AND INFORMATIONAL 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 Verification requirements in accordance with Section 01 47 17- Sustainable Requirements: Contractor's Verification, include:
  - .1 Materials and resources.
  - .2 Storage and collection of recyclables.
  - .3 Construction waste management.
  - .4 Resource reuse.
  - .5 Recycled content.
  - .6 Local/regional materials.
  - .7 Certified wood.
  - .8 Low-emitting materials.

**3.8 CLEANING**

- .1 Clean in accordance with Section 01 74 11- Cleaning.
  - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.
- .2 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21- Construction/Demolition Waste Management and Disposal.

**END OF SECTION**

## **PART 1 GENERAL**

### **1.1 SUMMARY**

- .1 Section Includes:
  - .1 Heat tracing cables for pipes and tanks including controls and installation.

### **1.2 REFERENCE STANDARDS**

- .1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).

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

- .1 Product Data:
  - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00- Submittal Procedures. Include product characteristics, performance criteria, and limitations.
    - .1 Submit two (2) copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00- Submittal Procedures as required.
- .2 Quality assurance submittals: submit following in accordance with Section 01 33 00- Submittal Procedures.
  - .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .3 Instructions: submit manufacturer's installation instructions.
  - .1 Departmental Representative will make available one (1) digital copy of systems supplier's installation instructions.

### **1.4 QUALITY ASSURANCE**

- .1 Health and Safety:
  - .1 Do construction occupational health and safety in accordance with Section 01 35 29.06- Health and Safety Requirements.

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

- .1 Packing, shipping, handling and unloading:
  - .1 Deliver, store and handle in accordance with manufacturer's written instructions and Section 01 61 00- Common Product Requirements.
- .2 Waste Management and Disposal:
  - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for recycling in accordance with Section 01 74 21- Construction/Demolition Waste Management and Disposal.

## **PART 2 PRODUCTS**

### **2.1 PIPE TRACING HEATING CABLES**

- .1 Type B: copper alloy conductor with X-link polyethylene insulation copper ground braid, pvc protective jacket, cold leads factory spliced and as required. Heating capacity: 6 W/ft

## **2.2 CONTROLS**

- .1 Thermostat: remote bulb type, Rated for indoor use and outdoor design temperatures of the region.

## **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 datasheet.

### **3.2 INSTALLATION**

- .1 Install heating cables in accordance with manufacturer's instructions. Co-ordinate installation with pipe insulation application.

### **3.3 FIELD QUALITY CONTROL**

- .1 Tests:
  - .1 Perform tests in accordance with Section 26 05 00- Common Work Results for Electrical.
- .2 Use 500 V Megger to test cables for continuity and insulation value and record readings before, during and after installation.
- .3 Where resistance of 50 megohms or less is measured, stop work and advise Departmental Representative.

### **3.4 CLEANING**

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

**END OF SECTION**



## **PART 1 GENERAL**

### **1.1 SUMMARY**

- .1 TAB is used throughout this Section to describe the process, methods and requirements of testing, adjusting and balancing for HVAC.
- .2 TAB means to test, adjust and balance to perform in accordance with requirements of Contract Documents and to do other work as specified in this section.

### **1.2 QUALIFICATIONS OF TAB PERSONNEL**

- .1 Submit names of personnel to perform TAB to Departmental Representative within 90 days of award of contract.
- .2 Provide documentation confirming qualifications, successful experience.
- .3 TAB: performed in accordance with the requirements of standard under which TAB Firm's qualifications are approved:
  - .1 Associated Air Balance Council, (AABC) National Standards for Total System Balance, MN-1-2002.
  - .2 National Environmental Balancing Bureau (NEBB) TABES, Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems-1998.
  - .3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA), HVAC TAB HVAC Systems - Testing, Adjusting and Balancing-2002.
- .4 Recommendations and suggested practices contained in the TAB Standard: mandatory.
- .5 Use TAB Standard provisions, including checklists, and report forms to satisfy Contract requirements.
- .6 Use TAB Standard for TAB, including qualifications for TAB Firm and Specialist and calibration of TAB instruments.
- .7 Where instrument manufacturer calibration recommendations are more stringent than those listed in TAB Standard, use manufacturer's recommendations.
- .8 TAB Standard quality assurance provisions such as performance guarantees form part of this contract.
  - .1 For systems or system components not covered in TAB Standard, use TAB procedures developed by TAB Specialist.
  - .2 Where new procedures, and requirements, are applicable to Contract requirements have been published or adopted by body responsible for TAB Standard used (AABC, NEBB, or TABB), requirements and recommendations contained in these procedures and requirements are mandatory.

### **1.3 PURPOSE OF TAB**

- .1 Test to verify proper and safe operation, determine actual point of performance, evaluate qualitative and quantitative performance of equipment, systems and controls at design, average and low loads using actual or simulated loads
- .2 Adjust and regulate equipment and systems to meet specified performance requirements and to achieve specified interaction with other related systems under normal and emergency loads and operating conditions.
- .3 Balance systems and equipment to regulate flow rates to match load requirements over full operating ranges.

### **1.4 EXCEPTIONS**

- .1 TAB of systems and equipment regulated by codes, standards to satisfaction of authority having jurisdiction.

## **1.5 CO-ORDINATION**

- .1 Schedule time required for TAB (including repairs, re-testing) into project construction and completion schedule to ensure completion before acceptance of project.
- .2 Do TAB of each system independently and subsequently, where interlocked with other systems, in unison with those systems.

## **1.6 PRE-TAB REVIEW**

- .1 Review Contract Documents before project construction is started confirm in writing to Departmental Representative adequacy of provisions for TAB and other aspects of design and installation pertinent to success of TAB.
- .2 Review specified standards and report to Departmental Representative in writing proposed procedures which vary from standard.
- .3 During construction, co-ordinate location and installation of TAB devices, equipment, accessories, measurement ports and fittings.

## **1.7 START-UP**

- .1 Follow start-up procedures as recommended by equipment manufacturer unless specified otherwise.
- .2 Follow special start-up procedures specified elsewhere in Division 23.

## **1.8 OPERATION OF SYSTEMS DURING TAB**

- .1 Operate systems for length of time required for TAB and as required by Consultant for verification of TAB reports.

## **1.9 START OF TAB**

- .1 Notify 7 Consultant days prior to start of TAB.
- .2 Start TAB when building is essentially completed, including:
- .3 Installation of ceilings, doors, windows, other construction affecting TAB.
- .4 Application of weatherstripping, sealing, and caulking.
- .5 Pressure, leakage, other tests specified elsewhere Division 23.
- .6 Provisions for TAB installed and operational.
- .7 Start-up, verification for proper, normal and safe operation of mechanical and associated electrical and control systems affecting TAB including but not limited to:
  - .1 Proper thermal overload protection in place for electrical equipment.
  - .2 Air systems:
    - .1 Filters in place, clean.
    - .2 Duct systems clean.
    - .3 Ducts, air shafts, ceiling plenums are airtight to within specified tolerances.
    - .4 Correct fan rotation.
    - .5 Fire, smoke, volume control dampers installed and open.
    - .6 Coil fins combed, clean.
    - .7 Access doors, installed, closed.
    - .8 Outlets installed, volume control dampers open.
  - .3 Liquid systems:
    - .1 Flushed, filled, vented.
    - .2 Correct pump rotation.

- .3 Strainers in place, baskets clean.
- .4 Isolating and balancing valves installed, open.
- .5 Calibrated balancing valves installed, at factory settings.
- .6 Chemical treatment systems complete, operational.

#### **1.10 APPLICATION TOLERANCES**

- .1 Do TAB to following tolerances of design values:
  - .1 HVAC systems: plus 10%, minus 10%.

#### **1.11 ACCURACY TOLERANCES**

- .1 Measured values accurate to within plus or minus 2% of actual values.

#### **1.12 INSTRUMENTS**

- .1 Prior to TAB, submit to Departmental Representative list of instruments used together with serial numbers.
- .2 Calibrate in accordance with requirements of most stringent of referenced standard for either applicable system or HVAC system.
- .3 Calibrate within 3 months of TAB. Provide certificate of calibration to Departmental Representative.

#### **1.13 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit, prior to commencement of TAB:
- .2 Proposed methodology and procedures for performing TAB if different from referenced standard.

#### **1.14 PRELIMINARY TAB REPORT**

- .1 Submit for checking and approval of Consultant, prior to submission of formal TAB report, sample of rough TAB sheets. Include:
  - .1 Details of instruments used.
  - .2 Details of TAB procedures employed.
  - .3 Calculations procedures.
  - .4 Summaries.

#### **1.15 TAB REPORT**

- .1 Format in accordance with [referenced standard].
- .2 TAB report to show results in SI units and to include:
  - .1 Project record drawings.
  - .2 System schematics.
- .3 Submit 2 copies of TAB Report to Departmental Representative for verification and approval, in English in D-ring binders, complete with index tabs.

#### **1.16 VERIFICATION**

- .1 Reported results subject to verification by Departmental Representative.
- .2 Provide personnel and instrumentation to verify up to 30% of reported results.
- .3 Number and location of verified results as directed by Departmental Representative.
- .4 Pay costs to repeat TAB as required to satisfaction of Departmental Representative.

#### **1.17            SETTINGS**

- .1      After TAB is completed to satisfaction of Departmental Representative, replace drive guards, close access doors, lock devices in set positions, ensure sensors are at required settings.
- .2      Permanently mark settings to allow restoration at any time during life of facility. Do not eradicate or cover markings.

#### **1.18            COMPLETION OF TAB**

- .1      TAB considered complete when final TAB Report received and approved by Departmental Representative.

#### **1.19            AIR SYSTEMS**

- .1      Standard: TAB to most stringent of TAB standards of NEBB or ASHRAE.
- .2      Do TAB of following systems, equipment, components, controls:
  - .1          Ventilation System
  - .2          Domestic Water Systems
- .3      Qualifications: personnel performing TAB current member in good standing of NEBB.
- .4      Quality assurance: perform TAB under direction of supervisor qualified NEBB to standards of AABC.
- .5      Measurements: to include as appropriate for systems, equipment, components, controls: air velocity, static pressure, flow rate, pressure drop (or loss), temperatures (dry bulb, wet bulb, dewpoint), duct cross-sectional area, RPM, electrical power, voltage, noise, vibration.
- .6      Locations of equipment measurements: to include as appropriate:
  - .1          Inlet and outlet of dampers, filter, coil, humidifier, fan, other equipment causing changes in conditions.
  - .2          At controllers, controlled device.
- .7      Locations of systems measurements to include as appropriate: main ducts, main branch, sub-branch, run-out (or grille, register or diffuser).

#### **1.20            OTHER TAB REQUIREMENTS**

- .1      General requirements applicable to work specified this paragraph:
  - .1          Qualifications of TAB personnel: as for air systems specified this section.
  - .2          Quality assurance: as for air systems specified this section.
- .2      Building pressure conditions:
  - .1          Adjust HVAC systems, equipment, controls to ensure specified pressure conditions during design conditions.
- .3      Zone pressure differences:
  - .1          Adjust HVAC systems, equipment, controls to establish specified air pressure differentials, with systems in every possible combinations of normal operating modes.

#### **1.21            POST-OCCUPANCY TAB**

- .1      Measure air flow patterns, air velocity, WBT (or %RH), in occupied zone of following areas: Shower Areas, Washrooms, and Corridor,
- .2      Participate in systems checks twice during Warranty Period - #1 approximately 3months after acceptance and #2 within 1month of termination of Warranty Period.

**PART 2        PRODUCTS**

**2.1            NOT USED**

.1        Not used.

**PART 3        EXECUTION**

**3.1            NOT USED**

.1        Not used.

**END OF SECTION**

## **PART 1        GENERAL**

### **1.1        REFERENCE STANDARDS**

- .1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
  - .1 ANSI/ASHRAE/IESNA 90.1-2011, SI; Energy Standard for Buildings Except Low-Rise Residential Buildings.
- .2 ASTM International Inc.
  - .1 ASTM B209M-07, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric).
  - .2 ASTM C335-05ae1, Standard Test Method for Steady State Heat Transfer Properties of Pipe Insulation.
  - .3 ASTM C411-05, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
  - .4 ASTM C449/C449M-00, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.
  - .5 ASTM C547-07e1, Standard Specification for Mineral Fiber Pipe Insulation.
  - .6 ASTM C553-02e1, Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
  - .7 ASTM C612-04e1, Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
  - .8 ASTM C795-03, Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
  - .9 ASTM C921-03a, Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
- .3 Canadian General Standards Board (CGSB)
  - .1 CGSB 51-GP-52Ma-89, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.
- .4 Green Seal Environmental Standards (GSES)
  - .1 Standard GS-36-00, Commercial Adhesives.
- .5 South Coast Air Quality Management District (SCAQMD), California State
  - .1 SCAQMD Rule 1168-A2005, Adhesive and Sealant Applications.
- .6 Thermal Insulation Association of Canada (TIAC): National Insulation Standards (2005).
- .7 Underwriters Laboratories of Canada (ULC)
  - .1 CAN/ULC-S102-03, Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
  - .2 CAN/ULC-S701-05, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.

### **1.2        DEFINITIONS**

- .1 For purposes of this section:
  - .1 "CONCEALED" - insulated mechanical services and equipment in suspended ceilings and non-accessible chases and furred-in spaces.
  - .2 "EXPOSED" - means "not concealed" as previously defined.
  - .3 Insulation systems - insulation material, fasteners, jackets, and other accessories.
- .2 TIAC Codes:
  - .1 CRD: Code Round Ductwork,

- .2 CRF: Code Rectangular Finish.

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

- .1 Provide submittals in accordance with Section 01 33 00- Submittal Procedures.
- .2 Product Data:
  - .1 Provide manufacturer's printed product literature and datasheets for duct insulation, and include product characteristics, performance criteria, physical size, finish and limitations.
    - .1 Description of equipment giving manufacturer's name, type, model, year and capacity.
    - .2 Details of operation, servicing and maintenance.
    - .3 Recommended spare parts list.
- .3 Shop Drawings:
  - .1 Submit drawings stamped and signed by professional engineer registered or licensed in British Columbia, Canada.
- .4 Samples:
  - .1 Submit for approval: complete assembly of each type of insulation system, insulation, coating, and adhesive proposed.
  - .2 Mount sample on 12 mm plywood board.
  - .3 Affix typewritten label beneath sample indicating service.
- .5 Manufacturers' Instructions:
  - .1 Provide manufacture's written duct insulation jointing recommendations. and special handling criteria, installation sequence, cleaning procedures.

### **1.4 QUALITY ASSURANCE**

- .1 Qualifications:
  - .1 Installer: specialist in performing work of this section, and have at least 3 years successful experience in this size and type of project.

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

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

## **PART 2 PRODUCTS**

### **2.1 FIRE AND SMOKE RATING**

- .1 To CAN/ULC-S102:
  - .1 Maximum flame spread rating: 25.
  - .2 Maximum smoke developed rating: 50.

### **2.2 INSULATION**

- .1 Mineral fibre: as specified includes glass fibre, rock wool, slag wool.

- .2 Thermal conductivity ("k" factor) not to exceed specified values at 24 degrees C mean temperature when tested in accordance with ASTM C335.
- .3 TIAC Code C-1: Rigid mineral fibre board to ASTM C612, with factory applied vapour retarder jacket to CGSB 51-GP-52Ma (as scheduled in PART 3 of this Section).
- .4 TIAC Code C-2: Mineral fibre blanket to ASTM C553 faced with factory applied vapour retarder jacket to CGSB 51-GP-52Ma (as scheduled in PART 3 of this section).
  - .1 Mineral fibre: to ASTM C553.
  - .2 Jacket: to CGSB 51-GP-52Ma.
  - .3 Maximum "k" factor: to ASTM C553.

## **2.3 JACKETS**

- .1 Canvas:
  - .1 220gm/m<sup>2</sup> cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.
- .2 Lagging adhesive: compatible with insulation.
  - .1 Maximum VOC limit 250g/L.
- .3 Aluminum:
  - .1 To ASTM B209 with moisture barrier as scheduled in PART 3 of this section.
  - .2 Thickness: 0.50mm sheet.
  - .3 Finish: Smooth.
  - .4 Jacket banding and mechanical seals: 12mm wide, 0.5 mm thick stainless steel.
  - .5 Thickness: 0.25mm sheet.
  - .6 Finish: Smooth.
  - .7 Jacket banding and mechanical seals: 12mm wide, 0.5 mm thick stainless steel.

## **2.4 ACCESSORIES**

- .1 Vapour retarder lap adhesive:
  - .1 Water based, fire retardant type, compatible with insulation.
    - .1 Maximum VOC limit 200g/L.
- .2 Indoor Vapour Retarder Finish:
  - .1 Vinyl emulsion type acrylic, compatible with insulation.
- .3 Insulating Cement: setting on mineral wool, to ASTM C449.
- .4 ULC Listed Canvas Jacket:
  - .1 220gm/m<sup>2</sup> cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.
- .5 Outdoor Vapour Retarder Mastic:
  - .1 Vinyl emulsion type acrylic, compatible with insulation.
  - .2 Reinforcing fabric: Fibrous glass, untreated 305 g/m<sup>2</sup>.
- .6 Tape: self-adhesive, aluminum, reinforced, 50mm wide minimum.
- .7 Contact adhesive: quick-setting
  - .1 Maximum VOC limit 250g/L.
- .8 Canvas adhesive: washable.
  - .1 Maximum VOC limit 250g/L.
- .9 Tie wire: 1.5mm stainless steel.
- .10 Banding: 12mm wide, 0.5mm thick stainless steel.



- .11 Facing: 25mm galvanized steel hexagonal wire mesh stitched on one face of insulation].
- .12 Fasteners: 2mm diameter pins with 35mm diameter clips, length to suit thickness of insulation.

## **PART 3 EXECUTION**

### **3.1 APPLICATION**

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

### **3.2 PRE-INSTALLATION REQUIREMENTS**

- .1 Pressure test ductwork systems complete, witness and certify.
- .2 Ensure surfaces are clean, dry, free from foreign material.

### **3.3 INSTALLATION**

- .1 Install in accordance with TIAC National Standards.
- .2 Apply materials in accordance with manufacturers instructions and as indicated.
- .3 Use 2 layers with staggered joints when required nominal thickness exceeds 75 mm.
- .4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
  - .1 Ensure hangers, and supports are outside vapour retarder jacket.
- .5 Hangers and supports in accordance with Section 23 05 29- Hangers and Supports for HVAC Piping and Equipment.
  - .1 Apply high compressive strength insulation where insulation may be compressed by weight of ductwork.
- .6 Fasteners: install at 300 mm on centre in horizontal and vertical directions, minimum 2 rows each side.

### **3.4 DUCTWORK INSULATION SCHEDULE**

- .1 Insulation types and thicknesses: conform to following table:

<b>Ductwork</b>	<b>TIAC Code</b>	<b>Vapour Retarder</b>	<b>Thickness mm</b>
Rectangular cold and dual temperature supply air ducts	C-1	yes	50
Round cold and dual temperature supply air ducts	C-2	Yes	50
Rectangular warm air ducts	C-1	no	25
Round warm air ducts	C-1	no	25
Supply, return and exhaust ducts exposed in space being served	none		
Outside air ducts to mixing plenum	C-1	yes	25

### **3.5 CLEANING**

- .1 Clean in accordance with Section 01 74 11- Cleaning.
  - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.
- .2 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21- Construction/Demolition Waste Management and Disposal.

**END OF SECTION**

## **PART 1 GENERAL**

### **1.1 REFERENCE STANDARDS**

- .1 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)
- .2 ASTM International
  - .1 ASTM A480/A480M-12, Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.
  - .2 ASTM A635/A635M-09b, Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Hot-Rolled, Alloy, Carbon, Structural, High-Strength Low-Alloy, and High-Strength Low-Alloy with Improved Formability, General Requirements for.
  - .3 ASTM A653/A653M-11, Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.
- .3 Green Seal Environmental Standards (GS)
  - .1 GS-36-11, Standard for Adhesives for Commercial Use.
- .4 National Fire Protection Association (NFPA)
  - .1 NFPA 90A-12, Standard for the Installation of Air-Conditioning and Ventilating Systems.
  - .2 NFPA 90B-12, Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.
  - .3 NFPA 96-11, Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.
- .5 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
  - .1 SMACNA HVAC Duct Construction Standards - Metal and Flexible, 2005.
  - .2 SMACNA HVAC Air Duct Leakage Test Manual, 2012.
  - .3 IAQ Guideline for Occupied Buildings Under Construction 2007.

### **1.2 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 metal ducts and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
  - .1 Submit drawings stamped and signed by professional engineer registered or licensed in British Columbia, Canada.
- .4 Test and Evaluation Reports:
  - .1 Certification of Ratings:
    - .1 Catalogue or published ratings to be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.
  - .2 Construction Waste Management:
    - .1 Submit project Waste Reduction Workplan 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 Recycled Content:
  - .1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of post-consumer content, and total cost of materials for project.
- .4 Construction IAQ Management Plan:
  - .1 During construction meet or exceed the requirements of SMACNA IAQ Guideline for Occupied Buildings Under Construction.

### 1.3 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 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 and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect metal ducts from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: remove for reuse in accordance with Section 01 74 21- Construction/Demolition Waste Management and Disposal.

## PART 2 PRODUCTS

### 2.1 SEAL CLASSIFICATION

- .1 Classification as follows:

Maximum Pressure Pa	SMACNA Seal Class
500	C
250	C
125	C

- .2 Seal classification:
  - .1 Class A: longitudinal seams, transverse joints, duct wall penetrations and connections made airtight with sealant and tape.
  - .2 Class B: longitudinal seams, transverse joints and connections made airtight with sealant or tape.
  - .3 Class C: transverse joints and connections made air tight with tape, sealant gaskets or combination thereof. Longitudinal seams unsealed.

### 2.2 SEALANT

- .1 Sustainability Characteristics:
  - .1 Adhesives and sealants: in accordance with Section 07 92 00- Joint Sealants.
  - .2 Adhesives and sealants: VOC limit 250g/L maximum
- .2 Sealant: oil resistant, polymer type flame resistant duct sealant. Temperature range of minus 30 degrees C to plus 93 degrees C.

### 2.3 TAPE

- .1 Tape: polyvinyl treated, open weave fiberglass tape, 50mm wide.

## 2.4 DUCT LEAKAGE

- .1 In accordance with SMACNA HVAC Air Duct Leakage Test Manual.

## 2.5 FITTINGS

- .1 Fabrication: to SMACNA.
- .2 Radiused elbows:
  - .1 Rectangular: standard radius 1.5 times width of duct.
  - .2 Round: smooth radius: 1.5 times diameter.
- .3 Branches:
  - .1 Rectangular main and branch: with radius on branch 1.5 times width of duct.
  - .2 Round main and branch: enter main duct at 45 degrees with conical connection.
  - .3 Provide volume control damper in branch duct near connection to main duct.
  - .4 Main duct branches: with splitter damper.
- .4 Transitions:
  - .1 Diverging: 20 degrees maximum included angle.
  - .2 Converging: 30 degrees maximum included angle.
- .5 Offsets:
  - .1 Full radiused elbows.
- .6 Obstruction deflectors: maintain full cross-sectional area.
  - .1 Maximum included angles: as for transitions.

## 2.6 FIRE STOPPING

- .1 Retaining angles around duct, on both sides of fire separation in accordance with Section 07 84 00- Fire Stopping.
- .2 Fire stopping material and installation must not distort duct.

## 2.7 GALVANIZED STEEL

- .1 Lock forming quality: to ASTM A653/A653M, Z90 zinc coating.
- .2 Thickness, fabrication and reinforcement: to SMACNA.
- .3 Joints: to SMACNA.

### HANGERS AND SUPPORTS

- .4 Hangers and Supports: in accordance with Section 23 05 29- Hangers and Supports for HVAC Piping and Equipment.
  - .1 Strap hangers: of same material as duct but next sheet metal thickness heavier than duct.
    - .1 Maximum size duct supported by strap hanger: 500.
  - .2 Hanger configuration: to SMACNA.
  - .3 Hangers: galvanized steel angle with galvanized steel rods to following table:

Duct Size (mm)	Angle Size (mm)	Rod Size (mm)
up to 750	25 x 25 x 3	6
751 to 1050	40 x 40 x 3	6
1051 to 1500	40 x 40 x 3	10
1501 to 2100	50 x 50 x 3	10
2101 to 2400	50 x 50 x 5	10
2401 and over	50 x 50 x 6	10

- .4 Upper hanger attachments:
  - .1 For concrete: manufactured concrete inserts.
  - .2 For steel joist: manufactured joist clamp.
  - .3 For steel beams: manufactured beam clamps:

## **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 metal duct 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 GENERAL**

- .1 Do work SMACNA in accordance with ASHRAE.
- .2 Do not break continuity of insulation vapour barrier with hangers or rods.
  - .1 Ensure diffuser is fully seated.
- .3 Support risers in accordance with SMACNA.
- .4 Install breakaway joints in ductwork on sides of fire separation.
- .5 Install proprietary manufactured flanged duct joints in accordance with manufacturer's instructions.
- .6 Manufacture duct in lengths and diameter to accommodate installation of acoustic duct lining.

### **3.3 HANGERS**

- .1 Strap hangers: install in accordance with SMACNA.
- .2 Angle hangers: complete with locking nuts and washers.
- .3 Hanger spacing: in accordance with as follows:

Duct Size (mm)	Spacing (mm)
to 1500	3000
1501 and over	2500

### **3.4 WATERTIGHT DUCT**

- .1 Provide watertight duct for:
  - .1 Fresh air intake.
- .2 Form bottom of horizontal duct without longitudinal seams.
  - .1 Solder joints of bottom and side sheets.
  - .2 Seal other joints with duct sealer.
  - .3 Slope header ducts down toward risers.

**3.5 SEALING AND TAPING**

- .1 Apply sealant in accordance with to manufacturer's recommendations.
- .2 Bed tape in sealant and recoat with minimum of 1coat of sealant to manufacturers recommendations.

**3.6 LEAKAGE TESTS**

- .1 In accordance with SMACNA HVAC Duct Leakage Test Manual.
- .2 Do leakage tests in sections.
- .3 Complete test before performance insulation or concealment Work.

**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 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 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.

**END OF SECTION**

**PART 1 GENERAL**

**1.1 REFERENCE STANDARDS**

- .1 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
  - .1 SMACNA - HVAC Duct Construction Standards - Metal and Flexible, 2005.

**1.2 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 air duct accessories and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 Indicate:
    - .1 Flexible connections.
    - .2 Duct access doors.
    - .3 Turning vanes.
    - .4 Instrument test ports.
- .3 Sustainable Design Submittals:
  - .1 Construction Waste Management:
    - .1 Submit project Waste Reduction Workplan 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.
  - .2 Recycled Content:
    - .1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of post-consumer content, and total cost of materials for project.

**1.3 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 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 and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect air duct accessories from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: remove for reuse in accordance with Section 01 74 21- Construction/Demolition Waste Management and Disposal.



## **PART 2 PRODUCTS**

### **2.1 GENERAL**

- .1 Manufacture in accordance with SMACNA - HVAC Duct Construction Standards.

### **2.2 FLEXIBLE CONNECTIONS**

- .1 Frame: galvanized sheet metal frame
- .2 Material:
  - .1 Fire resistant, self extinguishing, neoprene coated glass fabric, temperature rated at minus 40 degrees C to plus 90 degrees C, density of 1.3 kg/m2.

### **2.3 ACCESS DOORS IN DUCTS**

- .1 Non-Insulated Ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm thick complete with sheet metal angle frame.
- .2 Insulated Ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm thick complete with sheet metal angle frame and 25 mm thick rigid glass fibre insulation.
- .3 Gaskets: neoprene.
- .4 Hardware:
  - .1 Up to 300 x 300mm: two sash locks complete with safety chain.

### **2.4 INSTRUMENT TEST**

- .1 1.6mm thick steel zinc plated after manufacture.
- .2 Cam lock handles with neoprene expansion plug and handle chain.
- .3 28 mm minimum inside diameter. Length to suit insulation thickness.
- .4 Neoprene mounting gasket.

### **2.5 SPIN-IN COLLARS**

- .1 Conical galvanized sheet metal spin-in collars with lockable butterfly damper.
- .2 Sheet metal thickness to co-responding round duct standards.

## **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 air duct accessories 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 INSTALLATION**

- .1 Flexible Connections:
  - .1 Install in following locations:
    - .1 Inlets and outlets to supply air units and fans.
    - .2 Inlets and outlets of exhaust and return air fans.
    - .3 As indicated.
  - .2 Length of connection: 100mm.
  - .3 Minimum distance between metal parts when system in operation: 75mm.
  - .4 Install in accordance with recommendations of SMACNA.
  - .5 When fan is running:
    - .1 Ducting on sides of flexible connection to be in alignment.
    - .2 Ensure slack material in flexible connection.
- .2 Access Doors and Viewing Panels:
  - .1 Size:
    - .1 As indicated.
  - .2 Locations:
    - .1 Fire and smoke dampers.
    - .2 Control dampers.
    - .3 Devices requiring maintenance.
    - .4 Required by code.
- .3 Instrument Test Ports:
  - .1 General:
    - .1 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.
  - .2 Locate to permit easy manipulation of instruments.
  - .3 Install insulation port extensions as required.
  - .4 Locations:
    - .1 For traverse readings:
      - .1 Ducted inlets to roof and wall exhausters.
      - .2 Inlets and outlets of other fan systems.
      - .3 Main and sub-main ducts.
      - .4 And as indicated.
    - .2 For temperature readings:
      - .1 And as indicated.
- .4 Turning Vanes:
  - .1 Install in accordance with recommendations of SMACNA and as indicated.

### **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 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.

**END OF SECTION**

## **PART 1 GENERAL**

### **1.1 REFERENCE STANDARDS**

- .1 Sheet Metal and Air Conditioning National Association (SMACNA)
  - .1 SMACNA HVAC Duct Construction Standards, Metal and Flexible-2013.

### **1.2 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 dampers and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Sustainable Design Submittals:
  - .1 Construction Waste Management:
    - .1 Submit project Waste Reduction Workplan 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.
  - .2 Recycled Content:
    - .1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of post-consumer content, and total cost of materials for project.
  - .3 Construction IAQ Management Plan:
    - .1 During construction meet or exceed the requirements of SMACNA IAQ Guideline for Occupied Buildings Under Construction.

### **1.3 CLOSEOUT SUBMITTALS**

- .1 Submit in accordance with Section 01 78 00- Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for dampers for incorporation into manual.

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

- .1 Deliver, store and handle materials in accordance with Section 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 and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect dampers from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: remove for reuse in accordance with 01 74 21- Construction/Demolition Waste Management and Disposal.

## **PART 2 PRODUCTS**

### **2.1 GENERAL**

- .1 Manufacture to SMACNA standards.

### **2.2 SINGLE BLADE DAMPERS**

- .1 Fabricate from same material as duct, but one sheet metal thickness heavier. V-groove stiffened.
- .2 Size and configuration to recommendations of SMACNA, except maximum height 100 mm.
- .3 Locking quadrant with shaft extension to accommodate insulation thickness.
- .4 Inside and outside nylon end bearings.
- .5 Channel frame of same material as adjacent duct, complete with angle stop.

### **2.3 MULTI-BLADED DAMPERS**

- .1 Factory manufactured of material compatible with duct.
- .2 Opposed blade: configuration, metal thickness and construction to recommendations of SMACNA.
- .3 Maximum blade height: 100 mm.
- .4 Bearings: self-lubricating nylon.
- .5 Linkage: shaft extension with locking quadrant.
- .6 Channel frame of same material as adjacent duct, complete with angle stop.

## **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 damper 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 INSTALLATION**

- .1 Install where indicated.
- .2 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.
- .3 Locate balancing dampers in each branch duct, for supply, return and exhaust systems.
- .4 Runouts to registers and diffusers: install single blade damper located as close as possible to main ducts.
- .5 Dampers: vibration free.
- .6 Ensure damper operators are observable and accessible.

**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 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.

**END OF SECTION**

## **PART 1 GENERAL**

### **1.1 REFERENCE STANDARDS**

- .1 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE)
- .2 Sheet Metal and Air-Conditioning Contractors' National Association (SMACNA)
  - .1 SMACNA HVAC Duct Construction Standards - Metal and Flexible, 2005.
  - .2 SMACNA IAQ Guideline for Occupied Buildings under Construction, 2005.
- .3 Underwriters' Laboratories (UL)
  - .1 UL 181-2005, Standard for Factory-Made Air Ducts and Air Connectors.
- .4 Underwriters' Laboratories of Canada (ULC)
  - .1 CAN/ULC-S110-2007, Standard Methods of Tests for Air Ducts.

### **1.2 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 flexible ducts and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 Indicate at a minimum:
    - .1 Thermal properties.
    - .2 Friction loss.
    - .3 Acoustical loss.
    - .4 Leakage.
    - .5 Fire rating.
- .3 Test and Evaluation Reports:
  - .1 Catalogue or published ratings to be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.
- .4 Sustainable Design Submittals:
  - .1 Construction Waste Management:
    - .1 Submit project Waste Reduction Workplan 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.
  - .2 Recycled Content:
    - .1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of post-consumer content, and total cost of materials for project.
  - .3 Construction IAQ Management Plan:
    - .1 During construction meet or exceed the requirements of SMACNA IAQ Guideline for Occupied Buildings Under Construction.

### **1.3 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 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 and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect flexible ducts from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: remove for reuse in accordance with Section 01 74 21-Construction/Demolition Waste Management and Disposal.

## **PART 2 PRODUCTS**

### **2.1 GENERAL**

- .1 Factory fabricated to CAN/ULC-S110.
- .2 Pressure drop coefficients listed below are based on relative sheet metal duct pressure drop coefficient of 1.00.
- .3 Flame spread rating not to exceed 25. Smoke developed rating not to exceed 50.

### **2.2 METALLIC - UNINSULATED**

- .1 spiral wound flexible aluminum, as indicated.
- .2 Performance:
  - .1 Factory tested to 2.5kPa without leakage.
  - .2 Maximum relative pressure drop coefficient: 3.

### **2.3 METALLIC - INSULATED**

- .1 spiral wound flexible aluminum with factory applied, 37mm thick flexible glass fibre thermal insulation with vapour barrier and vinyl jacket, as indicated.
- .2 Performance:
  - .1 Factory tested to 2.5kPa without leakage.
  - .2 Maximum relative pressure drop coefficient: 3.

### **2.4 NON-METALLIC - UNINSULATED**

- .1 non-collapsible, coated mineral base fabric type, mechanically bonded to, and helically supported by, external wire, as indicated.
- .2 Performance:
  - .1 Factory tested to 2.5kPa without leakage.
  - .2 Maximum relative pressure drop coefficient: 3.

### **2.5 NON-METALLIC - INSULATED**

- .1 [non-collapsible, coated mineral base fabric type mechanically bonded to, and helically supported by, external wire with factory applied, 37mm thick flexible mineral fibre thermal insulation with vapour barrier and vinyl jacket, as indicated.



- .2 Performance:
  - .1 Factory tested to 2.5kPa without leakage.
  - .2 Maximum relative pressure drop coefficient: 3.

## **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 flexible ducts 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 DUCT INSTALLATION**

- .1 Install in accordance with: SMACNA.

### **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 recycling and reuse 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.

**END OF SECTION**

## **PART 1 GENERAL**

### **1.1 REFERENCE STANDARDS**

- .1 American National Standards Institute/Air Movement and Control Association (ANSI/AMCA)
  - .1 AMCA Publication 201-02(R2011), Fans and Systems.
  - .2 ANSI/AMCA Standard 210-2007/(ANSI/ASHRAE 51-07), Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.
  - .3 ANSI/AMCA Standard 300-2008, Reverberant Room Method for Sound Testing of Fans.
  - .4 ANSI/AMCA Standard 301-1990, Methods for Calculating Fan Sound Ratings from Laboratory Test Data.
  - .5 AMCA Publication 302-73(R2012), Application of Sone Ratings for Non-Ducted Air Moving Devices.
  - .6 AMCA Publication 303-79(R2012), Application of Sound Power Level Ratings for Fans.

### **1.2 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 domestic fans and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Sustainable Design Submittals:
  - .1 Construction Waste Management:
    - .1 Submit project Waste Reduction Workplan 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.
  - .2 Recycled Content:
    - .1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of [post-consumer] [post-industrial]content, and total cost of materials for project.

### **1.3 MAINTENANCE MATERIAL SUBMITTALS**

- .1 Extra Materials:
  - .1 Submit in accordance with Section 01 78 00- Closeout Submittals.
  - .2 Furnish list of individual manufacturer's recommended spare parts for equipment, include:
    - .1 Bearings and seals.
    - .2 Addresses of suppliers.
    - .3 List of specialized tools necessary for adjusting, repairing or replacing.

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

- .1 Deliver, store and handle materials in accordance with Section 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 and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect domestic fans from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: remove for reuse in accordance with Section 01 74 21- Construction/Demolition Waste Management and Disposal.

### **PART 2 PRODUCTS**

#### **2.1 FANS - GENERAL**

- .1 Standard of rating:
  - .1 AMCA Publication 201 for fan application.
  - .2 AMCA Publication 302 for application of some loudness ratings for non-ducted air moving devices.
  - .3 AMCA Publication 303 for application of sound power ratings for ducted air moving devices.
  - .4 Performance: to ANSI/AMCA Standard 210. Unit to bear ANSI/AMCA certified seal.
- .2 Sound level ratings to comply with ANSI/AMCA Standard 301, tested to ANSI/AMCA Standard 300.
- .3 Maximum loudness: 5 sones.

#### **EXTERIOR MOUNTED DISCHARGE FANS**

- .4 Wall mounted, direct driven centrifugal fan, 93W electric ball bearing thermally protected motor.
- .5 Sizes and capacity: as indicated.
- .6 Control: humidity or interlocked with light occupancy sensor with a 15 minute delay operated.
- .7 Rust resistant aluminum with aluminum backdraft damper, spring loaded complete with cushioned frame.

#### **2.2 WALL AND CEILING DISCHARGE FANS**

- .1 Centrifugal direct drive,[with plug-in type electric motor suitable for ceiling wall installation, zinc coated rectangular metal housing.
- .2 Sizes and capacity: as indicated.
- .3 humidity or interlocked with light occupancy sensor with a 15 minute delay operated complete with integral electrical outlet box.
- .4 Side 80 mm x 250 mm rectangular 75 mm diameter duct outlet with integral backdraft damper.
- .5 Wall cap complete with spring loaded backdraft damper with neoprene gasket.
- .6 Silver anodized aluminum grille.

**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 domestic fan 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 INSTALLATION**

- .1 Install in accordance with manufacturer's recommendations.

**3.3 ANCHOR BOLTS AND TEMPLATES**

- .1 Supply for installation by other divisions.

**3.4 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 recycling and reuse 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.

**END OF SECTION**

## **PART 1 GENERAL**

### **1.1 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 diffusers, registers and grilles and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 Indicate following:
    - .1 Capacity.
    - .2 Throw and terminal velocity.
    - .3 Noise criteria.
    - .4 Pressure drop.
    - .5 Neck velocity.
- .3 Sustainable Design Submittals:
  - .1 Construction Waste Management:
    - .1 Submit project Waste Reduction Workplan 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.
  - .2 Recycled Content:
    - .1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of post-consumer content, and total cost of materials for project.

### **1.2 MAINTENANCE MATERIAL SUBMITTALS**

- .1 Extra Materials:
  - .1 Provide maintenance materials in accordance with Section 01 78 00- Closeout Submittals.
  - .2 Include:
    - .1 Keys for volume control adjustment.
    - .2 Keys for air flow pattern adjustment.

### **1.3 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions].
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials off ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect diffuser, registers and grilles from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.

- .4 Packaging Waste Management: remove for reuse in accordance with section 01 74 21-Construction/Demolition Waste Management and Disposal.

## **PART 2 PRODUCTS**

### **2.1 SYSTEM DESCRIPTION**

- .1 Performance Requirements:
  - .1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards.

### **2.2 GENERAL**

- .1 To meet capacity, pressure drop, terminal velocity, throw, noise level, neck velocity as indicated.
- .2 Frames:
  - .1 Full perimeter gaskets.
  - .2 Plaster frames [and as specified] [where set into plaster or gypsum board].
  - .3 Concealed fasteners.
- .3 Concealed manual volume control damper operators.
- .4 Colour: as directed by Consultant.

### **2.3 MANUFACTURED UNITS**

- .1 Grilles, registers and diffusers of same generic type, products of one manufacturer.

### **2.4 SUPPLY GRILLES AND REGISTERS**

- .1 General: with opposed blade dampers.
- .2 Type SA: aluminum, 25mm border, double deflection with airfoil shape, horizontal face and vertical rear bars.

### **2.5 RETURN AND EXHAUST GRILLES AND REGISTERS**

- .1 General: with opposed blade dampers.
- .2 Type RA: aluminum, 19mm border, single 45 degrees deflection, horizontal face bars.

### **2.6 DIFFUSERS**

- .1 General: volume control dampers with flow straightening devices and blank-off quadrants and gaskets.
- .2 Type DA: aluminum round type, having adjustable pattern, surface mounted.
- .3 Type DB: aluminum square type, having adjustable pattern, surface mounted.

### **2.7 LINEAR GRILLES**

- .1 Bar core type with no margin.
- .2 Plaster frame, sealing strip and accessories as indicated.
- .3 Air volume control damper with concealed adjustment.
- .4 Sill grilles to be capable of supporting 90kg point load weight between supports with negligible deflection and be pencil proof.

## **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 diffuser, register and grille 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 INSTALLATION**

- .1 Install in accordance with manufacturers instructions.
- .2 Install with flat head cadmium plated vandal proof screws in countersunk holes where fastenings are visible.
- .3 Bolt grilles, registers and diffusers, in place, in gymnasium and similar game rooms.
- .4 Provide concealed safety chain on each grille, register and diffuser in accessible areas.

### **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 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.

**END OF SECTION**

## **PART 1 GENERAL**

### **1.1 REFERENCE STANDARDS**

- .1 ASTM International
  - .1 ASTM E90-09, Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
- .2 National Fire Protection Association (NFPA)
  - .1 NFPA 96-11, Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.
- .3 National Research Council Canada (NRC)
  - .1 National Building Code of Canada 2015 (NBC).
- .4 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
- .5 Society of Automotive Engineers (SAE)

### **1.2 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 louvers, intakes and vents and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 Indicate following at a minimum:
    - .1 Pressure drop.
    - .2 Face area.
    - .3 Free area.
- .3 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .4 Test Reports: submit certified data from independent laboratory substantiating acoustic and aerodynamic performance to ASTM E90.

### **1.3 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials off ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect louvers, intakes and vents from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.

## **PART 2 PRODUCTS**

### **2.1 SYSTEM DESCRIPTION**

- .1 Performance Requirements:



- .1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards.

## **2.2 GRAVITY OUTSIDE AIR INTAKES AND RELIEF VENTS**

- .1 Factory manufactured frp or galvanized steel or aluminum.
  - .1 Complete with integral birdscreen of 2.7mm diameter ss or aluminum wire.
  - .2 Vertical backdraft dampers.
  - .3 Maximum throat velocity: 3.3m/s
  - .4 Maximum loss through unit: 15 Pa external static pressure.
  - .5 Maximum velocity through damper area: 1.5m/s.
  - .6 Shape: as indicated.
- .2 Birdscreens:
  - .1 Complete with integral birdscreen of 2.7mm diameter aluminum or ss wire. Use 12 mm mesh on exhaust, 19 mm mesh on intake.

## **2.3 FIXED LOUVRES - ALUMINUM**

- .1 Construction: welded with exposed joints ground flush and smooth.
- .2 Material: extruded aluminum alloy 6063-T5.
- .3 Blade: stormproof pattern with centre watershed in blade, reinforcing bosses and maximum blade length of 1500mm.
- .4 Frame, head, sill and jamb: 150mm deep one piece extruded aluminum, minimum 3mm thick integral to unit.
- .5 Mullions: at 1500mm maximum centres.
- .6 Fastenings: stainless steel SAE-194-8F with SAE-194-SFB nuts and resilient neoprene washers between aluminum and head of bolt, or between nut, ss washer and aluminum body.
- .7 Screen: 12] mm exhaust, 19] mm intake mesh, 2mm diameter wire aluminum birdscreen on inside face of louvres in formed U-frame.
- .8 Finish: factory applied enamel or anodized. Colour: to Consultant's approval.

## **2.4 ADJUSTABLE LOUVRES**

- .1 Construction: welded with exposed joints ground flush and smooth.
- .2 Material: extruded aluminum alloy 6063-T5.
- .3 Blade: stormproof pattern with centre watershed in blade, reinforcing bosses and maximum blade length of 1500mm.
- .4 Frame, head, sill and jamb: 100mm deep one piece extruded aluminum, minimum 3mm thick integral to unit.
- .5 Mullions: at 1500mm maximum centres.
- .6 Fastenings: stainless steel SAE-194-8F with SAE-194-SFB nuts and resilient neoprene washers between aluminum and head of bolt, or between nut, ss washer and aluminum body.
- .7 Screen: 19 mm intake, 12 mm exhaust mesh, 2mm diameter wire aluminum birdscreen on inside face of louvres in formed U-frame.
- .8 Finish: factory applied enamel. Colour: to Consultant's approval.
- .9 Operator: electric actuator

**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 louvres, intakes and vents 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 Consultant

**3.2 INSTALLATION**

- .1 In accordance with manufacturer's and SMACNA recommendations.
- .2 Reinforce and brace as indicated.
- .3 Anchor securely into opening. Seal with caulking to ensure weather tightness.

**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.

**END OF SECTION**

## **PART 1        GENERAL**

### **1.1        REFERENCE STANDARDS**

- .1 American National Standard Institute (ANSI)/American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)
  - .1 ANSI/ASHRAE 52.2-12, Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particulate Size (ANSI approved).
- .2 American National Standards Institute (ANSI)/CSA Group
  - .1 ANSI Z21.47/CSA 2.3-12, Gas-Fired Central Furnaces.
  - .2 ANSI Z83.8/CSA 2.6-13, Gas Unit Heaters, Gas Packaged Heaters, Gas Utility Heaters and Gas-Fired Duct Furnaces.
- .3 CSA Group
  - .1 CGA 3.2-1976(R2009), Industrial and Commercial Gas-Fired Package Furnaces.
  - .2 CSA B139-09, Installation Code for Oil Burning Equipment.
  - .3 CSA B140.2.1-10, Atomizing- Type Oil Burners.
  - .4 CSA B140.2.2-1971(R2011), Pressure Atomizing Oil Burner Nozzles.
  - .5 CAN/CSA-B140.4-04(R2009), Oil-Fired Warm Air Furnaces.
  - .6 CSA B140.14-M1979 (R2001), Automatic Flue-Pipe Dampers for Use with Oil Fired Appliances.
  - .7 CSA B149.1-10, Natural Gas and Propane Installation Code.
  - .8 CSA B149.2-10, Propane Storage and Handling Code.
  - .9 CSA C22.1-12, Canadian Electrical Code, Part 1 (22nd Edition), Safety Standard for Electrical Installations.
  - .10 CSA C22.2 No.24-1993(R2008), Temperature-Indicating and Regulating Equipment.
  - .11 CSA C22.2 No.46-M1988(R2011), Electric Air-Heaters.

### **1.2        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 furnace units and parts and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
  - .1 Submit drawings stamped and signed by professional engineer registered or licensed in British Columbia, Canada.
  - .2 Submit manufacturer's written recommendations.
- .4 Sustainable Design Submittals:
  - .1 Construction Waste Management:
    - .1 Submit project Waste Reduction Workplan 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.
  - .2 Recycled Content:

- .1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of post-consumer content, and total cost of materials for project.

### **1.3 CLOSEOUT SUBMITTALS**

- .1 Submit in accordance with Section 01 78 00- Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for the furnace

### **1.4 MAINTENANCE MATERIAL SUBMITTALS**

- .1 Submit in accordance with Section 01 78 00- Closeout Submittals.
- .2 Extra Stock Parts:
  - .1 Spare filters: in addition to filters installed immediately prior to acceptance by Departmental Representative, supply 1 complete set of filters for each filter unit or filter bank.

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

- .1 Deliver, store and handle materials in accordance with Section 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 and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect furnaces from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: remove for reuse in accordance with Section 01 74 21- Construction/Demolition Waste Management and Disposal.

## **PART 2 PRODUCTS**

### **2.1 GENERAL**

- .1 Provide CSA approved, packaged factory assembled unit consisting of cabinet, fan motor, intake/exhaust assembly, heat exchanger, combustion chamber, burner, controls, air filter, condensate drain.
- .2 High efficiency level range: 95%
- .3 Certification of components and construction of factory assembled gas-fired unit: to ANSI Z83.8/CSA 2.6 for gas fired duct furnace or CGA 3.2 for commercial package furnace.
- .4 Certification of components and construction of factory assembled oil-fired unit: to CAN/CSA-B140.4.

### **2.2 CAPACITY**

- .1 Output: 100,000 BTU/Hr rating.6000 ft above sea level
- .2 Air flow rate: 1300 CFM
- .3 External static pressure: 0.5" Static
- .4 Electrical characteristics: 120V, Single Phase, 60 Hz

**2.3 TYPE**

- .1 Upflow type with gas burner.

**2.4 CABINET**

- .1 1.0mm thick minimum steel with baked enamel finish.
- .2 Welded steel base for floor type.
- .3 Easily removed and secured access doors for components requiring service.
- .4 Thermally insulated cabinet.

**2.5 HEAT EXCHANGER**

- .1 Primary: stainless steel tube with aluminum stainless steelfins.
- .2 Secondary: stainless steel tube with stainless steel fins.
- .3 Warranty: non-prorated 20 years.

**2.6 COMBUSTION CHAMBER**

- .1 Power vent, forced draft: to manufacturers standard.
- .2 Sealed type: 100% outside air, to ANSI Z21.47/CSA 2.3.

**2.7 CIRCULATION BLOWER MOTOR ASSEMBLY**

- .1 Blower: centrifugal type:
  - .1 Statically and dynamically balanced.
  - .2 Rubber mounted.
  - .3 Speed adjustment: multi-speed direct drive or variable speed drive.
  - .4 Wiring adjustment of multi-speed motor
- .2 Motor: ¼ hp motor minimum, 1750 r/min. variable speed or multi-speed, overload protection, adjustable mounts.

**2.8 AIR FILTER(S)**

- .1 Filter(s):25mm thick, cleanable, permanent type to ANSI/ASHRAE 52.2.

**2.9 HEATER BURNER**

- .1 General: to bear CSA and ULC labels.
- .2 Gas burner:
  - .1 Continuous port steel or multi-slotted, non-clogging cast iron with adjustable combustion air supply.
  - .2 Electronic ignition combustion type gas burner.
  - .3 Pulsed combustion type with spark plug ignitor.
  - .4 Or approved equal

**2.10 INTAKE AND VENT ASSEMBLY**

- .1 Provide manufacturer's standard separate combined concentric vent and intake complete with termination assembly for high efficiency gas (condensing) furnace.
- .2 CPVC schedule 40 plastic pipe.
- .3 Manufacturer's external power venting kit.

## **2.11 CONDENSATE DRAIN**

- .1 Provide PVC condensate drain trap.
- .2 Condensate filter/neutralizer kit.

## **2.12 CONTROLS**

- .1 General: conform to CSA C22.2 No.24.
- .2 Gas firing:
  - .1 Operating controls:
    - .1 Set-back Heating-cooling thermostat with ability to be interlocked with exhaust fans.
    - .2 Electronic pilot ignition or Intermittent ignition.
    - .3 Manual main shut-off valve, automatic safety pilot, automatic electric valve and gas pressure regulator.
    - .4 Fan operating control switch with adjustable set points and continuous operating switch.
  - .2 Safety controls:
    - .1 Electronic combustion control relay with flame rectification sensor to detect and supervise flame by shutting off fuel upon flame failure or safety interlock signal within seconds, in sequence pre-purge-pilot ignition, supervision-main valve opening-pilot cut-off-burner operation and roll out switch.
    - .2 Blocked vent shut-off switch or control system.
    - .3 Limit control to shut down furnace if heat exchanger temperature exceeds limit setting. Combination fan and limit control to be spiral wound.
    - .4 Door interlock switch on fan compartment access panel to shut down furnace when panel is removed.
    - .5 Internal float switch to shut off furnace if condensate do not drain properly.
    - .6 Electronic board built-in diagnostics.

## **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 fuel-fired furnaces 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 INSTALLATION**

- .1 Install in accordance with manufacturer's instructions, regulations of authorities having jurisdiction and to Canadian Electric Code and CSA B149.1.
- .2 Co-ordinate with Concrete Division regarding concrete base as indicated.
- .3 Provide Departmental Representative written report of test results.
- .4 Bacharach smoke density number not to exceed #1.

**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 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.

**END OF SECTION**

## **PART 1 GENERAL**

### **1.1 REFERENCE STANDARDS**

- .1 CSA Group
  - .1 CSA C22.2 No.46-13, Electric Air-Heaters.

### **1.2 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 cabinet convector heaters and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 Include:
    - .1 Mounting methods.
    - .2 kW rating, voltage, phase.
    - .3 Cabinet material thicknesses.
    - .4 Colour.
- .3 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .4 Sustainable Design Submittals:
  - .1 Construction Waste Management:
    - .1 Submit project Waste Reduction Workplan 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.
  - .2 Recycled Content:
    - .1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of post-consumer content, and total cost of materials for project.

### **1.3 CLOSEOUT SUBMITTALS**

- .1 Submit in accordance with Section 01 78 00- Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for incorporation into manual.

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

- .1 Deliver, store and handle materials in accordance with Section 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 and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect cabinet convector heaters from nicks, scratches, and blemishes.



- .3 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: remove for reuse in accordance with Section 01 74 21- Construction/Demolition Waste Management and Disposal.

## **PART 2 PRODUCTS**

### **2.1 CABINET CONVECTOR HEATERS**

- .1 Wall mounted cabinet: to CSA C22.2 No.46, pre-drilled back for securing to wall:
  - .1 Front inlet/front outlet.
  - .2 Front panel: 1.6mm thick, aluminum.
  - .3 Finish: phosphatized and finished with standard colour as approved by the Consultant. powder coated finish
- .2 Elements: mineral insulated with steel sheath and welded fins, secured and free-floating for expansion.

### **2.2 CONTROLS**

- .1 Wall mounted thermostats: type low line voltage
- .2 Built-in thermostat: 2 pole with tamperproof screws and cover and auxiliary relays, transformer.

## **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 cabinet convector heater 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 INSTALLATION**

- .1 Install cabinet convectors as indicated.
- .2 Install wall mounted thermostats in locations indicated.
- .3 Make power and control connections.

### **3.3 FIELD QUALITY CONTROL**

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

### **3.4 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 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.

**END OF SECTION**

## **PART 1 GENERAL**

### **1.1 WORK INCLUDED**

- .1 The Contractor shall furnish all labour, materials and necessary equipment to provide complete and operating electrical systems as set forth on the plans and in these Specifications, and as called for elsewhere in the Contract documents. Any work, even if not shown or specified, which is obviously necessary or reasonably implied to complete the work, shall be carried out as if it was both shown and specified.

### **1.2 RELATED WORK**

- .1 Division 01 – General Requirements.
- .2 Division 03 – Concrete.
- .3 Division 10 – Specialties.
- .4 Divisions 22, 23 – Mechanical.

### **1.3 REFERENCES**

- .1 Reference documents listed below form part of this Specification to the extent specified in this Section.
- .2 Reference documents
  - .1 Comply with applicable standards of following organizations:
    - .1 Electrical and Electronic Manufacturers Association of Canada (EEMAC).
    - .2 National Electrical Manufacturers Association. (NEMA).
    - .3 Institute of Electrical and Electronic Engineers (IEEE).
    - .4 Insulated Power Cable Engineers Association (IPCEA).
    - .5 Canadian Electrical Code (CEC) (CSA 22.1 – latest edition)
    - .6 Canadian Standards Association (CSA)
    - .7 Area Electrical Inspection Authority

### **1.4 DRAWINGS AND SPECIFICATIONS**

- .1 General Conditions, Supplementary Conditions and Division 01 are a part of this specification and apply to Division 26 and 27.
- .2 Intent of drawings and specifications is to include all labour, products and services necessary for complete work, tested and ready for operation.
- .3 Symbols used to represent various electrical devices often occupy more space on drawing than actual device does when installed. In such instances, do not scale locations of devices from electrical symbols. Install devices with primary regard for usage of wall space, convenience of operation and grouping of devices.
- .4 Specifications and drawings of all other divisions to be considered as an integral part of accompanying drawings. Any item or subject omitted from either specifications or drawings but which is mentioned or reasonably specified in and by the others, to be considered as properly and sufficiently specified and be provided.
- .5 Provide all minor items and work not shown or specified but which are reasonably necessary to complete Work.
- .6 If discrepancies or omissions in drawings or specifications are found, or if intent or meaning is not clear, advise Consultant for clarification before submitting tender.
- .7 Responsibility to determine which Division provides various products and work rests with Contractor. Additional compensation will not be considered because of differences in interpretation of specifications.

## **1.5 QUALITY ASSURANCES**

- .1 Regulatory Requirements
  - .1 Comply with Safety Codes Act and rules and regulations made pursuant thereto, including Canadian Electrical Code.
  - .2 Unless otherwise indicated, all references in the Contract Documents to "Canadian Electrical Code" or "CEC" refers to the edition of the Canadian Electrical Code, Part I, CSA C22.1 - latest edition and the variations made thereto by Alberta regulation, which are in force on the date of bid closing for the Contract.
  - .3 Should any instance occur in this Specification or on the Drawings in which the materials or construction methods called for are less than the minimum requirements of the above codes, the requirements of the codes to take precedence, and the Contractor is to supply the materials and perform the work as though called for to the minimum code standards.
  - .4 All electrical products to be tested, certified and labelled in accordance with a certification program accredited by the Standards Council of Canada. Where a product is not so labelled, provide written approval by the authority having jurisdiction.
  - .5 Aforementioned minimum standards are not to detract from the quality of materials or methods of installation shown where these exceed said standards.
  - .6 Submit to authority having jurisdiction and utility company, necessary number of drawings and specifications for examination and approval prior to commencement of electrical work. Pay associated fees.
  - .7 Notify the Parks Canada Representative of changes required by Electrical Inspection Authority prior to making changes. Make reasonable changes and alterations required by the Inspection Authority at no extra cost to the Owner.

## **1.6 SUBMITTALS**

- .1 Provide the following submittals.
- .2 Shop Drawings and Product Data
  - .1 Twenty (20) days prior to fabrication, submit for the approval of the Parks Canada Representative, the shop drawings, product data and samples as specified, indicating details of construction, dimensions, capacities, weights and electrical performance characteristics of equipment and materials. Include data on manufacturer's recommended environmental conditions for equipment affected by temperature and humidity.
  - .2 Provide vendor shop drawings including but not limited to wiring, single line and schematic diagrams where applicable. Wiring drawings or diagrams shall show interconnection among work of different Sections.
  - .3 Cross or block out from manufacturer's standard product data sheets all data inapplicable or irrelevant to project.
- .3 Certificates
  - .1 Within 7 days of inspection, submit inspection certificates of any authority having jurisdiction of any part of the Work.
- .4 Project Record Documents
  - .1 Comply with requirements of Section 01 78 00 – Closeout Submittals.
  - .2 Record accurately all changes that are made during construction.
- .5 Reports
  - .1 Collect and submit field reports including the following:
    - .1 Start-up and testing reports.

- .2 Manufacturer start-up and testing reports.
- .6 Electrical Permit
  - .1 Copy of electrical permit obtained from authority having jurisdiction.

## **1.7 RECORD DRAWINGS**

- .1 Contractor to keep one complete set of white prints at site office, including all addenda, change orders, site instructions, clarifications and revisions for purpose of record drawings. As work on site proceeds, Contractor to clearly record in Red Pencil all as-built conditions which deviate from original contract documents. Record drawings to include circuiting of all devices, conduit and feeder runs and locations of all electrical equipment. Contractor to turn over the record drawings to the consultant prior to substantial completion. Refer to section 01 78 39 for additional requirements.

## **1.8 OPERATION AND MAINTENANCE MANUALS (IF APPLICABLE)**

- .1 Electrical operations and maintenance manuals to be prepared by the Electrical Contractor or his designate. The electrical contractor is to include all costs associated with preparation of O & M Manuals in tender price. Refer to section 01 78 23 for form, format and content requirements for all manuals.
- .2 The electrical contractor is to be responsible for:
  - .1 Supply and preparation of O & M Manual binders and tabs as specified.
  - .2 Preparation of all written system descriptions and schematics.
  - .3 Securing and assembling all necessary literature describing operational and maintenance procedures for all equipment into the O & M Manuals including preventative maintenance data.
  - .4 Preparation of safety in maintenance suggestions and procedures.
- .3 The electrical contractor to be responsible for supplying appropriate number of copies of:
  - .1 Final shop drawings.
  - .2 All wiring diagrams.
  - .3 List of all major sub-trades and suppliers including names of equipment supplied and by whom, addresses, phone and fax numbers and contact names.
  - .4 Each manual shall contain a complete and original copy of all owners operating manuals for systems equipment and hardware.
  - .5 Spare / replacement parts lists for all of the above.
  - .6 Test results for all electrical systems.
- .4 O & M Manuals to be submitted for final review prior to Substantial Completion.
- .5 Provide sections and tabs as follows:
  - .1 Contractors Warranty & Supplier Information
  - .2 Panelboards
  - .3 Motor Controls
  - .4 Lighting Fixtures
  - .5 Emergency and Exit Lighting
  - .6 Interior and Exterior Lighting and control
  - .7 Communication Cabling and Infrastructure
  - .8 Testing results

## **1.9 PRODUCT HANDLING**

- .1 Use all means necessary to protect products of this Division before, during and after installation and to protect products and installed work of all other trades.

- .2 Immediately make good any damage by repair or replacement at no additional cost to Owner and to approval of Consultant.
- .3 Remove advertising labels from all electrical equipment. Do not remove identification of certification labels.
- .4 Remove dirt, rubbish, grease, etc. resulting from this work from all surfaces, including inside of all cabinets, equipment enclosures, panels, etc.

#### **1.10 GUARANTEE**

- .1 Furnish written guarantee to Owner prior to final contract payment, which will be in effect for one year from date of final acceptance of complete work. Replace or repair at no cost to Owner any defective material or workmanship except where, in opinion of Consultant, such defects are due to misuse or neglect by Owner.
- .2 General guarantee to not act as waiver of any specified or special equipment guarantees which cover greater length of time.

### **PART 2 PRODUCTS**

#### **2.1 MATERIALS**

- .1 All equipment and material to be new and CSA certified and conform to EEMAC Standards. Where there is no alternative to supplying equipment which is not CSA certified, obtain special approval from Electrical Inspection Authority and the Parks Canada Representative.
- .2 Where two or more items of the same kind are required, all such items to be the product of a single manufacturer.

#### **2.2 SELECTED PRODUCTS AND ALTERNATES**

- .1 Products and materials provided to be new and free from all defects. Defective products or materials will be rejected, regardless of previous inspections. Contractor to be responsible to remove and replace defective products at their expense, and be responsible for any resulting delays and associated expenses which result from defective products being rejected.
- .2 Products and materials referred to in specifications by trade names, manufacturer's name and catalogue reference are those which shall be used as basis for Tender.

#### **2.3 ALTERNATIVE PRODUCTS**

- .1 All product substitutions must be approved by Consultant. Failure to obtain approval from Consultant during the tender process will result in proposed equal/alternative product being rejected, in which case Contractor to provide approved product at no additional cost to the Owner.
- .2 Contractor to assume full responsibility for ensuring that when providing equal/alternative products or materials, all space, weight, connections, power and wiring requirements etc. are considered. Any costs incurred for additional components, changes to services, structural or space requirements, layouts and plans, etc. that may be necessary will be borne by Contractor.
- .3 Suppliers to submit all requests for equal/alternative product approval to Consultant. Submissions must be received by Consultant prior to final addendum. All submissions which are approved by Consultant to be identified as "Approved Equal/Alternates" in Addendum. Alternative products not listed in Addendum are considered to be rejected.
- .4 Approval of equal/alternate is not intended to change original specifications unless specified in addenda. Submitter is responsible for all costs incurred by other trades as well as his own, to install product/system in accordance with contract documents.

- .5 All submissions to be provided with technical data and whatever pertinent information that may be required by Consultant to evaluate equivalency to the specified product. Responsibility to provide sufficient technical data with respect to submissions will remain solely with those making submission.

## **2.4 UNIFORMITY OF MANUFACTURE**

- .1 Unless otherwise specified, uniformity of manufacture to be maintained for similar products throughout.

## **2.5 PRODUCT FINISHES**

- .1 Finish all cabinets, panelboards, switchboards, equipment cabinets, etc. in ANSI 61 grey enamel.
- .2 Apply primer on all items which are to be finished on job site.
- .3 Touch up all damaged painted finishes with matching lacquer, or, if required by Consultant, completely repaint damaged surface.

## **2.6 USE OF PRODUCTS DURING CONSTRUCTION**

- .1 Any equipment used for temporary or construction purposes to be approved by General Contractor and in accordance with General Conditions, "Use of Premises". Clean and restore to "as new" condition all equipment prior to time of substantial completion. Warranty period to not begin until date of substantial performance of work.

# **PART 3 EXECUTION**

## **3.1 SITE EXAMINATION**

- .1 Examine site of work and become familiar with all features and characteristics affecting this work before submitting tender.
- .2 No additional compensation will be given for extra work due to existing conditions which such examination should have disclosed.
- .3 Report to Consultant any unsatisfactory conditions which may adversely affect proper completion of work.

## **3.2 COORDINATION WITH OTHER DIVISIONS**

- .1 Examine drawings and specifications of all divisions and become fully familiar with their work. Before commencing work, obtain ruling from Consultant if any conflict exists, otherwise no additional compensation will be made for any necessary adjustments.
- .2 Lay out work and equipment with due regard to architectural, structural and mechanical features. Architectural and structural drawings take precedence over electrical drawings regarding locations of walls, doors and equipment.
- .3 Do not cut structural members without approval of Consultant.
- .4 Coordinate with all Division installing equipment and services, and ensure that there are no conflicts.
- .5 Install anchors, bolts, pipe sleeves, hanger inserts, etc. in ample time to prevent delays.
- .6 Examine previously constructed work and notify Consultant of any conditions which prejudice proper completion of work. Commencement of work without such notification to Consultant constitutes acceptance of other work.

## **3.3 LOCATION OF OUTLETS AND LUMINAIRES**

- .1 Electrical drawings are, unless otherwise indicated, drawn to scale and approximate distances and dimensions may be obtained by scaling. Figured dimensions to govern

over scaled dimensions. Where exact dimensions and details are required, refer to Architectural and Structural drawings.

- .2 Outlet and equipment locations shown on drawings are approximate. Locations may be revised up to 3 meters to suit construction and equipment arrangements without additional cost to Owner, provided that Contractor is notified prior to installation of outlets, or equipment.
- .3 Maintain luminaire locations wherever possible. Notify Consultant of conflicts with other services.
- .4 Unless otherwise specified, install products in accordance with recommendations and ratings of manufacturers.

### **3.4 SEPARATION OF SERVICES**

- .1 Maintain separation between electrical wiring system and building piping, ductwork, etc. so that wiring system is isolated (except at approved connections to such systems) to prevent galvanic corrosion.
- .2 In particular, contact between dissimilar metals, such as copper and aluminum, in damp or wet locations is not permitted.
- .3 Do not support wiring from pipes, ductwork, etc. Hangers for suspended ceilings may be used for support of wiring only when approval is obtained from Consultant and ceiling installer, and approved clips or hangers are used.

### **3.5 WIRING TO EQUIPMENT SUPPLIED BY OTHERS**

- .1 Equipment supplied by Owner or under other Division will be moved to installation site by others. However, electrical connection to equipment to be done by this Division.

### **3.6 ACCESS PANELS**

- .1 Where electrical equipment, junction boxes, remote ballasts or the like are concealed, access panels to be supplied. Panels to be of adequate size for servicing of electrical work and complete with necessary frames and hinged doors held closed with captive fasteners. Coordinate type and size of panels with Consultant.

### **3.7 MOUNTING HEIGHTS**

- .1 Unless a conflict exists, use the following as mounting heights from finished floors to centre of device.

Receptacles in Mechanical Rooms	1200 mm
Receptacles	300 mm
Receptacles above Counters	175 mm above countertop or backsplash
Light Switches	1200 mm
Emergency Lights	2200 mm
Exit Lights	300 mm above door
Communications Outlets	300 mm
Panelboards, starters, and disconnects (to top of cover)	2000 mm
Barrier Free door pushbuttons	800 mm

### **3.8 SEALING OF WALL AND FLOOR OPENINGS**

- .1 All conduit and cable entries through outside walls of buildings, through partition walls separating electrical rooms from other areas, through fire separations, and through floors above grade to be sealed to prevent passage of moisture, dust, gasses, flame, or to maintain pressurization.



- .2 Sealing material to be fire resistant and not contain any compounds which will chemically affect wiring jacket or insulating material. Cable penetrations through fire separations to be sealed.

### **3.9 HOUSEKEEPING PADS**

- .1 All interior floor mounted electrical equipment installed by this Division to be mounted on concrete housekeeping pads which, unless otherwise noted, to be responsibility of the General Contractor.
- .2 The electrical contractor is to determine the size and location of housekeeping pads required and supply all information and details as to size and locations to the General Contractor.

### **3.10 SLEEVES**

- .1 Provide sleeves of galvanized steel pipe with machine cut ends of ample size to accommodate conduits passing through walls, partitions, ceilings, floors, etc.
- .2 For wall, partitions and ceilings the ends to be flush with finish on both sides but for floors they shall extend 100 mm above finished floor level.
- .3 Space between sleeve and conduit to be filled with Dow Corning silicone RTV foam for fire stop and caulked around top and bottom with approved permanently resilient, non-flammable and weatherproof silicone base compound and ensure that seal is compatible with floor and ceiling finishes.
- .4 Locate and position sleeves exactly prior to construction of walls, floors. Failure to comply with above requirements to be remedied at this Division's expense.

### **3.11 TEMPORARY LIGHTING AND POWER**

- .1 Provide grounded extension cords and temporary lights required for electrical work.
- .2 If Owner's operations will be affected by any power outage required for this work, give adequate notice to Owner and do not interrupt power until approval has been obtained.
- .3 Give adequate notice to General Contractor and Owner of any power outage required for this work. Schedule outages to provide least interference with other work.

**END OF SECTION**

## **PART 1 GENERAL**

### **1.1 WORK INCLUDED**

- .1 Provide complete system of wiring, making all connections necessary for installation shown on drawings.

### **1.2 REFERENCES, CODES AND STANDARDS**

- .1 Install and rate power cables in accordance with Canadian Electrical Code requirements or in accordance with ICEA requirements where permissible.

### **1.3 RELATED WORK**

- .1 Section 26 05 28 – Grounding – Secondary
- .2 Section 26 05 32 – Outlet Boxes, Conduit Boxes and Fittings
- .3 Section 26 05 34 – Conduits, Conduit Fastenings, and Conduit Fittings
- .4 Section 26 05 44 – Installation of Cables in Trenches and in Ducts

## **PART 2 PRODUCTS**

### **2.1 BUILDING WIRES**

- .1 Conductors: stranded for #8 AWG and larger. Minimum size: #12 AWG for all applications.
- .2 Copper conductors: size as indicated, with 600 V insulation of chemically cross-linked thermosetting polyethylene (XLPE) material rated RW90.

### **2.2 ARMOURED CABLES**

- .1 Conductors: insulated, copper, size as indicated.
- .2 Type: AC90.
- .3 Armour: interlocking type fabricated strip.

### **2.3 LUMINAIRE WIRE**

- .1 Type TEW: Copper conductors, #12 AWG, with thermoplastic and glass braid insulation, flame retardant, heat and moisture resistant, rated 600 Volts, 105oC.

## **PART 3 EXECUTION**

### **3.1 INSTALLATION OF BUILDING WIRES**

- .1 Install all wiring in conduit systems in accordance with Section 26 05 34.

### **3.2 INSTALLATION OF ARMOURED CABLES**

- .1 Group cables wherever possible. Ensure all cables run in ceiling space are adequately supported.
- .2 Use of armoured cable to be limited to individual drops from ceiling mounted junction boxes to light fixtures above accessible ceilings. Maximum length to be 3.0 m. Use one drop per fixture. No looping between fixtures.

### **3.3 INSTALLATION OF LUMINAIRE WIRE**

- .1 Run wires from outlet boxes through luminaire raceways, splice and connect in raceways. Connect continuous rows of luminaires to circuit without breaking conductors.

### **3.4 WORKMANSHIP**

- .1 Before pulling wire, ensure conduit is dry and clean. If moisture is present, thoroughly dry out conduits; vacuum if necessary. To facilitate pulling, recognized specially manufactured wire pulling lubricants may be used. Do not use grease.
- .2 Employ suitable techniques to prevent damage to wire when ambient temperature is below the minimum permitted for each insulation type. Do not pull wires into incomplete conduit runs.
- .3 Installation to be free of opens and grounds.
- .4 Size all conductors to limit voltage drop from panels to farthest point of use, do not exceed 2% at full load in any case.
- .5 Conduit fill limitations for #12 AWG conductors as below to allow for future spare capacity, 75 degree equipment rating, and table 5C.
  - .1 21C-6#12, 1#12 ground.
  - .2 27C-8#12, 1#12 ground.

### **3.5 IDENTIFICATION, CODING AND BALANCING**

- .1 For branch circuit wiring, follow identification system as specified.
- .2 Connect single phase equipment to minimize imbalance on feeders. Adjust branch circuiting shown as required for optimum balancing. Record all changes on "record" drawings.
- .3 Colour code all feeders at all terminations, at all points where taps are made, and at all panelboards, switchboards, etc. Use two wraps of 3M #471 plastic film tape 48 mm wide.
- .4 Conductors sized No. 10 and smaller are required to be factory coloured, not taped on site.

### **3.6 TESTING**

- .1 All 208V panelboard feeders are to be meggered using a 1000V megger.
- .2 Record and tabulate all results and include in the O&M manuals.

**END OF SECTION**

## **PART 1 GENERAL**

### **1.1 WORK INCLUDED**

- .1 Securely and adequately ground all components of electrical system in accordance with requirements of all related sections in Canadian Electrical Code, National Building Code and local Electrical Inspection Branch.
- .2 System is to consist of cables, clamps, lugs, supports, and all necessary materials and inter-connections to provide complete system. All ground conductors shall be run in conduit.
- .3 All branch circuit conduits shall contain a green ground conductor whether the conduits are metal or not.
- .4 Refer to Section 27 10 00, clause 3.8 for additional bonding requirements related to the low tension cabling systems.

## **PART 2 PRODUCTS**

### **2.1 EQUIPMENT**

- .1 Cables #3/0 and smaller to be connected to ground bars via Burndy Quiklug Type QA-2B connectors. Connections for cables larger than #4/0 shall be brazed.
- .2 All ground wires to be stranded copper TWH complete with green jacket unless otherwise shown.
- .3 Uninsulated ground wires to be bare stranded copper, tinned, soft annealed. Size as indicated.
- .4 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 Bonding jumpers, straps.
  - .5 Pressure wire connectors.

### **2.2 GROUNDING BUS**

- .1 Install copper grounding bus mounted on insulated supports on wall of electrical room.
- .2 Ground items of electrical equipment in electrical room to ground bus with individual bare stranded copper connections.

## **PART 3 EXECUTION**

### **3.1 GENERAL INSTALLATION**

- .1 New installation to provide continuous bonding to ground system including conductors and accessories. Where conduit is used, run ground wire in conduit. All connectors to be installed in accordance with manufacturers requirements. All frames and metallic enclosures of all electrical equipment and electrically operated equipment to be grounded via ground wire.
- .2 All panelboards and CDP's fed from main distribution centre to be grounded by grounding conductors sized in accordance with Canadian Electrical Code. Ground wire to be terminated at each end with appropriate grounding lug which be connected to equipment ground bus. Ground wire to be green TWH. Use mechanical connectors for grounding connections to equipment provided with lugs.

- .3 All panels such as lighting panels, local distribution panels, etc., to be grounded with green ground wire run back to panel from which it is fed. Ground conductor to be sized according to Canadian Electrical Code.
- .4 All bolted connections must be accessible.
- .5 All motors to be grounded by means of adequately sized green ground wire contained within feeder conduit.
- .6 Include separate green ground wire in all power conduits including branch circuit wiring sized to Canadian Electrical Code.
- .7 Expansion joints and telescoping sections of raceways to be bonded using jumper cables as per Canadian Electrical Code.
- .8 Install rigid conduit sleeves where ground wires pass through concrete slabs.
- .9 Conduit installed buried in earth or installed in or under grade floor slabs to have separate ground wire installed, whether conduits are metal or not.
- .10 Protect exposed grounding conductors from mechanical injury.
- .11 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.
- .12 Provide a #6 AWG ground conductor along the entire length of cable tray. Bond ground conductor to each section of tray or at minimum every 15 meters.
- .13 Home run ground conductor back to main building ground bus.

### **3.2 EQUIPMENT GROUNDING**

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

### **3.3 FIELD QUALITY CONTROL**

- .1 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of Departmental Representative and local authority having jurisdiction over installation.
- .2 Perform tests prior to energizing the electrical system.

**END OF SECTION**

## **PART 1 GENERAL**

### **1.1 WORK INCLUDED**

- .1 Supply and install all hangers, supports and inserts for the installation shown on drawings and specified herein, as necessary to fasten electrical equipment securely to building structure.

## **PART 2 PRODUCT**

### **2.1 FRAMING AND SUPPORT SYSTEM**

- .1 Materials:
  - .1 Intermediate duty supporting structures to employ P1000 Unistrut or equal together with manufactures connecting components and fasteners for complete system.
  - .2 Heavy duty supporting structures to be fabricated and welded from steel structural members and prime painted before installation.
- .2 Finishes:
  - .1 Outdoors, wet locations: Hot dipped galvanized.
  - .2 Indoors, dry locations: Galvanized when available, prime painted if not available.
  - .3 Nuts, bolts, machine screws: Cadmium plated.
- .3 Unistrut:
  - .1 Section P1000 or as required for load and span, with mounting screws, or approved. P1000 or equal is minimum standard for supporting conduits 50 mm and larger.

### **2.2 CONCRETE AND MASONRY ANCHORS**

- .1 Materials: Hardened steel inserts, zinc plated for corrosion resistance. All anchor bolts must be galvanized.
- .2 Components: non-drilling anchors for use in predrilled holes, sized to safely support the applied load with minimum safety factor of four.
- .3 Manufacturer: Hilti (Canada) Limited or approved equal.

### **2.3 NON-METALLIC ANCHORS**

- .1 Material: Plastic anchors for sheet metal screws.
- .2 Manufacturer: Fischer.

### **2.4 CONDUIT SUPPORTS**

- .1 General: Malleable iron one-hole conduit straps where exposed to weather. Stamped steel two-hole straps indoors.
- .2 Structural Steel: Crouse-Hinds "Wedgetite" supports or equivalent manufactured by Appleton.
- .3 Masonry, concrete, stone, etc.: Anchors.
- .4 Title: Toggle bolts.
- .5 Metal studs, ceiling hangers, etc.: "Caddy-Clips".
- .6 Unistrut: Unistrut conduit clamps.

## **2.5 CABLE SUPPORTS AND CLAMPS**

- .1 General: As per conduit supports, except that for single conductor cables, suitable non-ferrous, or approved stainless steel or aluminum clamps to be used.

## **PART 3 EXECUTION**

### **3.1 WORKMANSHIP**

- .1 Do not cut or drill beams, joists or structural steel unless written permission of Departmental Representative is obtained.
- .2 Distance between conduit or cable supports not to exceed code requirements.
- .3 Supports to be suitable for real loads imposed by equipment.
- .4 Do not support heavy loads from bottom chord of open web steel joists.
- .5 Do not use wire lashing or perforated strap to support or secure raceways or cables.
- .6 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Departmental Representative.
- .7 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.
- .8 Provide conduit rack with 25% spare capacity for multiple runs.

### **3.2 INSTALLATION**

- .1 Secure equipment to masonry, tile and plaster surfaces.
- .2 Secure equipment to poured concrete with expandable inserts.
- .3 Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.
- .4 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.
- .5 Supports to be securely fastened, free from vibration and excessive deflection or rotation. Maximum deflections are 4 mm over 1 meter span and 8 mm over 2 meter span.
- .6 Fasten exposed conduit or cables to building construction or support system using straps.
  - .1 One-hole malleable iron or steel straps to secure surface conduits and cables 50 mm and smaller.
  - .2 Two-hole steel straps for conduits and cables larger than 50 mm.
  - .3 Beam clamps to secure conduit to exposed steel work.
- .7 Suspended support systems.
  - .1 Support individual cable or conduit runs with 6 mm diameter threaded rods and spring clips.
  - .2 Support 2 or more cables or conduits on channels supported by 6 mm diameter threaded rod hangers where direct fastening to building construction is impractical.
- .8 Use plastic anchors for light loads only. Use metal anchors for all other loads.
- .9 Shot driven pins may only be used with written approval of the structural engineer.
- .10 Use round or pan head screws for fastening straps, boxes, etc.
- .11 Support outlet boxes, junction boxes, panel tubs, etc., independent of conduits running to them. Support conduits within 600 mm of outlet boxes. Support surface mounted panel tubs with minimum of four 6 mm fasteners.
- .12 For surface mounting of two or more conduits use channels at 1.5 m on centre spacing.

- .13 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.
- .14 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.
- .15 Provide channel support with fittings for vertical runs of conduit and cables.

**END OF SECTION**



**PART 1 GENERAL**

**1.1 WORK INCLUDED**

- .1 Provide complete system of splitters boxes and cabinets for installation of wiring and equipment.

**1.2 SHOP DRAWINGS AND PRODUCT DATA**

- .1 Submit shop drawings and product data for cabinets in accordance with Section 26 05 00 – Common Work Results for Electrical.

**PART 2 PRODUCTS**

**2.1 JUNCTION BOXES AND PULL BOXES, WEATHERPROOF**

- .1 Materials:
  - .1 Cast steel, Crouse Hinds, WBJ Series.

**2.2 JUNCTION BOXES AND PULL BOXES, INDOOR DRY LOCATIONS**

- .1 Materials:
  - .1 Code gauge sheet steel, welded construction, phosphatized and factory paint finish.
- .2 Components:
  - .1 For flush mounting, covers to overlap box by 25 mm minimum all around with flush head cover retaining screws.
  - .2 Use rolled edges for surface boxes.
- .3 Junction boxes mounted in exterior walls to be complete with box vapour barriers.

**2.3 CABINETS**

- .1 Materials:
  - .1 Cabinets: Code gauge sheet steel, welded construction, phosphatized and factory paint finish, suitable for field painting.
  - .2 Locks: to match panelboards.
  - .3 Backboards: 19 mm GIS fir plywood, one piece per cabinet, covering entire cabinet interior.
- .2 Components:
  - .1 With hinged door and return flange overlapping sides, with handle, lock and catch for surface mounting, size as indicated or to suit.
  - .2 Surface or flush with trim and hinged door, latch and lock and two keys, size as indicated or to suit. Keyed to match panelboard keys. 19 mm GIS Fir Plywood backboard.

**2.4 SPLITTERS**

- .1 Materials:
  - .1 Code gauge sheet steel, welded construction, phosphatized and factory paint finish.
- .2 Components:
  - .1 Formed hinged cover suitable for locking in the closed position.
  - .2 Main and branch lugs to match required size and number of incoming and outgoing conductors as indicated.

- .3 At least three spare terminals on each set of lugs in splitters less than 400 AMP.

## **PART 3 EXECUTION**

### **3.1 INSTALLATION**

- .1 Junction Boxes and Pull Boxes:
  - .1 Supply all pull boxes and junction boxes shown on drawings or required for installation.
  - .2 Boxes installed in party walls to be offset by minimum of one stud space.
  - .3 Install in inconspicuous but accessible locations, above removable ceilings or in electrical rooms, utility rooms or storage areas.
  - .4 Identify with system name and circuit designation as applicable.
  - .5 Size in accordance with Canadian Electrical Code, as minimum.
- .2 Cabinets:
  - .1 Mount cabinets with top not greater than 1980 mm above finished floor, coordinated with masonry, panelboards and similar items. Securely fasten backboards to cabinet interiors.
  - .2 Install terminal block where indicated.
- .3 Splitters
  - .1 Install splitters and mount plumb, true and square to the building lines.
  - .2 Extend splitters full length of equipment arrangement except where indicated otherwise.
- .4 Identification
  - .1 Provide equipment identification in accordance with Section 26 05 00 – Common Work Results for Electrical.

**END OF SECTION**

## **PART 1 GENERAL**

### **1.1 WORK INCLUDED**

- .1 Provide complete system of boxes for installation of wiring and equipment.

### **1.2 REFERENCES**

- .1 CSA C22.1-Canadian Electrical Codes, Part 1.

## **PART 2 PRODUCTS**

### **2.1 OUTLET AND CONDUIT BOXES GENERAL**

- .1 Size boxes in accordance with CSA C22.1.
- .2 102 mm square or larger outlet boxes as required for special devices.
- .3 Gang boxes where wiring devices are grouped.
- .4 Blank cover plates for boxes without wiring devices.
- .5 Combination boxes with barriers where outlets for more than one system are grouped.

### **2.2 OUTLET BOXES FOR METAL CONDUIT**

- .1 Materials:
  - .1 Surface or recessed concealed type: Die formed steel, hot dip galvanized, 1.25 oz/sq. ft. minimum zinc coating.
  - .2 Surface mounting exposed: Cast aluminum FSU boxes threaded for conduit, with attached internal lugs, corrosion resistant two coats finish.
- .2 Components:
  - .1 Ceiling outlets, surface mounting, concealed:
    - .1 101 mm square, depth 54 mm, Iberville 52171 series
    - .2 119 mm square, depth 54 mm, Iberville 72171 series
  - .2 Ceiling outlets, concealed mounting in concrete:
    - .1 101 mm octagonal concrete rings, depth from 38 mm to 152 mm Iberville 54521 series.
    - .2 Extension ring to change from recessed conduit to exposed conduit, 101 mm octagonal, 38 mm deep square Iberville 53151-1/2 or 38 mm deep octagonal Iberville 51151C or 54 mm deep, Iberville 55171C.
    - .3 Wall boxes, concealed in concrete or masonry: for one and two gang applications shall be 101 mm square, 54 mm deep, 52171 series complete with suitable 52-C-49 series square cornered raised tile wall cover for proper device and wall surface application. Masonry boxes may be used for line voltage switching.
    - .4 Wall outlets, concealed non-masonry construction, with plaster finish: For one or two gangs used with switches, receptacles, etc., use 54 mm deep Iberville 52171 series, with matching plaster covers, depth to suit. Alternately, use 119 mm square boxes, Iberville 72171 series and covers as required.
    - .5 For more than two gangs use solid boxes Iberville GSB series with GBC series cover.
    - .6 Wall outlets, surface, exposed mounting or used for outdoor outlets: One or more gang, Crouse-Hinds FS series or FD series, conduit.

- .7 Covers: Unless wiring devices and plates are mounted, provide blank, round canopy covers to match boxes.

## **2.3 OUTLET BOXES FOR RIGID PVC CONDUIT**

- .1 Rigid PVC boxes and fittings: Unplasticized PVC.

## **2.4 MASONRY BOXES**

- .1 Electro-galvanized steel masonry single and multi-gang boxes for devices flush mounted in exposed block walls.

## **2.5 CONCRETE BOXES**

- .1 Electro-galvanized sheet steel concrete type boxes for flush mount in concrete with matching extension and plaster rings as required.

## **2.6 FITTINGS - GENERAL**

- .1 Bushing and connectors with nylon insulated throats.
- .2 Knock-out fillers to prevent entry of debris.
- .3 Conduit outlet bodies for conduit up to 32 mm and pull boxes for larger conduits.
- .4 Double locknuts and insulated bushings on sheet metal boxes.

# **PART 3 EXECUTION**

## **3.1 INSTALLATION**

- .1 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.
- .2 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.
- .3 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Reducing washers are not allowed.
- .4 Install all outlets flush and surface mounted as required for installation.
- .5 Surface mount above suspended ceilings, or in unfinished areas.
- .6 Adjust position of outlets in finished masonry walls to suit course lines. Coordinate cutting of masonry walls to achieve neat openings for all boxes.
- .7 Do not distort boxes during installation. If boxes are distorted, replace with new boxes.
- .8 Use plaster rings to correct depth. Use 30 mm on concrete block.
- .9 Do not use sectional boxes.
- .10 Provide boxes sized as required by Canadian Electrical Code.
- .11 Install vapour barrier material to surround and seal all outlet boxes located on exterior walls of building. Maintain wall insulation.
- .12 Ceiling outlet boxes shall be provided for every surface mounted fixture or row of fixtures installed on suspended "hard" ceilings.

**END OF SECTION**

**PART 1 GENERAL**

**1.1 WORK INCLUDED**

- .1 Provide complete system of conduit and fittings for installation of wiring.
- .2 Conduit system infrastructure shall be provided and installed for all power and system wiring as required for the installation of electrical work as described in the contract documents.

**PART 2 PRODUCTS**

**2.1 RIGID STEEL CONDUIT**

- .1 Galvanized with threaded joints and connections.
- .2 Connections in dry locations: steel or malleable iron locknuts inside and outside enclosures. Insulated bushings.
- .3 Connectors subjected to moisture interior and exterior: liquid and dust tight with insulated throat.
- .4 Fittings: cast metal including gasketted covers in damp locations.
- .5 Expansion joints: cast metal.

**2.2 E.M.T. CONDUIT**

- .1 Fittings in dry locations: Steel or zinc set screw connectors with insulated throat. Steel or zinc set screw couplings.
- .2 Fittings in locations subject to moisture: steel rain-tite connectors with insulated throat. Steel rain-tite couplings.

**2.3 RIGID P.V.C. CONDUIT**

- .1 Conduit: rigid non-metallic conduit of un-plasticized polyvinyl chloride, Schedule 40.
- .2 Fittings: threaded male or female solvent weld connectors and solvent weld couplings, as supplied by conduit manufacturer.
- .3 Solvent: as recommended by conduit manufacturer.

**2.4 FLEXIBLE CONDUIT**

- .1 Connectors: slip-proof, insulated throat or non-metallic bushings, steel.

**2.5 RIGID PVC DUCT**

- .1 Duct: Rigid non-metallic conduit of un-plasticized polyvinyl chloride Type DB-2, conforming to CSA Standard.
- .2 Accessories: Bell ends, couplings, adapters, bends and other fittings of same material as duct. Use solvent recommended by manufacturer. Use pre-manufactured horizontal, vertical and foundation spacers.

**2.6 LIQUID-TIGHT FLEXIBLE CONDUIT**

- .1 Conduit: flexible metal conduit with liquid-tight PVC jacket.
- .2 Connectors: captive sealing jacket and ground cone insulated throat.

## **PART 3 EXECUTION**

### **3.1 INSTALLATION**

- .1 Rigid Steel Conduit
  - .1 Use as raceways in all areas exposed to weather, locations where mechanical damage may occur.
- .2 E.M.T. Conduit
  - .1 Install all conduit and wiring concealed within wall or poured floor structure, drywall framing bulkheads, furring or above dropped ceiling finishes. Conduits shall not be installed surface mounted in finished areas.
  - .2 Use as raceways in surface and concealed areas or in poured concrete above ground level.
  - .3 It may not be used in damp locations, corrosive atmosphere, underground, outdoors, nor in areas exposed to mechanical damage.
  - .4 Do not recess conduit in columns without permission.
- .3 Rigid P.V.C. Conduit
  - .1 Use as raceways in poured concrete floors and walls and in underground runs exterior to buildings unless otherwise noted. Wiring installed in areas subject to intermittent or continuous moisture but not surface mounted. Rigid PVC conduit to not be surface mounted.
  - .2 Structural Slab on grade: Install rigid PVC conduit in the gravel base below concrete slabs.
  - .3 Use strictly in accordance with Canadian Electrical Code.
  - .4 Provide insulated ground wire in all rigid PVC conduits in accordance with Canadian Electrical Code.
  - .5 Where rigid PVC conduit is set in poured concrete, solvent joints must be completed and allowed to set as per manufacturer's instructions.
  - .6 Bend rigid conduit in strict accordance with manufacturer's directions. Distorted bends will not be accepted.
- .4 Flexible Conduit
  - .1 Use as raceways for connections to fractional .horsepower motors in dry locations.
  - .2 Use as raceway for connections to panelboards from transformer secondary.
  - .3 Provide separate insulated ground wire in all flexible conduits.
- .5 Rigid PVC Duct
  - .1 Provide separate green insulated copper ground wire in all ducts sized as required by Code.
  - .2 Arrange ducts in horizontal layer separated by plastic spacers to provide spacing between duct centers, as shown on drawings.
  - .3 Support duct bank on plastic spacers 35 mm between ducts. Foundation spacers to maintain at least 76 mm clearance between ducts and exterior coverage.
  - .4 Make joints with tapered couplings to provide a secure watertight connection. Stagger all joints to provide 200 mm vertical and horizontal clearance between adjacent couplings. Where needed, use factory bends to provide bends of radius required.
  - .5 When all ducts are installed, brace whole assembly at each spacer group to prevent duct floating when concrete is placed.
  - .6 Terminate ducts with standard bell ends where ducts enter cable pits, junction boxes and building interiors.

- .7 Cap ends of unused ducts with plug ends of same material as ducts.
- .8 Seal all joints in ducts with solvent cement.
- .6 Liquid-Tight Flexible Conduit
  - .1 Use as raceways at all motors, pipe mounted control devices, and other devices subject to movement or water.
  - .2 At all motors provide short length before connecting to motor terminal box. Minimum length to be 450 mm plus 4 times conduit diameter.
  - .3 Provide separate ground wire within flexible conduit, bonded to motor frames and system ground.

### 3.2 WORKMANSHIP

- .1 Size conduit in accordance with CEC 22.1-15 for all conductors larger than #12 AWG.
- .2 Provide spare capacity in all branch circuit and home run conduits. Conduit fill limitations for #12 AWG conductors as below:
  - .1 21C-6#12, 1#12 ground.
  - .2 27C-8#12, 1#12 ground.
- .3 Install all conduit and wiring concealed, unless otherwise indicated. Do not recess conduit in columns, except as noted, without permission.
- .4 Where conduit is run exposed in unfinished areas, run parallel to building lines. Where conduits are grouped (two or more), space evenly, make bends concentric and mount on Unistrut racks.
- .5 Lay out conduit to avoid interference with other work. Maintain minimum clearance of 150 mm from steam or hot water piping, vents, etc.
- .6 Slabs on grade: Install rigid PVC conduit in gravel base below concrete slabs. Provide mechanical protection around stub-ups through slab and extend 150 mm beyond concrete. When rigid steel conduit is installed in contact with earth it shall be protected by Polykin #940 tape. Extend taping 300 mm above finished grade.
- .7 Do not place conduit in concrete slabs in which slab thickness is less than four times conduit diameter. Place conduits larger than this size under floor. Conduits to have minimum 25 mm concrete cover.
- .8 Where conduits cannot be concealed within concrete pours, route conduits to be concealed within other finishing elements such as furring, bulkheads etc.
- .9 Organize conduit in slabs to minimize crossovers. Obtain approval and minimum concrete cover required from structural engineer prior to installing conduits in slabs.
- .10 All panelboards in unfinished and service spaces are to be installed surface mounted.
- .11 At all new recessed panels cap 2 – 27 mm empty conduits from panel into ceiling space above for future use.
- .12 Provide Brady underground warning tapes 300 mm below grade above all underground conduits. Tape to be yellow warning tape, 150 mm wide.
- .13 Where conduits or ducts enter or exit concrete structures below grade provide 16 mm x 1500 mm steel reinforcing dowels to prevent shearing. Extend dowel 1000 mm beyond concrete and band conduit to dowel. First 3 meter length of conduit extending from structure to be Polykin wrapped rigid steel.
- .14 Where conduit is installed in floor slabs to run up at equipment or motors, carefully check all conduit locations. Verify conduit locations for mechanical equipment from shop drawings or detail drawings. Brace all stub-ups. Stub-ups to be rigid steel.
- .15 Where steel conduit is required to be bent, do not heat, and do not bend conduit in such a way as to reduce pipe cross section area at any point. Radii of bends to be as per Canadian Electrical Code.

- .16 For all runs of conduits, do not include more than equivalent of 4 - quarter bends. Provide conduit fittings, pull boxes and junction boxes where necessary. Pulling elbows to not be used except by special permission.
- .17 Where possible, install conduits so that they are not trapped, cap turned up conduits to prevent entrance of dirt or moisture during construction. Swab out conduit and thoroughly clean internally before wires and cables are pulled.
- .18 Take extreme care in reaming ends of all conduit to ensure a smooth interior finish that will not damage the insulation of the wires.
- .19 Use insulated non-metallic bushings on all conduit terminations.
- .20 Ensure electrical continuity in all conduit systems.
- .21 All conduit in exposed ceiling finished areas is to be free of unnecessary labels and trademarks.
- .22 Install 90 lb. test line in all conduits left empty by Contractor including those which others will pull cables, wires, etc.
- .23 Conduits and ducts crossing building expansion joints to have conduit expansion fittings to suit type of conduit used.
- .24 Seal conduits with duct seal where conduits are run between heated and unheated areas. Where conduits, cables, or cable trays pierce fire separations, seal openings with Dow Corning 3-6548 sealant or approved equal.
- .25 Where conduits pass through walls, they shall be grouped and installed through openings. After all conduits shown on drawings are installed, wall openings to be closed with material compatible with wall construction. Review size and quantity of conduit sleeves with Consultant.
- .26 Where drawings show conduit designations, these conduits to be identified at each point of termination with Thomas & Betts "Ty-Rap" No. TY532M labels.
- .27 Where conduit finish is damaged, repair or replace.
- .28 Use "Conduit" fittings for power and telephone type conduit terminations in lieu of boxes where support is not provided.
- .29 All branch circuit wiring, home-runs, communication and data to be minimum 27 mm diameter unless otherwise stated.
- .30 Where conduits are required to pass through the roof, locations of all penetrations shall be coordinated on site with the General Contractor. Refer to architectural drawings for details.
- .31 Do not install EMT conduit in wet or damp locations.

**END OF SECTION**



## **PART 1 GENERAL**

### **1.1 RELATED SECTIONS**

- .1 Section 26 05 00 – Common Work Results for Electrical.
- .2 Section 26 05 34 – Conduits, Conduit Fastenings and Conduit Fittings.

### **1.2 REFERENCES**

- .1 Canadian Standards Association, (CSA International)
- .2 Insulated Cable Engineers Association, Inc. (ICEA)

## **PART 2 PRODUCTS**

### **2.1 PVC DUCTS AND FITTINGS**

- .1 Rigid PVC duct: to CSA C22.2 No. 211.1, Type DB2/ES2, with moulded fittings, for direct burial, Trade size as indicated. Nominal length: 6 or 3 m plus or minus 12 mm.
- .2 Rigid PVC bends, couplings, reducers, bell end fittings, plugs, caps, adaptors same product material as duct, to make complete installation.
- .3 Rigid PVC 90° and 45° bends.
- .4 Rigid PVC 5° angle couplings.

### **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 Continuous marker tape warning of buried power or telephone cables.

### **2.5 PULL BOXES**

- .1 Approved for underground direct burial, PVC, watertight.

## **PART 3 EXECUTION**

### **3.1 INSTALLATION OF DUCTS**

- .1 Install duct in accordance with manufacturer's instructions.
- .2 Clean inside of ducts before laying.
- .3 Ensure full and even support every 1.5 m throughout duct lengths.
- .4 Slope ducts with 1 to 400 minimum slope.
- .5 During construction, cap ends of ducts to prevent entrance of foreign materials.
- .6 Pull through each duct a wooden mandrel not less than 300 mm long and of a diameter 6 mm less than internal diameter of duct, followed by a stiff bristle brush to remove sand, earth and other foreign matter. Pull stiff bristle brush through each duct immediately before pulling-in cables.

- .7 In each duct install polypropylene pull cord continuous throughout each duct run with 3 m spare rope at each end.
- .8 Install markers at 300 mm below grade for entire length of run.
- .9 After 150mm thick of sand bedding is in place, lay ducts maintaining 75 mm clearance from each side of trench to nearest duct, then cover with an additional 150 mm of sand fill.
- .10 Provide concrete markers above all pull and splice boxes in hard surfaces.

### **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 After installation of cables, seal duct ends with duct sealing compound.

### **3.3 FIELD QUALITY CONTROL**

- .1 Perform tests in accordance with Section 26 05 01 – Electrical General Requirements.
- .2 Perform tests using qualified personnel. Provide necessary instruments and equipment.
- .3 Check phase rotation and identify each phase conductor of each feeder.
- .4 Check each feeder for continuity, short circuits and grounds. Ensure resistance to ground of circuits is not less than 50 megohms.
- .5 Pre-acceptance tests.
  - .1 After installing cable but before splicing and terminating, perform insulation resistance test with 1000 V megger on each phase conductor.
  - .2 Check insulation resistance after each splice and/or termination to ensure that cable system is ready for acceptance testing.
- .6 Acceptance Tests
  - .1 Ensure that terminations and accessory equipment are disconnected.
  - .2 Ground shields, ground wires, metallic armour and conductors not under test.
- .7 Provide Engineer with list of test results showing location at which each test was made, circuit tested and result of each test.
- .8 Remove and replace entire length of cable if cable fails to meet any of test criteria.

**END OF SECTION**

## **PART 1 GENERAL**

### **1.1 WORK INCLUDED**

- .1 Supply and install complete low voltage lighting control system consisting of panels, relays, remote switches, control transformers and automatic control devices.

## **PART 2 PRODUCTS**

### **2.1 SWITCHES**

- .1 Switches to be single pole, momentary action complete with solid state circuitry. Internal circuitry to be continuously conditioned by status of connected relay so that any subsequent operation shall be opposite to the relay position.
- .2 Provide stainless steel coverplates on all switches. Master switch banks to be provided with a single coverplate sized for multiple switches. Locate new master switches at the existing main entrance adjacent to the existing masters.
- .3 Provide nametag on all switches to indicate area to be controlled.
- .4 Master switches to be capable of being programmed to operate any relay or group of relays in any panel.

### **2.2 SENSORS (OCCUPANCY TYPE)**

- .1 DT – 120V line voltage dual technology occupancy sensor using passive infrared and Ultrasonic or Microphonic detection. Pushbutton field programmable detection and timing settings. These detectors to be integrated into local line voltage switching circuit and installed in locations where single technology detectors are not suitable such as large washrooms. Where shown on the mechanical equipment schedule, provide dual internal self-contained relay for control of the local exhaust fan circuit.
- .2 OC – 120V line voltage occupancy sensor using passive infrared detection. Internal self-contained relay for direct line voltage circuit control. Pushbutton field programmable detection and timing settings. These detectors to be installed in areas such as storage rooms, utility rooms or single washrooms where single technology detectors are suitable. Where shown on the mechanical equipment schedule, provide dual internal self-contained relay for control of the local exhaust fan circuit.
- .3 DS - 120V line voltage dual technology occupancy sensor using passive infrared and Ultrasonic or Microphonic detection. Detector to include an inhibit photocell on each relay to keep lights off when adjustable ambient daylight is present. Dual internal self-contained relays for two circuit control. Pushbutton field programmable detection and timing settings.
- .4 Switch OC – 120V wall mounted line voltage occupancy sensor switch using passive infrared detection. Adjustable mode of operation for manual or automatic on function, adjustable auto off function. To be installed in a single gang box and used for single circuit control of lighting in areas such as single offices or meeting rooms.
- .5 Locate occupancy sensors to maximize coverage in accordance with manufacturer's recommendations. In rooms with open ceilings higher than 16 feet, locate sensors as low as possible (on bottom of structural members).

### **2.3 ACCEPTABLE PRODUCTS**

- .1 Douglas
- .2 Wattstopper
- .3 Hubbell
- .4 LC&D Lighting Controls

**PART 3        EXECUTION**

**3.1            INSTALLATION**

- .1        All leads for line voltage connections to be 2.5 m minimum length.
- .2        Locate occupancy sensors to maximize coverage in accordance with manufacturer's recommendations. In rooms with open ceilings higher than 16 feet, locate sensors as low as possible (on bottom of structural members).

**END OF SECTION**

**PART 1 GENERAL**

**1.1 SHOP DRAWINGS**

- .1 Submit shop drawings in accordance with Section 26 05 00 – Common Work Results for Electrical.
- .2 Drawings to include electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.

**PART 2 PRODUCTS**

**2.1 PANELBOARDS**

- .1 Panelboards: product of one manufacturer.
  - .1 Install circuit breakers in panelboards before shipment.
  - .2 In addition to CSA requirements manufacturer's nameplate must show fault current that panel including breakers has been built to withstand.
- .2 250V panelboards: bus and breakers rated for 22 A (symmetrical) interrupting capacity or as indicated.
- .3 Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number and phase.
- .4 Panelboards: mains, number of circuits, and number and size of branch circuit breakers as indicated.
- .5 Two keys for each panelboard and key panelboards alike.
- .6 Copper bus with neutral of same ampere rating as mains.
- .7 Mains: suitable for bolt-on breakers.
- .8 Trim with concealed front bolts and hinges.
- .9 Surface mounted panelboards to be provided with covers and drip shields intended for surface mounted tubs.
- .10 Finish: grey.

**2.2 BREAKERS**

- .1 Breakers with thermal and magnetic tripping in panelboards except as indicated otherwise.
- .2 Lock-on devices for 10% of breakers installed as indicated. Turn over unused lock-on devices to Owner.

**2.3 EQUIPMENT IDENTIFICATION**

- .1 Provide equipment identification in accordance with Section 26 05 00 – Common Work Results for Electrical.
- .2 Complete circuit directory with typewritten legend showing location and load of each circuit.

**2.4 ACCEPTABLE PRODUCTS**

- .1 Eaton
- .2 Square D
- .3 Siemens

**PART 3 EXECUTION**

**3.1 INSTALLATION**

- .1 Locate panelboards as indicated and mount securely, plumb, true and square, to adjoining surfaces.
- .2 Install surface mounted panelboards on plywood backboards. Where practical, group on common backboard.
- .3 Connect loads to circuits.
- .4 Connect neutral conductors to common neutral bus with respective neutral identified.

**END OF SECTION**

**PART 1 GENERAL**

**1.1 WORK INCLUDED**

- .1 Provide and connect all wiring devices for the complete installation.

**PART 2 PRODUCTS**

**2.1 MANUFACTURER**

- .1 Wiring devices to be of one manufacture throughout project.
- .2 Manufacturers to be Hubbell, Leviton, Smith and Stone or Pass & Seymour.

**2.2 DEVICES**

- .1 Catalogue numbers shown below are for particular manufacturer's series and all necessary suffixes to be added for requirements as stated. All devices to be specification grade minimum and wherever possible be of same manufacture.
- .2 Devices to be white with stainless steel coverplates in all but mechanical areas unless noted otherwise. Use galvanized steel coverplates in mechanical areas and for surface mounted devices.

**2.3 SWITCHES**

- .1 120 volt, 20 amp, single and double pole, three and four-way: Hubbell No. 1221, 1222, 1223 and 1224 or equivalent.
- .2 Manually - operated general purpose white AC switches to have the following features:
  - .1 Terminal holes approved by AWG #10 wire.
  - .2 Silver alloy contacts.
  - .3 Urea or melamine molding for parts subject to carbon tracking.
  - .4 Suitable for back and/or side wiring.

**2.4 DIMMERS**

- .1 120 V, solid state slider type suitable for dimming of LED loads, white color, Leviton.

**2.5 RECEPTACLES**

- .1 The project is to utilize 15A receptacles throughout unless specifically noted otherwise on the electrical drawings or schedules.
- .2 Duplex 20 ampere, t-slot, 120 volt, 3 wire, white, U-ground, Hubbell No. 5352W with the following features:
  - .1 White urea molded housing.
  - .2 Suitable for #10 AWG for back and side wiring.
  - .3 Eight back wired entrances, four side wiring screws.
  - .4 Break-off links for use as split receptacles.
  - .5 Triple wipe contacts and rivetted grounding contacts.
- .3 Duplex 20 ampere, 120 volt, 3 wire, white, U-ground ground fault receptacle, Hubbell No. GF-5361 or equivalent.
- .4 Duplex 20 ampere, 120 volt, 3 wire, U-ground, blue surge suppression receptacle, audible alarm and visual indicating light, Hubbell No. 5362S or equivalent.
- .5 Duplex 20 ampere, 120 volt, 3 wire, U-ground, white, two USB ports, 3am, 5VDC, Type A, green LED specification grade. Hubbell No. USB20X2W or equivalent.

**2.6 COVERPLATES**

- .1 Provide coverplates for all wiring devices.
- .2 Use sheet steel utility box cover for wiring devices installed in surface mounted utility boxes.
- .3 Use stainless steel 1 mm thick coverplates on all wiring devices mounted in flush-mounted outlet boxes unless otherwise specified.
- .4 Weatherproof coverplates where receptacles would be exposed to weather when in use.

**PART 3 EXECUTION**

**3.1 INSTALLATION**

- .1 Install receptacles vertically in gang type outlet box when more than one receptacle is required in one location.
- .2 Protect cover plate finish with paper or plastic film until all painting and other work is finished, then remove paper.
- .3 Install suitable common coverplates where wiring devices are grouped. Do not distort plates by tightening screws excessively.
- .4 Do not use coverplates meant for flush outlet boxes on surface mounted boxes.
- .5 Wherever possible, mount equipment in straight line at uniform mounting height, coordinated with other equipment and materials.

**END OF SECTION**



**PART 1 GENERAL**

**1.1 PRODUCT DATA**

- .1 Submit product data in accordance with Section 26 05 00 – Common Work Results for Electrical.
- .2 Include time-current characteristic curves for breakers with interrupting capacity of 22,000 A symmetrical (rms) and over at system voltage.

**PART 2 PRODUCTS**

**2.1 BREAKERS GENERAL**

- .1 Bolt-On Moulded Case Circuit Breaker: Quick-make, quick-break type, for manual and automatic operation with temperature compensation for 40°C ambient.
- .2 Common-Trip Breakers: With single handle for multi-pole applications.
- .3 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting. Trip settings on breakers with adjustable trips to range from 3-8 times current rating.
- .4 Circuit breakers with interchangeable trips as indicated.

**2.2 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.

**2.3 MAGNETIC BREAKERS**

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

**2.4 SOLID STATE TRIP BREAKERS**

- .1 Moulded case circuit breaker to operate by means of a 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 fault short circuit protection.

**PART 3 EXECUTION**

**3.1 INSTALLATION**

- .1 Install circuit breakers as indicated.
- .2 All breakers 400A and larger to have a solid state trip unit type breaker.
- .3 Identification: Provide lamacoid plate on each breaker showing voltage, source of supply and load being fed (i.e. CDP-1, 120/208 V, 400A fed from MDP-1).

**END OF SECTION**

**PART 1 GENERAL**

**1.1 DESCRIPTION**

- .1 Provide ground fault protective system as indicated on the drawings.

**PART 2 PRODUCTS**

**2.1 MATERIALS**

- .1 Components comprising ground fault protective system to be of same manufacturer.

**2.2 BREAKER TYPE GROUND FAULT INTERRUPTER**

- .1 Single pole ground fault circuit interrupter for 15A, 120V, 1 phase circuit c/w test and reset facilities.

**2.3 GROUND FAULT PROTECTOR UNIT**

- .1 Self-contained with 15 A, 120 V circuit interrupter and duplex receptacle complete with:
  - .1 Solid state ground sensing device
  - .2 Facility for testing and reset
  - .3 CSA Enclosure 1, flush mounted with stainless steel face plate.

**PART 3 EXECUTION**

**3.1 INSTALLATION**

- .1 Connect supply and load wiring to equipment in accordance with manufacturer's recommendations.

**END OF SECTION**

## **PART 1 GENERAL**

### **1.1 WORK INCLUDED**

- .1 Prior to tendering, the Contractor and all subcontractors and suppliers shall read and be governed by all Parts, Specification Sections, Drawings and Addenda of the Tender and Contract Documents which affect the respective work of each.
- .2 The complete work under this Contract shall be governed by the dictates of good practice and shall be complete in all details of materials and methods even if not minutely specified. The work shall be properly coordinated with the requirements of all work specified in other sections. The work includes testing as specified, start up and placing of the work into operation (commissioning), ready for use by the Owner.

### **1.2 SCOPE OF WORK**

- .1 It is the intent of this specification to secure an outdoor, skid based, enclosed prime power generator system that has been prototype tested, is factory built, production tested, and site tested, of the latest commercial design, together with all accessories necessary for a complete installation as shown on the plans and drawings, and specifications.
- .2 The equipment supplied and installed shall meet the requirements of the Canadian Electrical Code, and all applicable local codes and regulations. All equipment shall be new, of current production of a national firm which manufactures the generator, control panel, battery and battery charger, fuel and exhaust systems, and assembles the generator set as a matched unit where there is a single source responsibility for warranty, part, and service through a local representative with factory-trained servicemen.
- .3 The site is at an approximate elevation of 1255m (4120ft) and the unit, under derating for the elevation, must deliver the values stated below. This may require a larger engine or turbocharging to achieve.

### **1.3 CODES AND STANDARDS**

- .1 The generator set shall conform to the requirements of the following codes and standards, as applicable. The generator set shall include necessary features to meet the requirements of these standards.
- .2 ANSI S1.13-2005 – Measurement of Sound Pressure Levels in Air
- .3 NFPA 30 – Flammable and Combustible Liquids
- .4 NEMA MG1-2009 – Alternator shall comply with the requirements of this standard
- .5 UL1236- Battery Chargers
- .6 ISO 9001 – The generator set manufacturer shall be certified to ISO 9001 International Quality Standard and shall have third party certification verifying quality assurance in design/development, production, installation, and service, in accordance with ISO 9001.
- .7 The engine used in this generator set shall comply with U.S. EPA and California emission regulations under the provisions of 40 CFR 89, Non-road (Mobile Off Highway) Tier 3 emissions limits and Transitional Program for Equipment Manufacturers (TPEM) when tested per ISO 8178 D2.
- .8 Controller Certifications
  - .1 CSA 22.2 No. 14 M91: Industrial Controls
  - .2 ISO8528-4:2005 Compliance; Controls and Switchgear

- .3 EN 50081-1,2: Residential/Light Industrial Emissions or Industrial Emissions
- .4 EN 50082-1,2: Residential/Light Industrial or Industrial Susceptibility
- .5 ISO 7637-2, level 2: DC Supply Surge Voltage Test

#### 1.4 SUBMITTALS

- .1 Submittals shall include prototype test certification and specification sheets showing all standard and optional accessories to be supplied, schematic wiring diagrams, dimension drawings, and interconnection diagrams identifying by terminal number each required interconnection between the generator set and distribution.
- .2 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

#### 1.5 TESTING

- .1 To assure that the equipment has been designed and built to the highest reliability and quality standards, the manufacturer and local representative shall be responsible for three separate tests: design prototype tests, final production tests, and site tests.
  - .1 Design Prototype Tests: Components of the propane prime power system such as the engine/generator set, and accessories shall not be subjected to prototype tests since the tests are potentially damaging. Rather, similar design prototypes and preproduction models, which will not be sold, shall have been used for the following tests.
    - .1 Maximum power (kW).
    - .2 Maximum motor starting (kVA) at 20% instantaneous voltage dip.
    - .3 Alternator temperature rise by embedded thermocouple and by resistance method per NEMA MG1-22.40 and 16.40.
    - .4 Governor speed regulation under steady-state and transient conditions.
    - .5 Voltage regulation and generator transient response.
    - .6 Fuel consumption at 1/4, 1/2, 3/4 and full load.
    - .7 Harmonic analysis, voltage waveform deviation, and telephone influence factor.
    - .8 Single-phase short circuit tests.
    - .9 Alternator cooling air flow.
    - .10 Torsional analysis testing to verify that the generator set is free of harmful torsional stresses.
    - .11 Endurance testing.
  - .2 Final Production Tests: Arrange for a plant test before shipment, attended by a representative of the Engineer. Notify the Engineer, in writing, five working days in advance that unit is ready for test. Test the complete propane generator unit prior to delivery, under various load conditions including 10% overload. Conduct with a suitable constant resistance type load bank. Use the control panel specified. Test to be as follows:
    - .1 Load test of 100% load for 4 hours continuous (no interruption).
    - .2 During 15 minute intervals over the 4 hour test, record the following data:
      - .1 Voltage.
      - .2 Load.

- .3 Frequency.
- .4 Inlet and Discharge Cooling Air Temperature.
- .5 Oil Temperature.
- .6 Oil Pressure.
- .7 Battery Voltage and Current.
- .8 Exhaust Gas Temperature.
- .3 Upon completion of the full load and overload test demonstrate the following:
  - .1 Overhead protection, both in the lubricating oil and cooling air circuits.
  - .2 Low oil pressure protection.
  - .3 Overspeed protection.
  - .4 Overcranking protection.
  - .5 Demonstrate all alarm and shutdown points are functional.
  - .6 Unit is shut down and visual inspection carried out to determine that materials, workmanship, dimensions and design conform with specified requirements as well as functioning of systems being satisfactory.
- .3 Site Tests: An installation check, start-up, both a building load test and a resistive portable load bank test shall be performed by the manufacturer's local representative. The Engineer, regular operators, and the maintenance staff shall be notified of the time and date of the site test. The tests shall be identical to the tests conducted under Item 1.3.2, Final Production Tests.
  - .1 Duration of 100% load test shall be 4 hours continuous (no interruptions).
  - .2 Data shall be recorded at 15 minute intervals for the entire test period.
  - .3 For the duration of the site test observe the operation of the unit ventilation system. Ensure that dampers operate to open and regulate the enclosure temperature. Record enclosure temperatures at 15 minute intervals for the entire test period.
  - .4 Should the final production test or a site test fail, the equipment shall be repaired to the satisfaction of the Engineer and a complete re-test of full duration as specified shall be conducted. The previous test shall be considered void.

## **1.6 USER TRAINING**

- .1 Provide a minimum of 4 hours of on-site user training in the operation, care and maintenance of the Power Generation System for the owner's regular operators and maintenance staff.

## **1.7 WARRANTY**

- .1 The generator system shall be warranted by the manufacturer for one year, from the date of final acceptance and turnover.

## **PART 2 PRODUCTS**

### **2.1 PRIME POWER GENERATION**

- .1 The generator set shall be rated continuous prime power (continuous for the duration of park operation season) 120/240 Volts, 1 phase, 3 wire, 37 kW, 37 kVA, 1.0 P.F.
  - .1 The generator set shall be capable of starting motor loads, with maximum voltage dip of 20% with established operating loads as indicated on the single line diagram of this project
  - .2 Vibration isolators shall be provided between the engine-generator and heavy-duty steel base. The unit will be mounted on a towable, heavy steel skid base.

### **2.2 ENGINE**

- .1 The engine shall operate on commercially available propane fuel and shall deliver rated continuous power at a governed speed of 1,800 rpm at the site elevation of 1255m (4120ft). The engine shall be equipped with the following:
  - .1 Fuel System:
    - .1 Electric solenoid control for propane fuel, fuel filters and electric solenoid fuel shut-off valve.
    - .2 Provide a pressure relief vent kit.
  - .2 Cooling System:
    - .1 Liquid cooled: heavy duty industrial coolant.
    - .2 Unit-mounted radiator, blower fan, water pump, thermostat, and radiator duct flange to properly cool the engine at 50°C ambient with up to 13 mm H2O static pressure on the fan.
    - .3 Cooling system to be designed to maintain manufacturer's recommended engine temperature at 100% prime power load, at the specified site elevation.
  - .3 Governor:
    - .1 Electronic actuator, speed droop externally adjustable from isochronous to 5%, temperature compensated with steady state speed maintenance capability of plus or minus 0.50%.
  - .4 Lubrication System:
    - .1 Pressure lubricated by engine driven pump.
    - .2 Lube oil filter: replaceable, full flow type, removable without disconnecting piping.
    - .3 Engine sump drain valve.
    - .4 Oil level dip-stick.
  - .5 Electric Starter:
    - .1 Positive shift, gear engaging starter 12 VDC.
    - .2 Lead acid, 12 V storage battery with lockable battery disconnect switch.
    - .3 Battery charger:
  - .6 Vibration isolated engine instrument panel with:
    - .1 Lube oil pressure gauge.

- .2 Lube oil temperature gauge.
- .3 Coolant temperature gauge.
- .4 Running time meter: non-tamper type.
- .7 Provide guards to protect personnel from moving parts. Locate guards such that normal daily maintenance inspections can be undertaken without their removal.
- .8 Removable drip tray under engine, with drain tube forward to front of skid.
- .9 Dry type replaceable air cleaner elements for heavy duty application.

## 2.3

### GENERATOR

- .1 The alternator shall be single bearing, synchronous type, brushless, self-ventilated of drip-proof construction with amortisseur rotor windings and skewed for smooth voltage waveform. The insulation shall meet the NEMA standard (MG1-22.40 and 16.40) for Class H and be insulated with epoxy varnish to be fungus resistant per MIL 1-24092. Temperature rise of the rotor and stator shall be limited to NEMA Class F ratings. The excitation system shall be of brushless construction controlled by a solid-state voltage regulator capable of maintaining voltage within  $\pm 2\%$  at any constant load from 0% to 100% of rating. The regulator must be isolated to prevent tracking when connected to SCR loads, and provide individual adjustments for voltage range, stability, and volts-per-hertz operations.
- .2 Upon one-step application of any load up to 90% of the rated load at 0.8 power factor, the voltage dip shall not exceed 20% and shall recover to 2% of rated voltage within one second.
- .3 The generator shall be capable of sustaining at least 250% of rated current for at least 10 seconds under a symmetrical short by inherent design or by the addition of an optional current boost system.
- .4 A re-settable line current sensing circuit breaker with inverse time versus current response shall be furnished to protect the generator from damage. This breaker shall not trip within the 10 seconds specified above to allow selective tripping of downstream fuses or circuit breakers under a fault condition. This breaker shall not automatically reset preventing restoration of voltage if maintenance is being performed. Field current-sensing breaker will not be acceptable.
- .5 The alternator shall be the maintenance-free single bearing type, mounted directly to the engine flywheel housing with a semi-flexible coupling between the rotor and the flywheel.
- .6 Gen Set Controller
  - .1 A vibration isolated unit controller shall be mounted on the generator enclosure. The microprocessor control board shall be moisture proof and capable of operation from  $-40^{\circ}\text{C}$  to  $85^{\circ}\text{C}$ . Relays will only be acceptable in high-current circuits.
  - .2 Circuitry shall be of plug-in design for quick replacement. Controller shall be equipped to accept a plug-in device capable of allowing maintenance personnel to test controller performance without operating the engine. The controller shall include:
    - .1 Fused DC circuit.
    - .2 Capable of two-wire start/stop control which shall be jumpered out in this application.
    - .3 Speed sensing and a second independent starter motor disengagement systems shall protect against starter engagement with a moving flywheel.

Battery charging alternator voltage will not be acceptable for this purpose.

- .4 Circuitry to shut down the engine when signal for high coolant temperature, low oil pressure, or overspeed are received.
- .5 Two-position (RUN - OFF) selector switch. In the RUN position, the engine shall start and operate properly, unless a fault condition occurs.
- .6 In the OFF position, the engine shall not start. This position shall also provide for immediate shutdown in case of an emergency. Reset of any fault shall also be accomplished by putting the switch to the OFF position.
- .7 Indicating lights to signal:
  - .1 Fuel Level Indicator
  - .2 Overcrank, Red
  - .3 Emergency Stop, Red
  - .4 High Water Temperature, Red
  - .5 Overspeed, Red
  - .6 Low Oil Pressure, Red
  - .7 Low Coolant Level
- .8 Provide a test button for indicating lights.
- .9 Terminals shall be provided for common fault and common pre-alarm.
- .10 The digital instrument panel to include the following readings:
  - .1 oil pressure
  - .2 engine water temperature
  - .3 DC battery voltmeter
  - .4 AC ammeter
  - .5 AC voltmeter
  - .6 frequency meter
  - .7 meter range selector switch
  - .8 running time meter
  - .9 generator output voltage adjust rheostat
  - .10 emergency stop switch.
- .11 Gauges able to be illuminated for night viewing.

## **2.4 EXHAUST SYSTEM**

- .1 The exhaust system shall be "hospital grade" type. The silencer should achieve 45 dba sound reduction at 1 metre from the exhaust exit. Provide exhaust transition from engine manifold or turbocharger to a single flanged flex adapter to the muffler.
- .2 Heavy duty exhaust pipe with flanged couplings as required.
- .3 Fittings and accessories as required.
- .4 Expansion joints: stainless steel, corrugated, of suitable length, to absorb both vertical and horizontal expansion.



**2.5 FUEL TANK**

- .1 Site propane tank will be provided by others. The contract is responsible for temporary fuel tank for factory and site tests, and for on engine carburetor / vapourizer and gas piping.

**2.6 ENCLOSURE**

- .1 Durable steel, sound attenuating enclosure with quiet operation at 68dB(A) log average at 7m (23ft.) at full load at prime rating. Acoustic insulation to meet UL 94 HF1 flammability classification and repel moisture absorption.
- .2 Fade, scratch and corrosion resistant automotive grade textured finish.
- .3 Stainless steel hinges and lockable latches on doors.

**2.7 HEAVY DUTY SKID BASE**

- .1 Heavy steel skid base suitable for moving generator using heavy equipment.

**2.8 ACCESSORIES - INSTALLED**

- .1 The following accessories shall be installed:
  - .1 Overvoltage protection will shut down the unit after one second of 15% or more overvoltage.
- .2 Line circuit breaker.

**2.9 ACCESSORIES - SHIPPED**

- .1 The following accessories shall be shipped loose:
  - .1 Battery rack, battery cables, 12-volt battery capable of delivering the manufacturer's recommended minimum cold-cranking amps required at -18°C.
  - .2 10 Ampere automatic float and equalize battery charger with  $\pm 1\%$  constant voltage regulation from no load to full load over  $\pm 10\%$  AC input line variation, current limited during engine cranking and short circuit conditions, temperature compensated for ambients from -40°C to +60°C, 5% accurate voltmeter and ammeter, fused, reverse polarity and transient protected.

**2.10 RECOMMENDED SPARES**

- .1 The vendor will assemble and include with the unit a full set of air, oil and fuel filter spares, spare belt(s), and lubricants (other than engine oil) or other fluids (other than coolant), together with any special wrenches or tools required to replace these normal maintenance items, such as would be consumed in a one year period in the normal maintenance of a prime power generator set. Bulk liquids such as engine oil, coolant are not to be included.

**PART 3 EXECUTION**

**3.1 ASSEMBLY**

- .1 Generator set complete with fuel tank, radiator, enclosure, line circuit breaker and instrument panel shall be factory assembled.
- .2 Install unit on towable steel rail skid base to be installed on gravel pad as indicated on drawings.
- .3 Install loose accessories and make required connections.
- .4 Turn over maintenance and spare parts, and manuals to owner.

**3.2 FUEL OIL PIPING**

- .1 Install fuel oil piping and accessories in accordance with CSA B139-1976, Installation Code for Oil Burning Equipment and with applicable National, Provincial and Local Codes.

**3.3 FIELD TESTS**

- .1 Provide site tests as specified in this section.
- .2 Provide all fuel required for testing, and re-fill tank for turnover to the owner. Fuel shall be Propane, obtained from a recognized agent.

**END OF SECTION**

## **PART 1 GENERAL**

### **1.1 WORK INCLUDED**

- .1 Supply and install lighting fixtures complete with lamps, ballasts and all fittings.

### **1.2 CODE REQUIREMENTS**

- .1 Installation of lighting equipment to conform to Section 30, Canadian Electric Code, Part 1, and as amended or supplemented by provincial, municipal or other regulatory agencies having jurisdiction.

### **1.3 SHOP DRAWINGS**

- .1 Submit complete list of types of lighting fixtures, lamps, ballasts and accessories with catalogue illustrations, data sheets, etc. for review.
- .2 Submit complete photometric data, based on actual fixtures proposed for project. Substantiate brightness and efficiency requirements. Photometric data must be produced by recognized independent laboratory.

### **1.4 LAMPS USED FOR TEMPORARY LIGHTING**

- .1 Fluorescent lamps may be used for temporary light and lamps used for this purpose will be accepted when project or portions of work are turned over to Owner. Spot re-lamp faulty or burned out lamps prior to this acceptance, without additional cost to the owner.

## **PART 2 PRODUCTS**

### **2.1 MATERIALS**

- .1 Provide only lighting fixtures which are structurally well designed and constructed and which use new parts and materials of highest commercial grade available.
- .2 Use cadmium plated chains for suspended fixtures in unfinished areas.

### **2.2 LAMPS**

- .1 LED lamps: input watts and lumen output as per individual fixture specification. Color temperature, 3000K, dimmable integral driver.
- .2 LED lamps: input watts and lumen output as per individual fixture specification. Color temperature, 3000K, dimmable integral driver.

### **2.3 LUMINAIRE SCHEDULE AND REQUIREMENTS**

- .1 Refer to drawings for luminaires schedule. The general requirements and features of the products are as listed on the product description.
- .2 All fixtures will also be required to meet the testing and documentation requirements as described below. Include for additional testing in accordance with the referenced IES standards if required.
- .3 All linear luminaires to have photometric data in accordance with IES LM-79 "Electrical and Photometric Measurements of Solid State Lighting Products".
- .4 The LED's to be tested and have test results in accordance with IES LM-80 "Measuring Lumen Maintenance of LED Light Sources".
- .5 Lumen maintenance as per IES TM-21-11 "Projecting Long Term Lumen Maintenance of LED Light Sources" to be minimum of 60,000 hours at L70.
- .6 The luminaire must have replaceable drivers and LED arrays. For recessed fixtures, they must be serviceable from below.

- .7 Luminous efficacy of the source to be a minimum of 85 lumens per watt, delivered fixture lumens.
- .8 Provide 2 spare drivers of each different type of driver on the project at project completion.

## **2.4 REQUEST FOR APPROVAL PROCESS DURING TENDER**

- .1 Request for approval for equal / alternate fixtures to be submitted in accordance with Section 26 05 00 – Common Work Results for Electrical. If submitted products are deemed acceptable, notification will be made in the form of a formal addendum.

## **PART 3 EXECUTION**

### **3.1 INSTALLATION**

- .1 Install fixtures in accordance with manufacturer's requirements, code requirements, and as shown on drawings.
- .2 Confirm compatibility and interface of other materials with luminaire and ceiling systems. Examine room finish schedule and reflected ceiling drawings. Report discrepancies and defer ordering until clarified.
- .3 Supply plaster frames, trim rings and backboxes to other trades as work requires.
- .4 Ground lighting equipment to metal raceway, armour of armoured cable, or to a separate grounding conductor.
- .5 Co-ordinate with other trades to avoid conflicts between luminaires, supports and fittings and mechanical and structural equipment.
- .6 Provide guards where fixtures are subject to mechanical damage.
- .7 Location of lighting control occupancy sensor are diagrammatic only. Confirm final location of all sensors on site with the Engineer. Calibrate time settings for all sensors and submit settings with testing documentation.

### **3.2 WORKMANSHIP**

- .1 Completely clean all glassware, lamps, and hangers. Polish metal parts before completion.
- .2 Protect fixtures, hangers, supports, fastenings and accessory fittings at site prior to and during installation. Unless fixtures are erected immediately, after delivery to site, deliver in original cartons or enclosed in air-tight plastic wrapping. Store in dry and secure space on site. Protect hangers, supports, fastenings and accessory fittings against corrosion. Take care during installation to ensure that insulation and corrosion protection is not damaged.
- .3 Fixtures which show evidence of corrosion, rough handling, scratching of finishes, etc. are to be replaced with new fixtures at no additional cost.
- .4 Install recessed fixtures to permit removal from below, for access to outlet or prewired fixture box.
- .5 Hang and mount fixtures to prevent distorting fixture frame, housing, sides or lens frame, and permit correct alignment of several fixtures in a row.
- .6 Support fixtures as shown on drawings, level, plumb and true with structure and other equipment in horizontal or vertical position as intended. Install wall or side bracket mounted fixture housings rigidly and adjust to neat flush fit with mounting surface.
- .7 Adjust length of hangers of suspended fixtures to hang fixture bodies level and in same horizontal plane, unless shown otherwise.
- .8 Install ceiling canopies to cover suspension attachments and fit tightly to ceiling without restricting alignment of hanger.

- .9 For recessed fluorescent or LED fixtures mounted in suspended ceiling with exposed tee bar grid system, support by ceiling tee bar grid structure. Provide any additional support necessary for oversize fixtures, or to meet code requirements.
- .10 Metal inserts, expansion bolts or toggle bolts which do not carry wiring to be accurately located in relation to outlet boxes, for perfect alignment and spacing of suspension stems or other hangers.

**END OF SECTION**

**PART 1 GENERAL**

**1.1 WORK INCLUDED**

- .1 Supply emergency lighting units throughout the school as shown on the electrical drawings.

**1.2 SPECIAL CODES**

- .1 Canadian Electric Code, Part 1, Section 46 "Emergency Systems, Unit Equipment and Exit Signs".
- .2 CSA Standard C22.2 No. 141 "Unit Equipment for Emergency Lighting".
- .3 Alberta Building Code

**1.3 PRODUCT DATA**

- .1 Submit product data in accordance with Section 26 05 00 – Common Work Results for Electrical.
- .2 Data to indicate system components, mounting method, source of power and special attachments.

**1.4 WARRANTY**

- .1 For batteries, extend the 12 months warranty period to a 10 year warranty period with a no-charge replacement during the first year and a pro-rate charge on the next 9 years.

**PART 2 PRODUCTS**

**2.1 GENERAL**

- .1 Supply and install battery power emergency lighting where shown on the drawings. Lights are to switch "ON" automatically in the event of failure of normal power, and "OFF" on restoration of power. The batteries shall be automatically recharged from a 120 VAC supply.
- .2 Voltage sensing relays shall be used on all circuits supplying power to lighting. In the event that any or all of the lighting circuits lose power, relays will turn off power to all emergency battery pack circuits connected to the same panelboard.

**2.2 EQUIPMENT**

- .1 Supply voltage: 120V, ac.
- .2 Output voltage: 12V dc.
- .3 Operating time: 60 min.
- .4 Charger: solid state, multi-rate, voltage/current regulated, inverse temperature compensated, short circuit protected with regulated output of plus or minus 0.01 V for plus or minus 10% input variations.
- .5 Solid state transfer circuit.
- .6 Low voltage disconnect: solid state, modular, operates at 80% battery output voltage.
- .7 Signal lights: solid state, for 'AC Power ON' and 'High Charge'.
- .8 Lamp heads: dual heads integral on unit and remote, 345° horizontal and 180° vertical adjustment. Lamp type: LED, 9 watt.
- .9 Cabinet: suitable for direct or shelf mounting to wall and c/w knockouts for conduit. Removable or hinged front panel for easy access to batteries.
- .10 Auxiliary equipment:
  - .1 Test switch

- .2 Time delay relay
- .3 Battery disconnect device
- .4 ac input and dc output terminal blocks inside cabinet
- .5 Cord and single twist-lock plug connection for ac

## **2.3 LINE CONNECTION**

- .1 Each battery unit shall be equipped with AC line cord and twistlock plug.

## **2.4 UNITS**

- .1 Units to contain solid state battery charger, transfer switch and batteries. Provide all relays, hardware and circuitry for operation specified. Units to have push-to-test switch, "ON" and "charging" lights with extended lamp life.

## **2.5 BATTERIES**

- .1 Unless specifically indicated provide batteries of sufficient watt-hour capacity to power the loads connected to each individual unit for 30 minutes, 12 volt, 10 year long life, maintenance free, sealed lead acid batteries, contained within the units.

## **2.6 REMOTE LIGHTING UNITS**

- .1 12VDC input voltage, injection molded thermoplastic, white with 2 x Par38 lamp holders, adjustable swivel heads, 9 watt LED PAR style lamps. Provide matching white wire guards on all fixtures.

## **2.7 ACCEPTABLE MANUFACTURERS:**

- .1 Aimplite, Lumacell, Redilite, Stanpro.

# **PART 3 EXECUTION**

## **3.1 INSTALLATION**

- .1 Mount battery units with the bottom of the enclosure not less than 2.4 m above the floor, where practicable.
- .2 Install twistlock receptacle adjacent to unit and connect to 1Ø, 120V circuit indicated.
- .3 Provide lock dogs on circuit breakers feeding emergency lighting equipment.

**END OF SECTION**

**PART 1 GENERAL**

**1.1 WORK INCLUDED**

- .1 Provision of exit lighting units connected to a 120VAC and 12VDC circuit wiring.
- .2 Submit product data in accordance with Section 26 05 00 – Common Work Results for Electrical.

**PART 2 PRODUCTS**

**2.1 STANDARD UNITS**

- .1 Fixture type X1
  - .1 Housing: steel housing, painted white finish.
  - .2 Face and back plates: painted white steel.
  - .3 Lamps: LED-2W, 120 VAC/ 12VDC.
  - .4 Operation: designed for 25 years of continuous operation without relamping.
  - .5 Running man snap in universal face, directional indicators on plate as require to indicate direction of travel. Green in color.
  - .6 Downlight: white glass in bottom of unit.
  - .7 Emergency power connection: 12VDC
  - .8 Universal mounting with directional arrows as shown on the drawings.

**2.2 ACCEPTABLE MANUFACTURERS:**

- .1 Aimlite, Lumacell, Redilite, Stanpro.

**PART 3 EXECUTION**

**3.1 INSTALLATION**

- .1 Install exit lights.
- .2 Connect fixtures to emergency 120VAC and 12VDC circuits.
- .3 Ensure that exit light circuit breaker is locked in on position.

**END OF SECTION**



## **PART 1 GENERAL**

### **1.1 RELATED WORK**

- .1 Section 26 05 00 – Common Work Results for Electrical
- .2 Section 26 05 34 – Conduits, Conduit Fastenings and Conduit Fittings.
- .3 Section 26 05 36 – Cabletroughs.

### **1.2 REFERENCES**

- .1 CSA T527 (ANSI/EIA/TIA 607), Grounding and Bonding for Telecommunications in Commercial Buildings.
- .2 CSA C22.1, Canadian Electrical Code Part 1.
- .3 American Society for Testing and Materials (ASTM):
  - .1 ASTM D4566-08, Standard Test Methods for Electrical Performance Properties of Insulations and Jackets for Telecommunications Wire and Cable
- .4 Canadian Standards Association (CSA):
  - .1 CAN/CSA C22.2 No. 182.4-M90 (R2010), Plugs, Receptacles, and Connectors for Communication System
  - .2 CAN/CSA C22.2 No. 214-08, Communications Cables (Bi-national standard, with UL 444)
  - .3 CSA T568.1-05 (R2010), Commercial Building Telecommunications Cabling Standard - Part 1: General Requirements (and all addenda)
  - .4 CSA T568.2-05 (R2010), Commercial Building Telecommunications Cabling Standard - Part 2: Balanced Twisted-Pair Cabling Components (and all addenda)
  - .5 CAN/CSA T530-99, Commercial Building Standard for Telecommunications Pathways and Spaces (Adopted ANSI/TIA/EIA-569-A)
- .5 Electronic Components Association (CEA)/Electronic Industries Association (EIA):
  - .1 ECA/EIA 310-E-2005, Cabinets, Racks, Panels, and Associated Equipment
- .6 Electronic Industries Association (EIA)/Telecommunications Industry Association (TIA):
  - .1 TIA 526-7-02, Measurement of Optical Power Loss of Installed Single-Mode Fibre Cable plant
  - .2 TIA/EIA 568-B SET 2008, Commercial Building Telecommunications Cabling Standards - Parts 1, 2, 3 Complete
  - .3 TIA/EIA 569B-2008, Commercial Building Standard for Telecommunication Pathways and Spaces
  - .4 TIA 604-2-2004, Fibre Optic Connector Intermateability Standards (FOCIS-2)
  - .5 TIA/EIA 604-3-2004 Fibre Optic Connector Intermateability Standards (FOCIS-3)
  - .6 TIA/EIA 606-A-2002, Administration Standard for Telecommunications Infrastructure
- .7 Underwriters Laboratories Canada (ULC):
  - .1 ULC S102.4-10, Standard Method of Test for Fire and Smoke Characteristics of Electrical Wiring and Cables
  - .2 ULC S139-00, Standard Method of Fire Test for Evaluation of Integrity of Electrical Cables

### **1.3 SUBMITTALS**

- .1 Submit shop drawings in accordance with Division 01. Include manufacturer's technical documentation related to cabling system.

- .2 Provide the following submittals before starting any work of this Section:
  - .1 Shop Drawings: Submit shop drawings of detailed elevation for data backboard, showing complete layout of all termination equipment complete with dimensions and indicating detailed elevation of front and rear for each data equipment rack showing layout of all termination equipment complete with dimensions; completed using AutoCAD drawing format.
  - .2 Labeling: Submit proposed cabling system labeling for cable installation based on TIA/EIA 606-A for review and acceptance by Consultant; proposed labeling shall clearly identify all components of the cabling system including; but not be limited to, racks, cables, panels and outlets, and as follows:
    - .1 Label each cable with a unique identifier designating cable origin and destination within the system.
    - .2 Label racks and patch panels to identify location within cabling system infrastructure.
  - .3 Site Quality Control Submittals: Submit a sample of proposed test forms and procedures as required below prior to start of testing.

#### **1.4 RECORD DRAWINGS**

- .1 Submit record drawings in accordance with Section 26 05 01.
- .2 Record on one set of white prints all of the structured cable locations, all changes during construction and other details. Indicate label number for each outlet using numbering system employed on project.

#### **1.5 OPERATION AND MAINTENANCE DATA**

- .1 Submit manufacturer's written instructions for repair and servicing procedures, include name of original installer and contact information. Compile and submit Operation and Maintenance Data for the communications system infrastructure as follows:
  - .1 Submit test documentation in a separate 3 ring binder from other operations and maintenance data; and in electronic media in a format acceptable to the Consultant within three (3) weeks after completion of the work of this Section as follows:
    - .1 Clearly label binder on outside front cover and spine with the words:  
**COMMUNICATION CABLING TEST RESULTS**  
**PROJECT NAME**  
**DATE OF COMPLETION: YEAR-MONTH-DAY**
    - .2 Divide binder into major sections named HORIZONTAL and BACKBONE.
    - .3 Divide each section using labelled tabs by test type including, but not limited to, scanner test results, optic power meter attenuation test results, Optical Time Domain Reflectometry (OTDR) traces and green light test results:
    - .4 Print scanner tests on standard 215 mm x 280 mm paper using native format of testing equipment.
    - .5 Hand write attenuation results and green light results using test form format acceptable to the Consultant.
    - .6 Print OTDR tests on standard 215 mm x 280 mm paper, and provide electronic format test results.
    - .7 Include the test equipment manufactures software for reading and interpreting test results for electronic native format test results.
    - .8 Provide a listing of testing equipment listed by name, manufacturer, model number, serial number and last calibration date attached to end of

each testing tab; indicate test method used and specific equipment settings used during tests.

- .9 Provide report of repairs and retesting results where corrective actions are required; include both failed and passed test results in the binder.

## **1.6 QUALITY ASSURANCE**

- .1 Qualifications:
  - .1 The system installer shall have actively carried out data and voice cabling installation for a period of not less than five consecutive years.
- .2 Certifications:
  - .1 Submit to the Consultant a letter from the cabling manufacturer, prior to installation of the system, verifying that they are qualified and capable of installing Category 6 cabling system meeting or exceeding all TIA/EIA certification requirements.
- .3 Consultation with the Owner:
  - .1 The contractor shall consult with the Information Technology Branch of the owner prior to installation of any data, voice cabling or equipment. The NAR and LAN room layouts and installation methodology is to be reviewed on site with the IT representative.

## **1.7 DELIVERY, STORAGE AND HANDLING**

- .1 Delivery and Acceptance Requirements: Deliver materials to site in manufacturer's original, unopened protective containers and packaging labeled clearly to identify product name and manufacturer.
- .2 Store materials in secure, clean, dry area in a heated indoor location in accordance with manufacturer's instructions. Protect materials and finishes from damage and moisture during handling and installation

## **1.8 WARRANTY**

- .1 Special Warranty: In addition to standard construction warranty required by the General Conditions of the Contract, provide a system warranty on supply of components covering the following:
  - .1 Installation: Installing Subcontractor shall warrant the cabling system against defects arising from defects in workmanship for a period of one year from the date of Substantial Performance for the Project covering all labour and materials necessary to correct any failed portion of the system and to demonstrate performance to within the original installation specifications after repairs are completed.
  - .2 Cabling System Warranty: Manufacturer shall warrant system performance of cabling system against defects in functionality of all components used in the system for a minimum period of fifteen (15) years from the date of Substantial Performance for the Project covering:
    - .1 Installed horizontal and backbone copper cabling.
    - .2 Installed backbone fibre optic.
    - .3 Copper links for performance below expected results in accordance with TIA/EIA 568-B.2-1
    - .4 Fibre optic links for line and segment performance below expected results in accordance with TIA/EIA 568-B.1.

## **1.9 DESCRIPTION OF WORK**

- .1 Product specifications, general design considerations, and installation guidelines are provided in this written document. For quantities of telecommunications outlets, typical installation details, cable routing etc refer to the drawings. If the bid documents are in conflict, the written specification shall take precedence. The successful vendor shall meet or exceed all requirements for the cabling system described in this document.
- .2 The Owner's Cable Infrastructure Project requires a single manufacturer Systems structured cabling system solution. The Category 6, signal transmission up to 250 MHz, portion of the cabling system shall comply with the link and channel performance requirements of ANSI/TIA/EIA 568-B
- .3 The successful Contractor is required to furnish all labor, supervision, tooling, miscellaneous mounting hardware and consumables for the cabling system installed. The Contractor shall staff each installation crew with the appropriate number of trained personnel.
- .4 This document defines the cabling system and subsystem components to include cable, termination hardware, supporting hardware, and miscellany that Contractor will furnish to install a complete telecommunications system supporting communications. The intent of this document is to provide all pertinent information to allow the vendor to bid the labor, supervision, tooling, and miscellaneous mounting hardware and consumables to install a
- .5 Distributed cabling infrastructure is based on a star wiring topology of Category 6, 4 pair UTP cabling from desktop to termination fields located in intermediate termination rooms (ITR) and single mode fibre optic backbone cables from ITC's to main termination field in the main network access room (NAR)

## **1.10 DISTANCE LIMITATIONS**

- .1 Structured cabling to conform to CSA T529 standards for distance limitation. Telecommunications Contractor to examine drawings and ensure that distance limitations are not exceeded, taking into account length of patch cables and service loops. Advise Consultant at time of tender of any runs that may exceed distance limitations.
- .2 Cabling system distances to not exceed 90 m in any situation, for either voice or data.
- .3 Total length of patch cables and cross connect jumpers to not exceed 10 m.
- .4 Patch cables or cross connect jumpers at horizontal cross connect (HC) to not exceed 7 m.

## **1.11 MANUFACTURERS**

- .1 Acceptable Materials Manufacturers: Subject to compliance with requirements specified in this Section, manufacturers offering products that may be incorporated into the Work include; but are not limited to, the following provided they meet the performance requirements established by the specifications; all components shall meet the technical performance requirement for Category 6 systems; systems specified are based on the following:
  - .1 Alcatel-Lucent
  - .2 Belden Inc. Nordex/CDT
  - .3 Hubbell Inc. Premise Wiring
  - .4 Leviton Manufacturing Co., NextLAN
  - .5 The Siemon Company
  - .6 Tyco Electronics, AMP NetConnect

## **PART 2 PRODUCTS**

### **2.1 TELECOMMUNICATION OUTLETS**

- .1 Each telecommunications outlet (TO) location, unless otherwise noted, shall be provided with three Category 6 cables. Each Category 6 cable shall be terminated on an 8-position, 8-conductor Category 6 modular jack to the T568A wiring code. The TO faceplates, unless otherwise noted, shall be mounted in a two gang recessed box, 63 mm minimum depth with 19 mm deep two-device ring, one gang wallboard adapter ring, 1.6 mm 16 AWG thickness, surface mount boxes and/or floor mounted devices boxes as required.

### **2.2 VOICE AND DATA CABLING**

- .1 Backbone Cabling System
  - .1 Voice Backbone Cabling:
    - .1 Copper cable; 24 AWG, 50 pair Shielded Twisted Pair (STP), ULC CMR Rated with black PVC jacket; third party verified to comply with TIA Category 6 requirements; install coupled bonding conductor within riser bundle, bonded and grounded at each end.
    - .2 Cable to be equal to Superior Essex - OSP Broadband Category 6.
    - .3 Terminate voice backbone cabling in rack mount Category 6 patch panels; and as follows:
      - .1 Front of each module shall be capable of accepting 9 mm to 13 mm wide labels.
      - .2 Each port shall be capable of accepting an icon to indicate its function.
      - .3 Patch panels shall terminate the building cabling on insulation displacement connectors;
      - .4 Patch panels shall be ULC listed.
  - .2 Data Backbone Cabling (Multi-mode Fibre):
    - .1 Fibre Optic Cable: Provide 6 strand multi-mode fibre optic cable, for connectivity between network rooms consisting of tight buffered 50 / 125µm cladding surrounded by aramid strength members and PVC jacket.
    - .2 Cable to be equal to Superior Essex - Loose Tube Indoor/Outdoor Riser – OFNR\ (Multi-Mode Fibre).
    - .3 Properties:
      - .1 Rating: ULC rated for OFNR (Riser) or OFNP (Plenum).
      - .2 Colour: Black
      - .3 Attenuation Rating: 0.4 dB/km @ 1310 nm and 0.25 dB/km @ 1550 nm.
      - .4 Bandwidth: 100,000 GHz/km @ 1310 nm.
  - .3 Terminate each fibre optic cable in 6 port rack mount enclosures providing protection to the terminated fibres; optical fibre patch panels shall be capable of containing 6 SC connectors in a 1U enclosure. Termination method shall be factory manufactured fibre pigtails fusion spliced onto the backbone cable utilizing correct splice trays compatible with the fibre patch panel used. Heat shrink sleeves shall be the only method of splice protection. Splice loss maximums will be less than 0.05db per splice.

- .2 Horizontal Cabling System
  - .1 Horizontal Cable:
    - .1 Plenum (FT6) Rated Category 6 Cable: 24 AWG, four (4) pair UTP, ULC CMR rated having lead free yellow PVC jacket, third party verified meeting the requirements of TIA/EIA 568-B.2.1, meeting performance requirements listed below.
  - .2 Color code the data cables as follows:
    - .1 Network Data – Yellow
    - .2 Network VOIP – White

## 2.3 COMMUNICATIONS EQUIPMENT

- .1 Racks:
  - .1 Place single racks to provide minimum 915 mm clearance from front and rear mounting surfaces and minimum 915 mm clearance on one (1) side of racks.
  - .2 Place mounting rail a minimum of 150 mm to the wall to allow for vertical management where mounting rail is placed against a wall.
  - .3 Gang racks together using vertical management hardware to provide interbay management where more than one rack is required.
  - .4 Place ganged racks to provide minimum 915 mm clearance from front and rear mounting surfaces and minimum 915 mm clearance on one side of racks.
- .2 Back Panels (For termination of voice trunk cabling only):
  - .1 Mount voice termination fields on fire retardant plywood panels on wall opposite from room entrance.
  - .2 Mount backbone termination fields to the left of horizontal voice fields from patch panels on racks including cross-connect wires as required.
  - .3 Provide a minimum of three (3) 100 mm diameter conduits, or larger to suit project requirements.
  - .4 Locate conduits for data backbone adjacent to racks; locate conduits for voice backbone adjacent to voice termination fields.
  - .5 Provide ladder and wall mount management rings to properly support and dress cables from conduits to racks and frames.
  - .6 Design all hardware to fit into a standard 480 mm rack.
  - .7 Horizontal Cabling Racks: Self supporting racks, 480 mm wide x 2130 mm high; constructed from aluminum having a black painted finish, in accordance with CEA 310.
  - .8 Horizontal and Vertical Cable Management shall be provided at each rack location. Properly dress the cables to flow from cabletray above via Velcro rings to rack supported cable management hardware along each vertical run and horizontal termination field.
- .3 Patch Panels:
  - .1 Provide Category 6 modular data jacks for multimedia jack patch panels; unkeyed four (4) pair fitting into nominal 20 mm x 15 mm opening; terminate modular jacks using a non-impact termination tool to eliminate connector damage and promote consistent termination; colour code jacks for T568A wiring; wire each jack to T568A.
  - .2 Horizontal cross-connect shall consist of Category 6 patch panels, which shall be 2U high and provide 48 modular jack ports, wired to T568A. Patch panels shall be configured as 6-port modules with individually replaceable jacks. Each modular jack shall be provided with a bend-limiting strain relief. The strain relief shall provide cylindrical support to limit the bend radius at the point of termination. The front of each 6-port module shall be capable of accepting 9mm

to 12mm labels. Each port shall be capable of accepting an icon to indicate its function. Patch panels shall terminate the building cabling on 110-style insulation displacement connectors. The installed system shall comply with the Category 6 performance characteristics.

- .3 Each fibre optic cable shall be terminated with an SC connector jack in the main and intermediate closets. Provide 2U rack-mount enclosures providing protection for the terminated fibres. Each jack shall be field-installable, requiring no epoxy, no polishing, no bench tool and no crimping. Fibre slack shall be neatly coiled within the fibre termination enclosures or in rack-mount fibre management enclosure. No slack loops shall be allowed external to the fibre enclosure(s).
- .4 The horizontal data cross-connects shall be contained in wall mounted frames within the ITR and NAR

## **2.4 HORIZONTAL VOICE CROSS CONNECT**

- .1 Backbone cross-connects for voice connectivity shall be wall-mount 110Connect XC frames. Wall-mount frames shall be field-terminated 110Connect XC frame kits which include frame, blocks, bottom trough, horizontal wire troughs, connecting blocks, and designation strips. Wire management frames shall be mounted between adjacent vertical frames to provide wire management of cross-connect wire. Frames and bottom troughs shall be constructed of carbon steel, light almond in color. Wiring blocks, connecting blocks and horizontal troughs shall be constructed of polycarbonate molding compound. Wiring blocks shall be marked black every fifth pair. Connecting block terminals shall be constructed of phosphor bronze, plated with a minimum of 150µin of tin-lead over a 50µin minimum nickel underplate. Combinations of 300 and/or 900 pair frames shall be used as required by the horizontal and backbone pair counts to be terminated in a given closet. Backbone frames shall employ 5-pair connecting blocks on each 25-pair row.

## **2.5 WORK AREA AND PATCH CORD CABLE ASSEMBLIES**

- .1 Data cable assemblies used for horizontal cross-connect and at the workstation shall be Category 6, 4-pair assemblies. Twisted pair data cable assemblies shall be factory-assembled by the manufacturer of the cabling system. Provide a patch cable for each communication cable at both the termination closet and user ends.

## **2.6 WALL FACEPLATES**

- .1 Work area wall outlets shall be constructed utilizing 110Connect single gang 4-Port faceplates 4.53" X 2.77" X .60" in size. White in color. Data outlets shall be loaded with modular jacks as described in 3.1.

# **PART 3 EXECUTION**

## **3.1 HORIZONTAL DISTRIBUTION CABLE INSTALLATION**

- .1 Cable shall be installed in accordance with manufacturer's recommendations and best industry practices. Do not use tie-wraps to bundle cables in cabletray or on multi-cable drops. Utilize Velcro straps to secure cables in bundles.
- .2 Cable raceways shall not be filled greater than the CEC maximum fill for the particular raceway type.
- .3 Cables shall be installed in continuous lengths from origin to destination.
- .4 The cable's minimum bend radius and maximum pulling tension shall not be exceeded.
- .5 Horizontal distribution cables shall be bundled in groups of not greater than 40 cables (cable bundle quantities in excess of 40 cables may cause deformation of the bottom cables within the bundle).
- .6 All cables shall be bundled using velcro straps, plastic tie-wraps are not acceptable.

- .7 Any cable damaged or exceeding recommended installation parameters during installation shall be replaced by the Contractor prior to final acceptance at no cost to the Owner.
- .8 Cables shall be identified by a self-adhesive label in accordance with the System Documentation Section of this specification.
- .9 The cable label shall be applied to the cable behind the faceplate on a section of cable that can be accessed by removing the cover plate.
- .10 Unshielded twisted pair cable shall be installed so that there are no bends less than four times the cables outside diameter (4 X cable O.D.) at any point in the run.
- .11 Pulling tension on 4-pair UTP cables shall not exceed 25-pounds for a single cable or cable bundle.

### **3.2 HORIZONTAL CROSS-CONNECT INSTALLATION**

- .1 Copper termination and management hardware shall be installed in the following manner.
  - .1 Cables shall be dressed and terminated in accordance with the recommendations made in the TIA/EIA-568-A document, manufacturer's recommendations and/or best industry practices.
  - .2 Pair untwist at the termination shall not exceed 0.5 inch for Category 6 connecting hardware.
- .2 Bend radius of the cable in the termination area shall not exceed 4 times the outside diameter of the cable.
- .3 Cables shall be neatly bundled and dressed to their respective panels or blocks.
- .4 Each panel or block shall be fed by an individual bundle separated and dressed back to the point of cable entrance into the rack or frame.
- .5 The cable jacket shall be maintained as close as possible to the termination point
- .6 Each cable shall be clearly labeled on the cable jacket behind the patch panel at a location that can be viewed without removing the bundle support ties.
- .7 Cable labels shall not be obscured from view.

### **3.3 TELECOMMUNICATIONS SPACES**

- .1 In all closets wall mounted 450mm wide cable tray is to be provided at the top of the termination equipment locations to properly support and dress incoming cables to racks and frames.

### **3.4 CABLING SYSTEM TESTING**

- .1 All cables and termination hardware shall be 100% tested for defects in installation and to verify cable performance under installed conditions. All conductors of each installed cable shall be verified useable by the Contractor prior to system acceptance. Any defect in the cabling system installation including but not limited to cable, connectors, feed-through couplers, patch panels, and connector blocks shall be repaired or replaced in order to ensure 100% useable conductors in all installed cables.
- .2 All cables shall be tested in accordance with this document and best industry practices.

### **3.5 COPPER**

- .1 Verify performance of Category 6 data cabling systems using an automated test set using a Level III qualified tester approved by the cabling manufacturer; test shall be a permanent link testing for the following performance parameters:
  - .1 Wire Map
  - .2 Length
  - .3 Insertion Loss



- .4 Pair-to-Pair Near End Crosstalk (NEXT)
- .5 Power Sum Near End Crosstalk (PSNEXT)
- .6 Equal Level Far End Crosstalk (ELFWXT)
- .7 Power Sum Equal Level Far End Crosstalk (PSELFEXT)
- .8 Return Loss (RL)
- .9 Propagation Delay
- .10 Delay Skew
- .2 Verify performance of Category 6 data cabling using an automated test set with results automatically evaluate by the equipment using most current criteria listed in TIA/EIA 568-B, 2.1; show results as pass/fail; print test results directly from testing unit or from a download file using application from test equipment manufacturer; indicate tests performed, the expected test results and the actual test result achieved.

### **3.6 FIBRE**

- .1 Attenuation: Test backbone optical fibre cabling link segment in at least one direction at both operating wavelengths to account for attenuation deltas associated with wavelength.

### **3.7 FIRESTOP SYSTEMS**

- .1 A firestop system is comprised of the item or items penetrating the fire-rated structure, the opening in the structure and the materials and assembly used to seal the penetrated structure. Firestop systems comprise an effective block for fire, heat, vapor and a pressurized water stream.
- .2 All penetrations through fire-rated building structures (walls and floors) shall be sealed with an appropriate firestop system. This requirement applies to "through" penetrations (complete penetration) and "membrane" penetrations (through one side of a hollow, fire-rated structure). Any penetrating items (i.e., riser slots and sleeves, cables, conduit, cable tray, raceways, etc.) shall be properly firestopped.
- .3 All firestop systems shall be installed in accordance with the manufacturer's recommendations and shall be completely installed and available for inspection by the local inspection authorities prior to cabling system acceptance.

### **3.8 GROUNDING AND BONDING**

- .1 The facility shall be equipped with a Telecommunications Bonding Backbone (TBB). This backbone shall be used to ground all telecommunications cable shields, equipment, racks, cabinets, raceways, cabletrays and other associated hardware that has the potential for acting as a current-carrying conductor. The TBB shall be installed independently of the building electrical ground and of the building ground and shall be designed in accordance with the recommendations contained in the ANSI/TIA/EIA-607-A Telecommunications Bonding and Grounding Standard.
- .2 A #6 AWG bare copper grounding conductor (TBB) shall be installed throughout the communications cabletray and terminating at the TMGB. The conductor shall be bonded to the tray at 15 meter intervals.
- .3 All racks, metallic backboards, cable sheaths, cable trays, etc. entering or residing in the MTC shall be grounded to the TMGB using a minimum #6 AWG stranded copper bonding conductor and compression connectors. The conductor shall be continuous, attaching all isolated components in a daisy chain fashion from top to bottom and bonded to the rack using an appropriate compression connector.
- .4 All wires used for telecommunications grounding purposes shall be identified with green insulation.

### **3.9 CABLING SYSTEM LABELING**

- .1 The Contractor shall develop and submit for approval a labeling scheme for the cable installation. Engineer will negotiate an appropriate labeling scheme with the successful Contractor. At a minimum, the labeling system shall clearly identify all components of the system: racks, cables, panels and outlets. The labeling system shall designate the cable origin and destination and a unique identifier for each cable within the system. Racks and patch panels shall be labeled to identify the location within the cabling system infrastructure. All labeling information shall be recorded on the as-built drawings and all test documents shall reflect the appropriate labeling scheme. The labeling shall be machine-generated and affixed to the cable, faceplate, patch panel, rack or other hardware.

### **3.10 OTHER COMMUNICATION CONDUCTORS**

- .1 COAXIAL TELEVISION CABLE
  - .1 RG-6 Coaxial cable to CAN/CSA - C22.2 No. 214 and as follows:
    - .1 Conductors: coaxial, 23 AWG solid, bare copper covered steel.
    - .2 Shielding: bare copper braid, 95% coverage braid.
    - .3 Fire Rating: plenum-rated overall jacket, CSA FT-4 compliant.

**END OF SECTION**

Approved: 2006-06-30

## **PART 1 GENERAL**

### **1.1 DEFINITIONS**

- .1 "Topsoil" means the top layer of soil containing organic material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping and seeding.
- .2 "Subsoil" means the portion of soil material that lies immediately beneath the Topsoil extending to root depth or "B" horizon. The upper portion of the parent material as defined by the Canadian System of Soil Classification.
- .3 "Unsuitable Organic Soils" means soils that contain organic materials and are not suitable for use as earthwork materials or as Topsoil and Subsoil. These soils would include soils that contain too much organic matter for earthwork materials, are contaminated, or do not meet the requirements.

## **PART 2 PRODUCTS**

### **2.1 PRODUCTS**

- .1 Supply all labour, materials and equipment required for topsoil stripping.

## **PART 3 EXECUTION**

### **3.1 EXECUTION**

- .1 The Contractor shall excavate the minimum practical area of topsoil required to perform work.
- .2 Topsoil shall be stripped to a depth that will ensure complete removal of all organic materials. The topsoil shall be stockpiled in areas designated by Departmental Representative.
- .3 Special care must be taken to avoid mixing topsoil with the underlying soil. Departmental Representative may require the Contractor to provide a separate stockpile for topsoil contaminated with common material.
- .4 Strip topsoil from the areas where common excavation and fill placement are required.
- .5 Conduct stripping and excavation operations so that undesirable mineral soil does not become mixed with topsoil or subsoil.
- .6 Suspend stripping operations during rain, snow, wet ground conditions, high winds, or other conditions that may result in contamination or loss of material.
- .7 Drain surface water away from the stripped areas to prevent ponding and infiltration in disturbed areas.
- .8 Stockpile topsoil at locations specified in the Contract Documents or as approved by Departmental Representative.
- .9 Maintain a minimum separation of 3 metres between stockpiles of differing material.
- .10 Use silt fences and other erosion control measures to prevent soil loss from the stockpiles due to wind or water erosion.
- .11 Do not interfere with drainage courses with stockpiled material. Keep stockpiles a minimum distance of 30 m from bodies of water or drainage course.
- .12 Do not stockpile material at slopes steeper than 3H:1V.
- .13 Maintain stockpiles in a condition meeting the above requirements.

- .14 Upon completion of grading operations and approval of Departmental Representative following inspection of subgrade, stockpiled topsoil shall be replaced in designated areas and as directed by Departmental Representative to rehabilitate all areas disturbed by the Contractor.

### **3.2 STRIPPING OF TOPSOIL**

- .1 Ensure that procedures are conducted in accordance with applicable Provincial 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 as directed by Departmental Representative.
- .5 Remove brush from targeted area by non-chemical means and dispose of through mulching or alternative disposal as directed by Departmental Representative.
- .6 Strip topsoil to depths as indicated in the design drawings or specifications and as directed by Departmental Representative.
  - .1 Avoid mixing topsoil with subsoil.
- .7 Pile topsoil in berms in locations as directed by Departmental Representative.
  - .1 Stockpile height not to exceed 2m.
- .8 Dispose of unused topsoil for later use in location as indicated by Departmental Representative.
- .9 Protect stockpiles from contamination and compaction.
- .10 Cover topsoil that has been piled for long term storage, with trefoil or grass to maintain agricultural potential of soil.

### **3.3 PLACING OF TOPSOIL**

- .1 Place topsoil only after Departmental Representative has accepted subgrade.
- .2 Spread topsoil during dry conditions in uniform layers not exceeding 150mm, 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.

**END OF SECTION**

## **PART 1 GENERAL**

### **1.1 DESCRIPTION**

- .1 This Section specifies requirement for excavating trenches and backfilling for installation of concrete footings, pipes, tanks and appurtenances.

### **1.2 DEFINITIONS**

- .1 Common Excavation:
  - .1 The excavation of all materials including hardpan, quicksand, and frozen earth; also rock, concrete or masonry less than 1.0 m<sup>3</sup> in volume at any particular location shall be classified as common excavation.
- .2 Rock Excavation:
  - .1 The excavation of rock, concrete or masonry exceeding 1.0 m<sup>3</sup> in volume at any particular location; and solid ledge rock, concrete or masonry which requires for its removal drilling, blasting, wedging, sledging, barring or breaking with a power operated hand tool shall be classified as rock excavation. Soft or disintegrated rock, concrete or masonry which can be removed with a hand pick, power operated excavator or shovel; and loose, shaken or previously blasted rock will not be classified as rock excavation.
  - .2 Rock excavation shall be divided into two categories: Type A and Type B, contingent upon its hardness and difficulty experienced in excavation.
  - .3 Type A - rock such as fractured sandstone, shale or ledge rock, which can be removed by the size of backhoe specified in the following table for the depth of trench excavation and size of pipe being installed or a D-8 Caterpillar with a single ripping tooth for open excavation or other equipment specified elsewhere in the documents and in the opinion of Departmental Representative, results in:
    - .1 A substantial or decrease in the normal rate of excavation for the project and/or significant damage or wear to the excavating equipment.

Minimum Size Backhoe for Rock Excavation Table (Cu. Yd.)

Pipe Diameter (mm)	Depth Range (metres)				
	0-3.00	3.01-4.00	4.01-5.00	5.01-7.5	Over 7.50
100 - 300	1	1.5	2	2.5	2.5
301 - 525	1.5	1.5	2	2.5	2.5
526 - 750	2	2	2	2.5	2.5
751 - 1050	2.5	2.5	2.5	2.5	4
1051 - 1350	2.5	2.5	2.5	4	4
1351 - 1650	2.5	2.5	4	4	4
1651 - 1950	2.5	2.5	4	4	4
1951 - 2101	2.5	2.5	4	4	4
2100 - larger	2.5	2.5	4	4	4

- .4 Type B - rock which requires drilling, blasting, wedging or jack-hammering to remove
- .3 Class 1 Backfill:
  - .1 Class 1 backfilling shall consist of backfilling the trench with sand or gravel compacted in even layers not exceeding 300 mm in depth so that there is no subsequent subsidence in the trench. Backfill shall be compacted to a minimum of 95% Standard Proctor Density. Fillcrete may be used in lieu of Class 1 backfill.

- .4 Native Backfill:
  - .1 Native backfilling shall consist of replacing the excavated material in even layers not exceeding 300 mm in depth, and compacting each layer by mechanical means to 95% Standard Proctor Density.
- .5 Borrow Backfill:
  - .1 Suitable borrow material excavated from designated borrow areas or as directed by Departmental Representative shall be used to backfill all or portions of utility trenches excavated in Type "A" or Type "B" rock.
- .6 Topsoil:
  - .1 The top layer of soil containing organic material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping and seeding.

### **1.3 PROTECTION OF EXISTING FEATURES**

- .1 Existing buried utilities and structures:
  - .1 Prior to commencing any excavation work, notify applicable owner or authorities and Departmental Representative; establish location and state of use of buried utilities and structures. Clearly mark such locations to prevent disturbance during work. Markings must be maintained throughout construction.
  - .2 Maintain and protect from damage, water, sewer, gas, electric, telephone and other utilities and structures encountered. All damage incurred shall be repaired by the Contractor at his expense.
- .2 Existing buildings and surface features:
  - .1 Maintain and protect from damage existing buildings, trees and other plants, lawns, fencing, service poles, wires, rail tracks, paving, survey bench marks and monuments which may be affected by work. All damage incurred shall be repaired by the Contractor at his expense.

### **1.4 SAFETY REQUIREMENTS**

- .1 The Contractor will be required to observe all applicable sections of the Alberta Regulations 271/76 made under the Occupational Health and Safety Act covering worker safety in trenches and excavations.
- .2 Open cut trenches shall be sheeted and braced as required by the Accident Prevention Regulations of the Occupational Health and Safety Division of the Department of Labour and Municipal Ordinances, and as may be necessary to protect life, property and the work.
- .3 Prefabricated cages or shields, provided they conform with all applicable safety requirements, may be used to supplement or replace conventional shoring.

### **1.5 SAMPLES AND SUBMITTALS**

- .1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 At least 2 weeks prior to commencing work, inform Departmental Representative of proposed source of granular materials.
- .3 The Contractor shall provide a sieve analysis of the material for Departmental Representative's approval.
- .4 Sand and gravel shall be approved by Departmental Representative before being used.

### **1.6 REFERENCE STANDARDS**

- .1 American Society for Testing and Materials International (ASTM)
  - .1 ASTM C117-04, Standard Test Method for Material Finer than 0.075 mm (No.200) Sieve in Mineral Aggregates by Washing.

- .2 ASTM C136-05, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
- .3 ASTM D422-63 (2007), Standard Test Method for Particle-Size Analysis of Soils.
- .4 ASTM D698-00ae1, 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 D1557-02e1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft<sup>3</sup>) (2,700 kN-m/m<sup>3</sup>).
- .6 ASTM D4318-17, 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 Canadian Standards Association (CSA International)
  - .1 CAN/CSA-A3000-03, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
    - .1 CSA-A3001-03, Cementitious Materials for Use in Concrete.
  - .2 CSA-A23.1/A23.2-04, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
- .4 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.

## 1.7 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 Unclassified excavation: excavation of deposits of whatever character encountered in Work.
- .3 Topsoil:
  - .1 Material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping and seeding.
  - .2 Material reasonably free from subsoil, clay lumps, brush, objectionable weeds, and other litter, and free from cobbles, stumps, roots, and other objectionable material larger than 25 millimeters in any dimension.
- .4 Waste material: excavated material unsuitable for use in Work or surplus to requirements.
- .5 Borrow material: material obtained from locations outside area to be graded, and required for construction of fill areas or for other portions of Work.
- .6 Recycled fill material: material, considered inert, obtained from alternate sources and engineered to meet requirements of fill areas.
- .7 Unsuitable materials:
  - .1 Weak, chemically unstable, and compressible materials.
  - .2 Frost susceptible materials:
    - .1 Fine grained soils with plasticity index less than 10 when tested to ASTM D4318, and gradation within limits specified when tested to ASTM C136: Sieve sizes to CAN/CGSB-8.2.

.2 Table:

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

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

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

## 1.8 ACTION AND INFORMATIONAL 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 for review by Departmental Representative proposed heave prevention and dewatering methods as described in PART 3 of this Section.
- .2 Submit to Departmental Representative written notice when bottom of excavation is reached.
- .3 Submit Departmental Representative inspection results as described in PART 3 of this Section.

.3 Preconstruction Submittals:

- .1 Submit records of underground utility locates, indicating: location plan of existing utilities as found in field.

## 1.9 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for recycling or reuse in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

## 1.10 EXISTING CONDITIONS

.1 Examine Geotechnical Site Investigation Report (AECOM, 2018) as provided with tender documents (Appendix A).

.2 Buried services:

- .1 Before commencing work, establish and verify location of buried services on and adjacent to site.
- .2 Arrange with appropriate authority for relocation of buried services that interfere with execution of work: pay costs of relocating services.
- .3 Remove obsolete buried services within 2 m of foundations: cap cut-offs.
- .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, establish location and state of use of buried utilities and structures to clearly mark such locations to prevent disturbance during Work.
- .6 Confirm locations of buried utilities by careful test excavations or soil hydrovac methods.
- .7 Maintain and protect from damage, water, sewer, gas, electric, telephone and other utilities and structures encountered.
- .8 Where utility lines or structures exist in area of excavation, obtain direction of Departmental Representative.



- .9 Record location of maintained, re-routed and abandoned underground lines.
- .10 Confirm locations of recent excavations adjacent to area of excavation.
- .3 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 Departmental Representative.
  - .3 Where required for excavation, cut roots or branches as directed by Departmental Representative in accordance with Section 32 01 90.33- Tree and Shrub Preservation.

## **PART 2 PRODUCTS**

### **2.1 MATERIALS**

- .1 Gradations to be limits specified when tested to ASTM C136 and ASTM C117. Within Sieve sizes to CAN/CGSB-8.1.

### **2.2 STABILIZING BASE GRAVEL**

- .1 Stabilizing base gravel shall be well graded gravel consisting of hard durable particles free from clay lumps, cementation, organic material, frozen material and other deleterious materials.
- .2 The material shall meet the following gradations:

Screened Rock	
Sieve Size (µm)	Percent Passing (by weight)
40,000	100
25,000	90 – 100
20,000	20 – 55
10,000	0 – 5

### **2.3 PIPE BEDDING MATERIAL**

- .1 Pipes and services bedding material shall meet the following gradations:
  - .1 Well rounded or fractured gravel:

Sieve Size (mm)	Percent Passing (By Weight)
20	100
10	20 - 80
4.75	10 – 50
0.075	0 - 8

### **2.4 FILTER FABRIC**

- .1 In accordance with section 31 32 19.16 - Geotextile Soil Stabilization.

## 2.5 BACKFILL MATERIAL

### .1 Class 1 Fill

- .1 Material for Class 1 backfill shall consist of sound, hard, durable, uniformly graded pit-run or crushed gravel and shall not contain organic or soft materials, materials that break up when alternately frozen and thawed or wetted and dried, or other deleterious materials. When compacted near the optimum moisture content to not less than 98% of the maximum dry density corrected for the stone content as determined by ASTM D698, the material shall have a minimum bearing ratio as defined by ASTM D1883, of fifteen percent (15%).

### .2 Type 1 and Type 2 fill:

- .1 Crushed, pit run or screened stone, gravel or sand.  
.2 Gradations to be within limits specified when tested to ASTM C136. Sieve sizes to CAN/CGSB-8.2.  
.3 Table:

Sieve Designation	% Passing	
	Type 2	Type 1
75 mm	-	100
50 mm	-	-
37.5 mm	-	-
25 mm	100	-
19 mm	75-100	-
12.5 mm	-	-
9.5 mm	50-100	-
4.75 mm	30-70	22-85
2.00 mm	20-45	-
0.425 mm	10-25	5-30
0.180 mm	-	-
0.075 mm	3-8	0-10

- .2 Type 3 fill: selected material from excavation or other sources, approved by Departmental Representative for use intended, unfrozen and free from rocks larger than 75mm, cinders, ashes, sods, refuse or other deleterious materials.

### .3 Unshrinkable fill: proportioned and mixed to provide:

- .1 Maximum compressive strength of 0.4 MPa at 28 days.  
.2 Maximum cement content of 25 kg/m<sup>3</sup>: to CSA-A3001, Type Exposure Class S-2, as per Geotechnical Report  
.3 Minimum strength of 0.07 MPa at 24 h.  
.4 Concrete aggregates: to CSA-A23.1/A23.2.  
.5 Cement: Type HS, HSb, HSLB or HSe as per CSA-A23.1 to meet Exposure Class S-2.  
.6 Slump: 160 to 200 mm.

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

## 2.6 FILLCRETE

- .1 Non-shrinking fill made up of a mixture of Portland cement, sand, water and admixtures conforming to the following:

- .1 Minimum 28 day compressive strength 0.30 to 0.60 MPa  
.2 Slump 100 mm ±25 mm

- |    |                 |         |
|----|-----------------|---------|
| .3 | Portland Cement | Type 10 |
| .4 | Air entrainment | 5% ±1%  |

### **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.
- .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.
- .4 All erosion and sediment control measures are incidental to the performance of the Work.

#### **3.2 SITE PREPARATION**

- .1 The Contractor will be required to strip organic material, clear and grub, remove weeds and grasses as specified or as required by Departmental Representative prior to excavation. Avoid intermixing of subsoil fill materials with organic material and from other forms of contamination. Clean stripped material to be stockpiled on site for use in site restoration.
- .2 Stripped material shall be stockpiled on site for use in site restoration.
- .3 Cut pavement or sidewalk neatly along limits of proposed excavation in order that surface may break evenly and cleanly.

#### **3.3 PREPARATION/PROTECTION**

- .1 Protect existing features in accordance with Departmental Representative 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 Departmental Representative approval.
- .4 Protect natural and man-made features required to remain undisturbed. Unless otherwise indicated or located in an area to be occupied by new construction, protect existing trees from damage.
- .5 Protect buried services that are required to remain undisturbed.

#### **3.4 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 COFFERDAMS, SHORING, BRACING AND UNDERPINNING**

- .1 Maintain sides and slopes of excavations in safe condition by appropriate methods and in accordance with Section 01 35 29.06 - Health and Safety Requirements.
  - .1 Where conditions are unstable, Departmental Representative to verify and advise methods.

- .2 Construct temporary Works to depths, heights and locations as approved by Departmental Representative.
- .3 During backfill operation:
  - .1 Unless otherwise indicated or directed by Departmental Representative, remove sheeting and shoring from excavations.
  - .2 Do not remove bracing until backfilling has reached respective levels of such bracing.
  - .3 Pull sheeting in increments that will ensure compacted backfill is maintained at elevation at least 500mm above toe of sheeting.
- .4 When sheeting is required to remain in place, cut off tops at elevations as indicated.
- .5 Upon completion of substructure construction:
  - .1 Remove cofferdams, shoring and bracing.
  - .2 Remove excess materials from site and restore watercourses as directed by Departmental Representative.

### **3.6 DEWATERING AND HEAVE PREVENTION**

- .1 Keep excavations free of water while Work is in progress.
- .2 Provide for Departmental Representative's approval details of proposed dewatering or heave prevention methods, including dikes, well points, and sheet pile cut-offs.
- .3 Avoid excavation below groundwater table if quick condition or heave is likely to occur.
  - .1 Prevent piping or bottom heave of excavations by groundwater lowering, sheet pile cut-offs, or other means.
- .4 Protect open excavations against flooding and damage due to surface run-off.
- .5 Dispose of water in accordance with Section 01 35 43- Environmental Procedures to approved areas and in a 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.

### **3.7 EXCAVATION**

- .1 Advise Departmental Representative at least 7 days in advance of excavation operations for initial cross sections to be taken.
- .2 Excavate to lines, grades, elevations and dimensions as shown on drawings.
- .3 Remove demolished foundations and rubble, paving, concrete, masonry, walks and other obstructions encountered during excavation in accordance with Division 2 specifications.
- .4 Excavation must not interfere with bearing capacity of adjacent foundations.
- .5 Do not disturb soil within branch spread of trees or shrubs that are to remain.
  - .1 If excavating through roots, excavate by hand and cut roots with sharp axe or saw.
- .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 as directed by Departmental Representative.
- .8 Restrict vehicle operations directly adjacent to open trenches.
- .9 Dispose of surplus and unsuitable excavated material in approved location on site or off site as directed by the Departmental Representative.
- .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 Notify Departmental Representative when bottom of excavation is reached.
- .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:
  - .1 Fill under bearing surfaces and footings with Type 2 fill compacted to not less than 100% of corrected Standard Proctor maximum dry density.
  - .2 Fill under other areas with Type 2 fill compacted to not less than 95% of corrected 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.
  - .2 Clean out rock seams and fill with concrete mortar or grout to approval of Departmental Representative.

### **3.8 FILL TYPES AND COMPACTION**

- .1 Use types of fill as indicated or specified below. Compaction densities are percentages of maximum densities obtained from ASTM D698.
  - .1 Exterior side of perimeter walls: use Type 3 fill to subgrade level. Compact to 95% of corrected maximum dry density.
  - .2 Within building area: use Type 2 to underside of base course for floor slabs. Compact to 100% of corrected maximum dry density.
  - .3 Under concrete slabs: provide 150 mm compacted thickness base course of Type 1 fill to underside of slab. Compact base course to 100%.
  - .4 Retaining walls: use Type 2 fill to subgrade level]on high side for minimum 500 mm from wall and compact to 95%. For remaining portion, use Type 3 fill compacted to 95%.
  - .5 Place unshrinkable fill in areas as indicated.

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

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

### **3.10 BACKFILLING**

- .1 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.
  - .5 Removal of shoring and bracing; backfilling of voids with satisfactory soil material.
- .2 Areas to be backfilled to be free from debris, snow, ice, water and frozen ground.
- .3 Do not use backfill material which is frozen or contains ice, snow or debris.
- .4 Place backfill material in uniform layers not exceeding 150 mm compacted thickness up to grades indicated. Compact each layer before placing succeeding layer.

- .5 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.
  - .4 Where temporary unbalanced earth pressures are liable to develop on walls or other structures:
    - .1 Permit concrete to cure for minimum 14 days or until it has sufficient strength to withstand earth and compaction pressure and approval obtained from Departmental Representative.
    - .2 If approved by Departmental Representative, erect bracing or shoring to counteract unbalance, and leave in place until removal is approved by Departmental Representative.
- .6 Consolidate and level unshrinkable fill with internal vibrators.

### **3.11 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 as indicated.
- .3 Reinstall lawns to elevation which existed before excavation.
- .4 Reinstall pavements and sidewalks disturbed by excavation to thickness, structure and elevation which existed before excavation.
- .5 Clean and reinstall areas affected by Work as directed by Departmental Representative.
- .6 Use temporary plating to support traffic loads over unshrinkable fill for initial 24 hours.
- .7 Protect newly graded areas from traffic and erosion and maintain free of trash or debris.

**END OF SECTION**

## **PART 1 GENERAL**

### **1.1 INTENT**

- .1 The Contractor shall supply and place non-woven geotextile filter fabric as indicated on the drawings, and as directed by the Parks Canada Representative in areas where the subgrade foundation conditions are considered soft and unstable.

### **1.2 MEASUREMENT AND PAYMENT**

- .1 Geotextile filter fabric is incidental to the larger work item for which they are performed.
- .2 If additional geotextile material is required for subgrade stabilization or other applications not detailed, measurement shall be per square metre in-place.

### **1.3 REFERENCE STANDARDS**

- .1 The following are a list of standards that may be referenced in this section:
  - .1 ASTM International
    - .1 ASTM D4632, Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.
    - .2 ASTM D6241, Standard Test Method for Static Puncture Strength of Geotextiles and Geotextile-Related Products Using a 50-mm Probe.
    - .3 ASTM D4533, Standard Test Method for Trapezoid Tearing Strength of Geotextiles.
    - .4 ASTM D4491, Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
  - .2 Canadian General Standards Board (CGSB)
    - .1 CAN/CGSB-4.2 No. 11.2, 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, Methods of Testing Geosynthetics - Mass per Unit Area.
      - .2 No.3, Methods of Testing Geosynthetics - Thickness of Geotextiles.
      - .3 No.6.1, Methods of Testing Geotextiles and Geomembranes - Bursting Strength of Geotextiles Under No Compressive Load.
      - .4 No.7.3, Methods of Testing Geotextiles and Geomembranes - Grab Tensile Test for Geotextiles.
      - .5 No. 10, Methods of Testing Geosynthetics - Geotextiles - Filtration Opening Size.
- .2 CSA Group
  - .1 CSA G40.20/G40.21, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

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

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

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

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

## **PART 2 PRODUCTS**

### **2.1 MATERIAL**

- .1 Synthetic filter fabric shall consist of a durable, permeable, non-woven, polyester fabric composed of continuous synthetic filaments in a random arrangement with typical properties as follows:

Non-Woven Geotextile Filter Fabric Minimum Specifications and Physical Properties		
Grab Strength	ASTM D4632	650 N
Elongation	ASTM D4632	50 %
CBR Puncture	ASTM D6241	1600 N
Trapezoidal Tear	ASTM D4533	250 N
Permittivity	ASTM D4491	1.7 /s

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- .1 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 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
  - .2 Proceed with installation only after unacceptable conditions have been remedied.

### **3.2 INSTALLATION**

- .1 Construction shall be as per manufacturer's instructions.
- .2 Place geotextile by unrolling onto graded surface in locations indicated on Drawings.
- .3 Place geotextile material smooth and free of tension, stress, folds, wrinkles, and creases.
- .4 Overlap each successive strip of geotextile 300 mm over previously laid strip. In the case of use below rip rap and rip rap channels, the upstream strip of geotextile is to overlap overtop of the downstream strip of geotextile.
- .5 The fabric placed on the inlet and outlet aprons shall be laid perpendicular to the centre line of the culvert and shall be laid so that the upslope strip of fabric will overlap the downslope strip.
- .6 Securing pins and washers shall be inserted through both strips of overlapped fabric at not greater than 1 m intervals along a line through the midpoint of the overlap, and at intervals necessary to prevent slippage of the fabric on downslopes. Each securing pin shall be pushed through the fabric until the washer bears against the fabric firmly and secures it to the foundation.
- .7 Protect installed geotextile material from displacement, damage, or deterioration before, during, and after placement.

**END OF SECTION**



**PART 1 GENERAL**

**1.1 DESCRIPTION**

- .1 The section outlines requirements to preparing the subgrade prior to placing overlying layers.

**1.2 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Make submittals in accordance with Section 01 33 00 - Submittal Procedures.

**PART 2 PRODUCTS**

**2.1 NOT USED**

- .1 Not Used

**PART 3 EXECUTION**

**3.1 UNSTABLE SUBGRADE**

- .1 Where the subgrade is unstable, or where it contains materials such as ashes, cinders, refuse, vegetable or organic material, the Contractor shall excavate such material to the width, depth and length ordered by Departmental Representative and dispose of the material as directed. The subgrade shall then be made by backfilling with approved native material or imported granular material as directed by Departmental Representative. Material shall be placed in successive layers not exceeding 150 mm in depth and compacted to a minimum of 95% Standard Proctor Density.

**3.2 RESERVATION OF MATERIAL**

- .1 Whenever gravel, sand topsoil, or any other material suitable for special use is encountered, it shall be deemed to be the property of the Yoho National Park.
- .2 Where layers of gravel or gravelly mixtures are encountered, suitable materials shall be excavated separately from other excavation and shall be stockpiled at Yoho National Park or incorporated into the work as base material after testing the material in a laboratory to determine the grain size distribution and CBR values.

**3.3 DISPOSAL OF MATERIAL**

- .1 Where excavated material is not specifically directed to be used as fill or for any other purpose, the Contractor will be required to haul the material from site to an approved disposal site. There is no separate payment for this work and is considered included in the subgrade preparation unit payment.
- .2 All materials deemed to be in excess of requirements or unsuitable shall be disposed of appropriately by the Contractor outside of Yoho National Park.

**3.4 SUBGRADE PREPARATION**

- .1 Field densities and moisture content tests will be taken by the Departmental Representative to ensure that the subgrade is compacted to the specified density.
- .2 Following organic stripping and excavation to achieve design grades, the exposed subgrade should be scarified to a minimum depth of 150 mm, moisture conditioned to within 2% of the optimum moisture content (OMC) and compacted to a minimum of 98% of standard proctor maximum dry density (SPMDD).
- .3 The subgrade shall be left sufficiently high after compaction so that it can be trimmed to the final grade, and any loose material resulting from this operation removed. All

- depressions caused by the finishing rollers shall be removed during the final blading operation.
- .4 Final compaction of the subgrade surface shall be done with pneumatic tire rollers. Rolling shall be continued until all loose soil is properly compacted true to within 10 mm of design elevations but not uniformly high or low. This requirement must be fulfilled before the work will be accepted.
  - .5 If excess moisture exists in the soil, the top 150 mm of the subgrade shall be dried to within 2% of the optimum moisture content as determined by the Standard Proctor Compaction Test. In order to expedite compaction, the subgrade
  - .6 If the moisture existing in the soil is insufficient for compacting to the specified density and for finishing, the Contractor shall add water. The proper moisture content shall be within 2% of the optimum moisture content, as determined by the Standard Proctor Compaction Test. The water shall be added uniformly by a pressure water sprayer.
  - .7 The cost of adding water will be considered incidental to compaction and shall be included in the contract price for compaction.
  - .8 Trench backfill encountered in the preparation of the subgrade which has not been compacted sufficiently shall be excavated and re-compacted. The cost of this item shall be included in the unit bid price for subgrade preparation.
  - .9 The Contractor shall be responsible for any repair required to roadworks arising from the subsidence of trenches after the completion of the maintenance period of the underground services contractor(s).
  - .10 Inaccessible areas by large compaction equipment shall be compacted by mechanical hand tampers.

### **3.5 EXCAVATION BELOW GRADE**

- .1 When topsoil, muskeg, or other soft areas are encountered below the finished subgrade, which in the opinion of the Departmental Representative require removal, the area shall be subcut and the unsuitable material excavated, loaded and disposed of outside of Yoho National Park. These materials shall be replaced with suitable common excavation.
- .2 Fill material shall be placed in successive horizontal layers not exceeding 150 mm in compacted thickness. Suitable spreading and leveling equipment shall be kept in continuous operation at all times.
- .3 The compaction shall be sufficient to obtain a minimum density of 98% of maximum dry density in accordance with ASTM D698 (Method C or D), unless otherwise stated in the specifications. Where it is necessary to add or remove moisture from the soil to obtain the compaction, it shall be done as part of the requirements of this section.
- .4 The fill section shall be compacted to a level slightly above the finished grade, and cut back to the final elevation. All loose material shall be removed from the surface of the subgrade.

### **3.6 COMPACTION TESTING**

- .1 The maximum dry density of the soil shall be determined by ASTM procedure D-698 (Moisture Density Relationships of soils), to be determined for each soil type. The optimum moisture content of the soil shall be determined from the laboratory compaction curve established.
- .2 Fill material shall be placed in compacted lifts at a moisture content within  $\pm 2\%$  of the optimum moisture content.
- .3 Compact subgrade to a minimum of ninety eight percent (98%) of Standard Proctor Density in accordance with ASTM D698, unless otherwise stated in the specifications.
- .4 The field density of soils shall be determined by ASTM D-2922 – Determining density of soil and soil aggregate in place by nuclear methods (shallow depth).

- .5 Compaction results shall be based on a minimum of one density test per 500 square metres of road structure per lift. Additional tests may be called for by Departmental Representative as deemed necessary.

### **3.7 TOLERANCES**

- .1 The finished surface of the subgrade shall conform to grades approved by Departmental Representative, and shall show no depression more than 15 mm under a straightedge 3.0 m long when placed parallel to the centreline. Subgrade higher than the approved grades shall be cut to the required grades.
- .2 The tolerance for ditches, boulevards, etc., shall be  $\pm 30$  mm.

### **3.8 INSPECTION**

- .1 Prior to application of the subsequent layer of roadway materials, the subgrade surface shall be true to cross-section and grade, shall conform to the density specified and shall show to detailed inspection no visible subsidence or heave under the wheels of a roller having a weight of 4.5 kilograms per millimetre of tread width.
- .2 The Contractor shall supply and operate a loaded test vehicle of 8,200 kg axle load to test the subgrade for rutting, heaving and soft spots. Where proof rolling indicates areas are defective, the Contractor shall remove and replace the material with suitable compacted material. Proof rolling shall be considered incidental to the subgrade construction.
- .3 Proof rolling should be completed under the supervision of qualified technical personnel. Recommendations pertaining to the repair of soft areas shall be provided at the time of inspection but may include sub-cutting the subgrade.
- .4 Both the Departmental Representative and the Contractor shall closely observe this operation and note and mark out areas where weakness is indicated. Failures which develop in the subgrade shall be replaced at the Contractor's cost. After the repairs are completed the axle test shall be repeated until test is satisfactory.
- .5 All costs incurred during the performance of this test shall be borne by the Contractor.
- .6 Access to prepared subgrades should be restricted to avoid loosening of the prepared subgrade by site traffic before placement and compaction of the pavement structure.
- .7 The prepared subgrade should not be left exposed for extended periods of time to avoid wetting, drying and freezing of the material.

**END OF SECTION**

## **PART 1 GENERAL**

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

- .1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.

## **PART 2 PRODUCTS**

### **2.1 SAMPLES**

- .1 At least two (2) weeks prior to commencing work, inform Departmental Representative of proposed source of granular materials and provide materials certification of properties below.
- .2 The Contractor shall provide a sieve analysis of the material for Departmental Representative's review.
- .3 The gradation curve developed shall be free from acute changes.

### **2.2 MATERIALS CERTIFICATION**

- .1 Aggregates: At least two (2) weeks prior to commencing work, Contractor shall provide:
  - .1 Test data reports representing granular base and/or granular sub-base processed into stockpile. Submit one (1) complete aggregate gradation analysis report for every 1,000 tonnes of each material required for the project or one complete analysis for each production day when production is less than 1,000 tonnes.
  - .2 Include percentage of crushed coarse aggregate particles in granular base reports.
  - .3 Certification that the physical properties of the aggregates meet the requirements of this section.
  - .4 Reports and certification shall be provided by an independent testing consultant under the signature and professional seal of a qualified material Departmental Representative.
- .2 At least two (2) weeks prior to contemplate change in source of aggregates, provide written notification to Departmental Representative and provide new materials certification in accordance with the requirements of this section.

### **2.3 GRANULAR BASE**

- .1 Material for the granular base course shall consist of sound, hard, durable crushed rock or crushed gravel and shall not contain organic or soft, thin, elongated, or laminated materials, materials that break up when alternately frozen and thawed or wetted and dried, or other deleterious materials. When compacted near the optimum moisture content to not less than 100% of the maximum dry density corrected for the stone content as determined by ASTM D698, the material shall have a minimum bearing ratio as defined by ASTM D1883 of fifty-five percent (55%).
- .2 Granular base course shall meet the following gradation when tested to ASTM C136 and ASTM C117, and give a smooth curve without sharp breaks when plotted on a semi-log grading chart:

Sieve Size	Percent Passing (by weight)
25 mm	100
20 mm	95 - 100
10 mm	55 - 80
5 mm	35 - 65
2.5 mm	28 - 52

Sieve Size	Percent Passing (by weight)
630 µm	13 - 35
315 µm	9 - 26
160 µm	6 - 18
80 µm	4 - 10

- .3 At least 50 percent by weight of material retained on the #4 sieve shall have two or more fractured faces.
- .4 The liquid limit shall not exceed 25 and the plasticity index shall not exceed 6 for the portion of material passing the 1,000 sieve.

### **PART 3 EXECUTION**

#### **3.1 PREPARATION**

- .1 The Contractor shall maintain the subgrade to the specified section, free from ruts, waves and undulations until granular base course material is placed. The subgrade shall be in a firm dry condition and must be approved by Departmental Representative before placement. The depositing of granular base on a soft, muddy or rutted subgrade will not be permitted.

#### **3.2 PLACING**

- .1 Place material on a clean unfrozen surface, properly shaped and compacted and free from mud, water, snow and ice.
- .2 Place using methods which do not lead to segregation or degradation of aggregate. Use approved methods to create uniform windrow of material along a crown line or high side of a one-way slope.
- .3 Place material to full width in layers not exceeding 150 mm in compacted thickness.
- .4 Shape each layer to a smooth contour and compact to the specified density before succeeding layer is placed.
- .5 Remove and replace any portion of a layer in which material becomes segregated during spreading.
- .6 Remove and replace any portion of a layer in which material becomes segregated during compaction.

#### **3.3 COMPACTION**

- .1 Each layer of granular base course shall be compacted near the optimum moisture (+/- 2%) content to not less than 98% of the maximum dry density in accordance with ASTM D698 Method (C or D).
- .2 During compaction, the moisture content shall be maintained at the optimum moisture content as determined by ASTM D698. If the moisture content exceeds the optimum moisture content the material shall be aerated by mechanical means until the material has dried sufficiently to reach the optimum moisture content. Water shall be added if the moisture content is below optimum.
- .3 Shape and compact alternately to obtain a smooth, even and uniformly compacted base.
- .4 In areas not accessible to rolling equipment, compact to specified density with approved mechanical tampers.

**3.4 TESTING COMPACTION**

- .1 Compaction results shall be based on a minimum of one density test per 500 square meters of road per each lift. Additional tests may be called for by Departmental Representative as deemed necessary.
- .2 Field density tests shall conform to ASTM D1556, ASTM D2167, or ASTM D2922 for comparison with a maximum density determined according to ASTM D698 Method A.

**3.5 FINISH TOLERANCES**

- .1 Finished base surfaces shall be within plus or minus 10 mm of established grade, but not uniformly high or low.
- .2 Correct surface irregularities by loosening and adding or removing materials until surface is within the specified tolerances.

**3.6 MAINTENANCE**

- .1 Maintain finished base in a condition conforming to this section until succeeding material is applied or until acceptance.

**3.7 INSPECTION**

- .1 Before acceptance by Departmental Representative the granular base course surface shall be true to cross-section and grade, shall conform to the density and bearing ratio requirements specified.
- .2 Field density and moisture content tests will be made by Departmental Representative or his representative to ensure that the material is satisfactory. Material not meeting the specification requirements will not be approved.

**END OF SECTION**

**PART 1 GENERAL**

**1.1 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 each type of abrasives and solvent used on project.
  - .2 Submit 2 copies of WHMIS MSDS in accordance with Section 01 35 29.06- Health and Safety Requirements.

**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.

**PART 2 PRODUCTS**

**2.1 MATERIALS**

- .1 Abrasives and solvents used for removal of paint, oil, grease, rubber deposits: proprietary products specially designed for pavement cleaning, subject to approval by Departmental Representative.

**PART 3 EXECUTION**

**3.1 REMOVING PAVEMENT MARKINGS**

- .1 Remove rubber tire deposits and paint markings, in areas as directed by Departmental Representative, by water blasting, rotary grinding, heater planning or other method approved in writing by Departmental Representative.
- .2 Exercise care to avoid dislodging of coarse aggregate particles, excessive removal of fines, damage to bituminous binder or damage to joint and crack sealers.
- .3 Do not heat pavement surfaces above 120 degrees C, when using heater planning equipment.

**3.2 PAVEMENT SURFACE CLEANING**

- .1 Remove sealing compound which has protruded excessively, where directed by Departmental Representative.
  - .1 Dispose of removed material as directed by Departmental Representative.
- .2 Remove dust, contaminants, loose and foreign materials, oil and grease, in areas as directed by and by method approved in writing by Departmental Representative.
- .3 Use vacuum sweepers supplemented by hand brooming.

**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 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.

**END OF SECTION**



## **PART 1 GENERAL**

### **1.1 REFERENCE STANDARDS**

- .1 Health Canada - Pest Management Regulatory Agency (PMRA)
  - .1 National Standard for Pesticide Education, Training and Certification in Canada (1995).
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).
- .3 Department of Justice Canada (Jus)
  - .1 Canadian Environmental Protection Act (CEPA), 1999, c. 33.
  - .2 Fertilizers Act (R.S. 1985, c. F-10).
  - .3 Fertilizers Regulations (C.R.C., c. 666).
  - .4 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.

### **1.2 DEFINITIONS**

- .1 Mycorrhiza: association between fungus and roots of plants. This symbiosis, enhances plant establishment in newly landscaped and imported soils.

### **1.3 ADMINISTRATIVE REQUIREMENTS**

- .1 Scheduling:
  - .1 Obtain approval from Departmental Representative of schedule indicating beginning of Work.

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

- .1 Provide in accordance with Section 01 33 00- Submittal Procedures.
- .2 Product Data:
  - .1 Provide manufacturer's instructions, printed product literature and data sheets for tree and shrub preservation materials and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 Provide monthly written reports on maintenance during warranty period, to Departmental Representative identifying:
    - .1 Maintenance work carried out.
    - .2 Development and condition of plant material.
    - .3 Preventative or corrective measures required which are outside Contractor's responsibility.
  - .3 Submit 2 copies of WHMIS MSDS in accordance with Section 01 35 43- Environmental Procedures / 01 35 29.06- Health and Safety Requirements.

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

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions and Section 01 61 00- Common Product Requirements.
- .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 a dry location, off ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect tree and shrub preservation materials from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.

## **1.6 MAINTENANCE DURING WARRANTY PERIOD**

- .1 From time of acceptance by Departmental Representative to end of warranty period, perform following maintenance operations.
  - .1 Water to maintain soil moisture conditions for optimum growth and health of plant material without causing erosion.
  - .2 Apply pesticides in accordance with National Standard for Pesticide Education, Training and Certification in Canada, Federal, Provincial and Municipal regulations as and when required to control insects, fungus and disease. Obtain product approval from Departmental Representative prior to application.
  - .3 Apply fertilizer in early spring at manufacturer's suggested rate.
  - .4 Remove dead, broken or hazardous branches from plant material. Dispose of debris through composting or mulching.

## **PART 2 PRODUCTS**

### **2.1 MATERIALS**

- .1 Fertilizer:
  - .1 To Canada Fertilizer Act and Fertilizers Regulations.
  - .2 Complete, commercial, slow release with 35% of nitrogen content in water-insoluble form.
- .2 Wood posts: 38x89x 2400mm length, untreated wood.
- .3 Board Cladding: to consist of 50 x 100 mm lumber secured around the perimeter of tree trunks with plastic strapping or other means which will not damage the tree.
- .4 Tree Barriers: steel T-rail posts 40 x 40 x 5 x 2440 mm, at 1800 mm o.c., with wood slat snow fencing attached to posts with 9 gauge wire, 13 per post.

## **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 tree and shrub preservation 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 IDENTIFICATION AND PROTECTION**

- .1 Tree protection to be installed prior to the start of any on site work.
- .2 Identify plants and limits of root systems to be preserved as approved Departmental Representative.
- .3 Protect plant and root systems from damage, compaction and contamination resulting from construction as approved by Departmental Representative.
- .4 Ensure no root pruning is done inside drip line. If pruning inside drip line is required consult an arborist or Canadian Certified Horticultural Technician (CCHT) as approved by Departmental Representative.

**3.3 TRUNK PROTECTION**

- .1 Install board cladding vertically around the perimeter of designated deciduous trees within the active work zone.

**3.4 PRUNING**

- .1 Prune in accordance with Section 32 93 43.01- Tree Pruning.
- .2 Prune crown to compensate for root loss while maintaining general form and character of plant. Dispose of debris through mulching and / or composting.

**3.5 ANTI-DESICCANT**

- .1 Apply anti-desiccant to foliage where applicable and as directed by Departmental Representative.

**3.6 VERIFICATION**

- .1 Verification requirement include:
  - .1 Materials and resources.
  - .2 Storage and collection of recyclables.
  - .3 Construction waste management.
  - .4 Local/regional materials.
  - .5 Low-emitting materials.

**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 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 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.

**END OF SECTION**

## **PART 1 GENERAL**

### **1.1 REFERENCE STANDARDS**

- .1 ASTM International
  - .1 ASTM C117, Standard Test Methods for Material Finer Than 0.075 mm Sieve in Mineral Aggregates by Washing.
  - .2 ASTM C131, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
  - .3 ASTM C136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
  - .4 ASTM D422, Standard Test Method for Particle-Size Analysis of Soils.
  - .5 ASTM D698, 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 D1557, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000ft-lbf/ft<sup>3</sup>) (2,700kN-m/m<sup>3</sup>).
  - .7 ASTM D1883, Standard Test Method for CBR (California Bearing Ratio) of Laboratory Compacted Soils.
  - .8 ASTM D4318, Standard Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils.
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-8.1, Sieves, Testing, Woven Wire, Inch Series.
  - .2 CAN/CGSB-8.2, Sieves, Testing, Woven Wire, Metric.

### **1.2 SAMPLES**

- .1 At least two (2) weeks prior to commencing work, inform Departmental Representative of proposed source of granular materials.
- .2 The Contractor shall provide a sieve analysis of the material for the Departmental Representative.

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

- .1 Submit in accordance with Section 01 33 00- Submittal Procedures.
- .2 Granular subbase analysis will be submitted to the Departmental Representative before being used.
- .3 Preliminary review of the material as represented by the test results shall not constitute general acceptance of all material in the deposit or source of supply. Materials may be considered unsuitable even though particle sizes are within the limits of gradation sizes required, if particle shapes are thin or elongated or any other characteristic precludes satisfactory compaction, or if the material fails to provide a roadway suitable for traffic. Rejected material will not be paid for. The Departmental Representative has the right to request additional testing if there are any concerns with the proposed aggregate.

### **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 in accordance with manufacturer's recommendations and erosion and sedimentation control plan.
  - .2 Replace defective or damaged materials with new.

## **PART 2 PRODUCTS**

### **2.1 MATERIALS**

- .1 Granular sub-base material shall consist of crushed pit run or screened stone, gravel, or sand
- .2 Gradations to be within limits specified when tested to ASTM C136 and ASTM C117. Sieve sizes to CAN/CGSB-8.1.

Sieve Designation	Percent Passing (%)
100 mm	100
80 mm	100
40 mm	60-90
20 mm	40-70
10 mm	25-60
5.0 mm	15-25
2.5 mm	10-35
0.63 mm	5-23
0.08 mm	0-5

- .3 Other properties as follows:
  - .1 Minimum % Fracture, by weight (2 faces) – 20%
  - .2 Los Angeles Abrasion, max loss – 40%
  - .3 Liquid Limit: to ASTM D4318, Maximum 25.
  - .4 Plasticity Index: to ASTM D4318, Maximum 6.
  - .5 California Bearing Ratio, when compacted to 100% of ASTM D698 – 40 min.

## **PART 3 EXECUTION**

### **3.1 PLACING**

- .1 Place granular sub-base after subgrade is inspected and approved by 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 Begin spreading sub-base material on crown line or high side of one-way slope.
- .6 Place granular sub-base materials using methods which do not lead to segregation or degradation.
- .7 Place material to full width in uniform layers not exceeding 150mm compacted thickness.
  - .1 Departmental Representative may authorize thicker lifts if specified compaction can be achieved.
- .8 Shape each layer to smooth contour and compact to specified density before succeeding layer is placed.
- .9 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 98% corrected maximum dry density in accordance with ASTM D698.
- .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 approved by Departmental Representative.
- .6 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.

### **3.3 CLEANING**

- .1 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11- Cleaning.
- .2 Waste Management: separate waste materials for 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 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 accepted by Departmental Representative.

**END OF SECTION**

## **PART 1 GENERAL**

### **1.1 DEFINITIONS**

- .1 Prime Coat: Prime coat shall be the application of bituminous material to previously prepared subgrade or granular base course, preparatory to placing bituminous surfacing materials or asphaltic concrete base course.
- .2 Tack Coat: Tack coat shall be the application of bituminous material to a previously constructed paving surface of any type in preparation of placing bituminous surfacing materials.

### **1.2 REFERENCE STANDARDS**

- .1 ASTM International
  - .1 ASTM D140/D140M, Standard Practice for Sampling Bituminous Materials.
  - .2 ASTM D633, Standard Volume Correction Table for Road Tar.
  - .3 ASTM D1250, Standard Guide for Use of the Petroleum Measurement Tables.
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-16.2, Emulsified Asphalts, Anionic Type, for Road Purposes.

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

- .1 Submit in accordance with Section 01 33 00 – Submittal Procedures.
  - .1 Submit two (2) 1 L samples of bituminous material proposed for use in new, clean, airtight, sealed, wide mouth jars or battles made with plastic to Departmental Representative, at least two (2) weeks prior to beginning work.
  - .2 Sample asphalt tack coat material to ASTM D 140.
  - .3 Provide access on tank truck for Departmental Representative to sample asphalt material to be incorporated into work to ASTM D 140.

### **1.4 QUALITY ASSURANCE**

- .1 Upon request from Departmental Representative, submit manufacturer's test data and certification that asphalt prime material meets requirements of this Section.

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

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials off ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect asphalt tack coats from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.
- .4 Provide, maintain and restore asphalt storage area.

### **1.6 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate waste materials for recycling in accordance with Section 01 74 21- Construction/Demolition Waste Management And Disposal.

## **PART 2 PRODUCTS**

### **2.1 MATERIALS**

- .1 The bituminous material for priming the subgrade and base course shall be anionic emulsified asphalt. The asphalt types shall be slow setting (SS) type SS-1 to SS-1H or a special emulsified asphalt primer S.E.P. 1 depending on conditions and environment.
- .2 Cut-back asphalt to AASHTO M081-92-UL, grade RC-70 or RC-250.
- .3 Water: clean, potable, free from foreign matter.

### **2.2 EQUIPMENT**

- .1 Equipment required for Work of this Section to be in satisfactory working condition and maintained for duration of Work.
- .2 Pressure distributor:
  - .1 Designed, equipped, maintained and operated so that asphalt material can be:
    - .1 Maintained at even temperature.
    - .2 Applied uniformly on variable widths of surface up to 5m.
    - .3 Applied at readily determined and controlled rates from 0.2 to 5.4 L/m<sup>2</sup> with uniform pressure, and with allowable variation from any specified rate not exceeding 0.1 L/m<sup>2</sup>.
    - .4 Distribute in uniform spray without atomization at temperature required.
  - .2 Equipped with meter, registering travel in metres per minute, visibly located to enable truck driver to maintain constant speed required for application at specified rate.
  - .3 Equipped with pump having flow metre graduated in units of 5 L or less per minute passing through nozzles and readily visible to operator. Pump power unit to be independent of truck power unit.
  - .4 Equipped with easily read, accurate and sensitive device which registers temperature of liquid in reservoir.
    - .1 Measure temperature to closest whole number.
  - .5 Equipped with accurate volume measuring device or calibrated tank.
  - .6 Equipped with nozzles of same make and dimensions, adjustable for fan width and orientation.
  - .7 Equipped with nozzle spray bar, with operational height adjustment in increments of 0.6 metres and capable of being raised or lowered.
  - .8 Cleaned if previously used with incompatible asphalt material.

## **PART 3 EXECUTION**

### **3.1 APPLICATION**

- .1 Apply asphalt tack coat only on clean and dry surface.
- .2 Dilute asphalt emulsion with water at 1:1 ratio for application.
  - .1 Mix thoroughly by pumping or other method approved by Departmental Representative.
- .3 Apply asphalt tack coat evenly to pavement surface at rate of 0.5 L/m<sup>2</sup> but not to exceed 0.7 L/m<sup>2</sup>.
- .4 Paint contact surfaces of curbs, gutters, headers, manholes and like structures with thin, uniform coat of asphalt tack coat material.



- .5 Apply asphalt tack coat only when air temperature greater than 10 degrees C and when rain is not forecast within 2 hours minimum of application.
- .6 Apply asphalt tack coat only on unfrozen surface.
- .7 Evenly distribute localized excessive deposits of tack coat by brooming as directed by Departmental Representative.
- .8 Keep traffic off tacked areas until asphalt tack coat has set.
- .9 Re-tack contaminated or disturbed areas as directed by Departmental Representative.
- .10 Permit asphalt tack coat to set before placing asphalt pavement.
- .11 Submit summary report within 7 days minimum of date of application and include information as follows:
  - .1 Total area tack coated.
  - .2 Quantity of tack coat used.
  - .3 Mean application rate.
  - .4 Actual product quantity used when using equipment on pressure distributors.
  - .5 Dipstick measurements or electronic printouts are acceptable.
- .12 Carry out measurements in presence of Departmental Representative upon request.
- .13 Inspect tack coat application to ensure uniformity.
  - .1 Re-spray areas of insufficient or non-uniform tack coat coverage as directed by Departmental Representative.
  - .2 Ensure tack coating performed using hand held devices is consistent in appearance with adjacent areas of machine applied material.

### **3.2 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.

**END OF SECTION**

## **PART 1        GENERAL**

### **1.1        DEFINITIONS**

- .1        Overlay: Paving over an existing pavement for rehabilitation purposes and not as part of staged paving.
- .2        Staged Paving: Paving where a lift or lifts that form part of the total pavement structure are deferred to a future date.

### **1.2        REFERENCE STANDARDS**

- .1        The following is a list of standards that may be referenced in this section:
  - .1        American Association of State Highway and Transportation Officials (AASHTO)
    - .1        AASHTO M320, Standard Specification for Performance Graded Asphalt Binder.
    - .2        AASHTO R29, Standard Specification for Grading or Verifying the Performance Graded of an Asphalt Binder.
    - .3        AASHTO T245, Standard Method of Test for Resistance to Plastic flow of Bituminous Mixtures Using Marshall Apparatus.
  - .2        Asphalt Institute (AI)
    - .1        AI MS-2, Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types.
  - .3        ASTM International
    - .1        ASTM C88, Standard Test Method for Soundness of Aggregates by Use of Sodium Sulphate or Magnesium Sulphate.
    - .2        ASTM C117, Standard Test Method for Material Finer Than 0.075mm (No.200) Sieve in Mineral Aggregates by Washing.
    - .3        ASTM C123, Standard Test Method for Lightweight Particles in Aggregate.
    - .4        ASTM C127, Standard Test Method for Specific Gravity and Absorption of Coarse Aggregate.
    - .5        ASTM C128, Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Fine Aggregate.
    - .6        ASTM C131, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
    - .7        ASTM C136, Standard Method for Sieve Analysis of Fine and Coarse Aggregates.
    - .8        ASTM C207, Standard Specification for Hydrated Lime for Masonry Purposes.
    - .9        ASTM D995, Standard Specification for Mixing Plants for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures.
    - .10       ASTM D2419, Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate.
    - .11       ASTM D3203, Standard Test Method for Percent Air Voids in Compacted Dense and Open Bituminous Paving Mixtures.
    - .12       ASTM D4791, Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate.
  - .4        Canadian General Standards Board (CGSB)
    - .1        CAN/CGSB-8.1, Sieves Testing, Woven Wire, Inch Series.
    - .2        CAN/CGSB-8.2, Sieves Testing, Woven Wire, Metric.
  - .5        British Columbia Ministry of Transportation and Infrastructure

.1 BC MoTI – Standard Specifications for Highway Construction

**1.3 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00- Submittal Procedures.
- .2 At least two (2) weeks prior to commencing work, inform Departmental Representative of proposed source of aggregate materials and asphalt binder.
- .3 The Contractor shall submit asphalt concrete mix design based on the Marshall Method and trial mix test results to the Departmental Representative for review at least 2 weeks prior to commencing work.
- .4 The Contractor shall provide a sieve analysis of the aggregate material for the Departmental Representative's review.
- .5 Asphalt concrete mix design and a minimum 60 kg sample of the mix shall be submitted to the Departmental Representative 48 hours prior to any mix being used.
- .6 Preliminary review of the aggregate as represented by the samples shall not constitute general acceptance of all material in the deposit or source of supply. Materials may be considered unsuitable even though particle sizes are within the limits of the gradation sizes required, if particle shapes are thin or elongated or any other characteristic precludes satisfactory compaction or if the material fails to provide a pavement suitable for traffic. Rejected material will not be paid for. The Departmental Representative has the right to request additional testing if there are any concerns with the proposed aggregate mix design.
- .7 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for asphalt mixes and aggregate and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 Submit viscosity-temperature chart for asphalt cement to be supplied showing either Saybolt Furol viscosity in seconds or Kinematic Viscosity in centistokes, temperature range 105 to 175 degrees C four (4) weeks prior to beginning Work.

**1.4 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Deliver and stockpile aggregates in accordance with erosion and sedimentation control plan. Stockpile minimum 50% of total amount of aggregate required before beginning asphalt mixing operation.
- .3 When necessary to blend aggregates from one or more sources to produce required gradation, do not blend in stockpiles.
- .4 Stockpile fine aggregate separately from coarse aggregate, although separate stockpiles for more than two mix components are permitted.
- .5 Provide approved storage, heating tanks and pumping facilities for asphalt cement.
- .6 Submit to Departmental Representative copies of freight and waybills for asphalt cement as shipments are received.
  - .1 Departmental Representative reserves right to check weights as material is received.
- .7 Stockpile crushed RAP separately in accordance where directed by Departmental Representative.
- .8 Protect and cover stockpiles of crushed RAP from rain to approval of Departmental Representative in accordance with erosion and sedimentation control plan.

## **PART 2 PRODUCTS**

### **2.1 ASPHALT MIX TYPE**

- .1 Contractor to provide asphalt mix design for BC MoTI Medium Mix Class 1 Asphalt Concrete that is in accordance with BC MoTI – Standard Specifications for Highway Construction (Latest Edition) Section 502 – Asphalt Pavement Construction (EPS).
- .2 Asphalt mix design shall be reviewed and approved by Departmental Representative.

## **PART 3 EXECUTION**

### **3.1 PREPARATION**

- .1 Patch and correct depressions and other irregularities to approval of Departmental Representative before beginning paving operations. Prior to laying mix, clean surfaces of loose and foreign material and apply tack coat in accordance with Section 32 12 13.16 – Asphalt Prime and Tack Coats.
- .2 All asphalt surfaces shall be clean pavement edges free from encroaching vegetation.

### **3.2 MIX TOLERANCES**

- .1 All mixture furnished shall conform to BC MoTI – Standard Specifications for Highway Construction (Latest Edition) Section 502 – Asphalt Pavement Construction (EPS) and meet specified tolerances.

### **3.3 MIXING PLANT**

- .1 The mixing plant and auxiliary equipment shall be as such to combine, dry and heat the mineral aggregate, heat the asphalt and accurately proportion the asphalt and aggregate to produce a uniform mixture in accordance with these specifications.
- .2 All asphalt mixing plants shall be registered with British Columbia's Ministry of Environment, Environmental Protection Division and shall be operated in accordance with the "Asphalt Plant Regulation" under the "Environmental Management Act".

### **3.4 TRANSPORTATION OF MIX**

- .1 The mixture shall be transported from the mixing plant to the work in vehicles with tight metal bottoms previously cleaned of all foreign materials. The vehicle shall be suitably insulated and each load shall be covered with canvas or other suitable material of sufficient size to protect it from weather conditions. The inside surface of all vehicles may be lightly lubricated with a thin oil or soap solution prior to loading but excess lubricating will not be permitted.
- .2 Any accumulation of asphaltic material which was collected in the box shall be thoroughly cleaned before loading with hot mix.
- .3 Trucks shall be maintained perfectly clean of mud or any substance which could contaminate the working area.

### **3.5 EQUIPMENT**

- .1 Pavers: mechanical grade controlled self-powered pavers capable of spreading mix within specified tolerances, true to line, grade and crown indicated.
- .2 Roller: The rollers used for compaction shall be self-propelled steel-wheeled or rubber-tired rollers, providing at least 35 Newtons per millimetre width of tread. The roller shall be in good condition without backlash when reversed and shall be operated by competent rollermen. The wheels shall be kept properly moistened, but excess water or oil will not be permitted.
- .3 Hand Tools: Lutes or rakes with covered teeth for spreading and finishing operations.

### 3.6 PLACING

- .1 Obtain Departmental Representative's approval of base and existing surface and tack coat and prime coat prior to placing asphalt. Asphaltic concrete shall be laid in lifts to the design thickness applicable to the project. Lift thickness shall not exceed 60 mm.
- .2 Place asphalt concrete to thicknesses, grades and lines indicated or directed by Departmental Representative.
- .3 Placing conditions:
  - .1 No asphalt shall be dispatched to the field unless local temperature, as issued by the Atmospheric Environmental Service, meets the requirements of the following table:

Depth of Asphalt	Minimum Air Temperature
Surface lift (<50mm)	15°C
60 mm lift	4°C and rising

- .2 A 2°C tolerance shall be permitted for plant start-up temperatures.
- .3 No asphalt shall be placed on or against any surface, which is at temperature of less than 5°C.
- .4 When temperature of surface on which material is to be placed falls below 10°C, provide extra rollers as necessary to obtain required compaction before cooling.
- .5 Do not place hot-mix asphalt when pools of standing water exist on surface to be paved, during rain, or when surface is damp.
- .4 Place asphalt concrete in compacted lifts of thickness not exceeding [50]mm.
- .5 Place individual strips no longer than [500]m.
- .6 Mixtures shall be spread at temperatures which, when measured in the hopper of the spreader, are:
  - .1 115°C to 150°C for an air temperature above 15°C
  - .2 140°C to 160°C for an air temperature below 15°C
- .7 In small areas where the use of mechanical finishing equipment is not practical, the mix may be spread and finished by hand, if so directed by the Departmental Representative. The material shall be distributed uniformly to avoid segregation of the coarse and fine aggregates. Broadcasting of material shall not be permitted. During the spreading operation, all material shall be thoroughly loosened and uniformly distributed by lutes or rakes. Material that has formed into lumps and does not break down readily shall be rejected.
- .8 Areas which are deemed likely to have vehicles, the pavement edge should have pavement edge sloped to protect pavement edge from damage. These areas are required to be indicated in the field by the Departmental Representative.

### 3.7 ROLLING AND COMPACTION

- .1 Before rolling is started, the surface shall be checked, inequalities in depth adjusted or sandy accumulations replaced and irregularities in alignment or grade along the outside edge shall be corrected.
- .2 The rollers must be kept in continuous operation as nearly as practicable and all parts of the pavement shall receive substantially the same compaction. Rolling shall be done at a maximum speed of 5 km per hour.
- .3 At least one roller shall be used for every 40 tonnes of asphaltic concrete laid per hour. Rolling shall start as soon as the pavement will bear the roller without checking or undue displacement, working from the low part or edge to the high part or edge continuously until no roller marks are left in the finished surface and no further compaction is possible.

Where width permits the pavement shall be rolled diagonally in two directions. At all curbs, manholes and other appurtenances, and at all locations not accessible to the rollers, hand tampers shall be used to produce the same density as provided by the roller. Where the asphaltic concrete is laid in more than one lift, each lift shall be so compacted.

- .4 Required Density: Each mat of hot mix placed shall be compacted to the following minimum density (% of Marshall Density) for the type of paving, or as indicated in Special Provisions.

Minimum Density	Type of Paving
98%	New paving and all stages in staged paving (except 2 <sup>nd</sup> stage residential material ≤ 40mm)
96%	Second stage residential material ≤ 40mm

### 3.8 JOINTS

- .1 The new mixture shall be laid so that all longitudinal joints are made while the first mat of the two being laid is still warm and shall be well bonded, sealed and finished to provide a continuous and smooth profile across the joint.
- .2 Transverse joints shall be carefully constructed and thoroughly compacted to provide a smooth-riding surface. Joints shall be straight-edged to assure smoothness and true alignment. The vertical face shall be treated with freshly laid mixture raked against it, tamped with hot tampers and rolled. Heat shall be used as necessary to ensure a proper bond.
- .3 Paving joints shall not be placed in the same vertical plane. Longitudinal joints shall be offset at least 75 mm and transverse joints in succeeding courses shall be offset at least 600 mm.
- .4 Joints in the surface course shall be offset a minimum of 300 mm beyond the limit of proposed lane markings.
- .5 Edges against which additional pavement is placed shall be vertically formed to true line. In making the joint along any adjoining edge such as curb, gutter or an adjoining pavement and after the hot mixture is placed by the finishing machine, enough material shall be carried back to fill any space left open.
- .6 The exposed edges of all cold asphalt joints and the face of concrete gutter shall be cleaned and painted with a thin coat of hot asphalt cement. When the ambient air temperature is less than 10° Celsius, joints shall be heated using an infrared heater prior to painting with hot asphalt cement.
- .7 Where a transverse joint is made with a cold asphalt mat, the joint shall be made on a vertically true line. Cold jointing shall be done in such a manner as to ensure a thorough and continuous bond between the cold and the hot mats.
- .8 Cold asphalt shall be one where the surface temperature, taken within 600 mm of the edge of the mat, is less than 65°C.

### 3.9 FINISH TOLERANCES

- .1 The finished pavement shall be true to the required profile and cross-section. Tests of pavement profile and thickness shall be made after the first layer of asphalt has been placed, and depressions or bumps in excess of 5 mm shall be corrected. The allowable tolerance for finished pavement shall be ±5 mm, and the surface shall show no depressions or bumps exceeding 3 mm under a straight-edge 3 m long placed parallel to the road centreline.
- .2 Gravel or soil material adjacent to pavement edge shall be adequately placed and compacted directly alongside road edge as specified in road section details.

### 3.10 DEFECTIVE WORK

- .1 Correct irregularities which develop before completion of rolling by loosening surface mix and removing or adding material as required. If irregularities or defects remain after final compaction, remove surface course promptly and lay new material to form a true and even surface and compact immediately to specified density.
- .2 Repair areas showing checking or hairline cracking.

### 3.11 TESTING AND INSPECTION

- .1 The Departmental Representative or his representative shall retain core samples from the completed pavement, from which depth of pavement and density tests shall be made.
- .2 One core shall be taken for approximately every 1500 m<sup>2</sup> of asphalt or at least once each day during placing operations. The following tests shall be carried out:
  - .1 Marshall stability (test for resistance of plastic flow of bituminous mixtures) using Marshall Apparatus as per ASTM D1559.
  - .2 Sieve analysis of extracted aggregates in accordance with ASTM C136 and entire washed sample in accordance with ASTM C117.
  - .3 Bulk specific gravity of compacted mixtures in accordance with ASTM D2726.
  - .4 Bitumen content of paving mixtures in accordance with ASTM D2172.
  - .5 Percent voids in the mineral aggregates (VMA) is to be calculated on the basis of ASTM D2726 Bulk Specific Gravity of the aggregate.
  - .6 Air voids in compacted mix in accordance with ASTM D3203.
- .3 The Contractor shall repair all test holes with fresh, hot mix asphaltic concrete mixture, and thoroughly compact it to the required density with no additional compensation.

### 3.12 PENALTIES

- .1 Thickness
  - .1 If a deficiency in thickness is found, two more cores shall be taken in the area, and the average thickness of the three cores shall represent the area. The Contract Unit Price shall be adjusted as follows for areas deficient in thickness.
    - .1 No payment shall be made for asphaltic surface course deficient in thickness by 13 mm or more.
    - .2 If the surface course is found deficient by more than 3 mm but less than 13 mm, then the adjusted unit price shall have the same ratio to the contract unit price that the square of the average thickness found has to the square of the specified thickness.
  - .2 No price adjustment shall be made for surface course found to be deficient by less than 3 mm or any thicker than specified.
- .2 Density:
  - .1 The cores will also be used to determine density. If any test fails to meet the density specified, two more cores shall be taken in the area, and the average density of the three cores shall represent the area. If the densities are less than specified, the Contract Unit Price shall be adjusted as follows:

ASPHALT DENSITY PAY FACTORS					
98% Required		97% Required		96% Required	
Actual Density %	Pay Factor %	Actual Density %	Pay Factor %	Actual Density %	Pay Factor %
98.0	100.0	97.0	100.0	96.0	100.0
97.9	99.9	96.9	99.9	95.9	99.7
97.8	99.8	96.8	99.7	95.8	99.3
97.7	99.6	96.7	99.4	95.7	98.9

<b>ASPHALT DENSITY PAY FACTORS</b>					
<b>98% Required</b>		<b>97% Required</b>		<b>96% Required</b>	
<b>Actual Density %</b>	<b>Pay Factor %</b>	<b>Actual Density %</b>	<b>Pay Factor %</b>	<b>Actual Density %</b>	<b>Pay Factor %</b>
97.6	99.4	96.6	99.1	95.6	98.4
97.5	99.1	96.5	98.7	95.5	97.8
97.4	98.7	96.4	98.2	95.4	97.1
97.3	98.3	96.3	97.7	95.3	96.4
97.2	97.8	96.2	97.1	95.2	95.6
97.1	97.2	96.1	96.3	95.1	94.6
97.0	96.5	96.0	95.5	95.0	93.4
96.9	95.8	95.9	94.6	94.9	92.2
96.8	95.0	95.8	93.6	94.8	90.7
96.7	94.2	95.7	92.5	94.7	89.1
96.6	93.3	95.6	91.3	94.6	87.3
96.5	92.3	95.5	89.9	94.5	85.1
96.4	91.1	95.4	88.4	94.4	82.6
96.3	89.8	95.3	86.7	94.3	79.5
96.2	88.5	95.2	84.8	94.2	75.5
96.1	87.1	95.1	82.7	94.1	69.7
96.0	85.5	95.0	80.3	94.0	60.0
95.9	83.8	94.9	77.6	Under 94.0	Reject
95.8	82.0	94.8	74.3		
95.7	80.0	94.7	70.6		
95.6	77.7	94.6	66.0		
95.5	75.4	94.5	60.0		
95.4	73.0	Under 94.5	Reject		
95.3	70.3				
95.2	67.2				
95.1	63.7				
95.0	60.0				
Under 95.0	Reject				

Actual Density = % of Marshall Density

Pay Factor = % of contract price

### 3.13 ACCEPTANCE

- .1 Locations shall be cleared of all excess material resulting from the paving operation and any damage caused by the Contractor shall be repaired to the Departmental Representative's satisfaction within 3 days of the date of completion of the street or lane. Failure to clean-up or repair damage may result in other crews undertaking this work without notice to the Contractor and deducting the costs from money due to the Contractor.
- .2 No traffic shall be allowed on the finished surface until it has cooled to atmospheric temperature.

**END OF SECTION**



## **PART 1 GENERAL**

### **1.1 REFERENCE STANDARDS**

- .1 The following is a list of standards that may be referenced in this section:
  - .1 ASTM International
    - .1 ASTM C131, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
    - .2 ASTM C88, Standard Test Method for Soundness of Aggregates by Use of Sodium sulphate or Magnesium Sulphate.
    - .3 ASTM D140/D140M, Standard Practice for Sampling Bituminous Materials.
    - .4 ASTM D2419, Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate.
    - .5 ASTM D3910, Standard Practice for Design, Testing and Construction of Slurry Seal.
    - .6 ASTM D4318, Standard Test Method for Liquid Limit, Plastic Limit and Plasticity Index of Soils.
  - .2 Canadian General Standards Board (CGSB)
    - .1 CAN/CGSB-16.2, Emulsified Asphalts, Anionic Type, for Road Purposes.
    - .2 CAN/CGSB-16.4, Emulsified Asphalts, Cationic Type, for Road Purposes.
  - .3 British Columbia Ministry of Transportation and Infrastructure
    - .1 BC MoTI – Standard Specifications for Highway Construction

### **1.2 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 chip seal and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Samples:
  - .1 Submit following samples of materials proposed for use at least 2 weeks prior to beginning Work:
    - .1 1 kg of aggregates.
    - .2 Four 1 L containers of asphalt material sampled and stored in accordance with ASTM D140/D140M.
- .4 Test and Evaluation Reports:
  - .1 Submit manufacturer's test data and certification that asphalt emulsion meets requirements of this section.

### **1.3 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 Replace defective or damaged materials with new.

## **PART 2 PRODUCTS**

### **2.1 MATERIALS**

- .1 Contractor to provide mix design for chip seal that is in accordance with BC MoTI – Standard Specifications for Highway Construction (Latest Edition).
- .2 Chip seal mix design shall be reviewed and approved by Departmental Representative.

### **2.2 EQUIPMENT**

- .1 Slurry seal mixing and spreading equipment: in accordance with ASTM D3910 to approval of Departmental Representative.
  - .1 Use rubber tired vehicle capable of maintaining uniform speed.
- .2 Rolling equipment: smooth pneumatic-tired, self-propelled type. Wobble-wheel types not permitted.
  - .1 Rollers to exert force of at least 3.0 tonnes/m of rolling width.
  - .2 Minimum contact pressure: 345 kPa.
  - .3 Rollers to be equipped with water sprinkling apparatus to keep wheels damp to prevent adherence of slurry material.

### **2.3 JOB MIX FORMULA**

- .1 Job mix formula approved by Departmental Representative.
- .2 Provide report prepared by commercial testing company giving detailed data on trial mixes and design mix selected to Departmental Representative at least 1 week prior to beginning Work.
- .3 Wet track abrasion loss of mix not to exceed 800g/m<sup>2</sup> when tested to ASTM D3910.

## **PART 3 EXECUTION**

### **3.1 GENERAL**

- .1 Do asphalt slurry seal work in accordance with ASTM D3910.

### **3.2 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for asphalt seal coat 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 OF PAVEMENT SURFACE**

- .1 Prepare surface in accordance with ASTM D3910 and Section 32 01 11.01- Pavement Cleaning and Marking Removal.
- .2 Protect maintenance holes and other service entrances to approval of Departmental Representative.
- .3 Pre-wet pavement surface with water as directed by Departmental Representative.
- .4 Apply tack coat in accordance with Section 32 12 13.16- Asphalt Prime and Tack Coats.

### **3.4 PREPARATION OF SLURRY MIX**

- .1 Charge mixer with materials in following order:
  - .1 Water,
  - .2 Aggregate in unfrozen condition,
  - .3 Asphalt emulsion,
  - .4 Additives.
- .2 When mineral filler is required to obtain required gradation, add slowly to other aggregates before adding asphalt emulsion.
- .3 Mix to produce a uniform coating of aggregate and continue mixing until discharged to spreader box.
- .4 Discard batch if Departmental Representative determines that emulsion has broken.

### **3.5 APPLICATION**

- .1 Obtain Departmental Representative's approval of existing surface prior to applying slurry seal.
- .2 Discharge slurry mix into moving spreader box at a rate to maintain ample supply of mix across width of strike-off squeegee.
- .3 Adjust strike-off squeegee to provide average slurry thickness of 3 mm but not exceeding 6 mm.
- .4 Use hand squeegees, approved by Departmental Representative, to spread mix in areas not accessible to spreader. Dampen surfaces prior to handwork.
- .5 Avoid excessive build-up of slurry material on longitudinal or transverse joints.
- .6 Place slurry seal only when temperature of pavement surface is 10 degrees C or above.
- .7 Place slurry only when freezing conditions or rain is not expected within 24 hours.
- .8 Immediately correct cause of surface irregularities including; streaking, segregation and lumping.

### **3.6 PATCHING**

- .1 Repair designated areas by removing and replacing as approved by Departmental Representative.
- .2 Hand patch slurry seal coat, using limited squeegee action, only as approved by Departmental Representative.

### **3.7 CURING**

- .1 Keep traffic off slurry seal until cured to firm condition.
- .2 Where two applications of slurry mix are required, cure initial treatment thoroughly before placing succeeding application.

### **3.8 ROLLING**

- .1 Where indicated, roll each application with minimum 5 passes of pneumatic tired roller when slurry has cured sufficiently that clear water can be squeezed from mix.
- .2 Increase operating contact pressure if directed by Departmental Representative.

**3.9 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.

**END OF SECTION**

## **PART 1        GENERAL**

### **1.1        SECTION INCLUDES**

- .1        The Work to be performed includes the preparation, stockpiling, hauling, placing, and compacting of crushed stone for pedestrian walkways as indicated on the drawings and specified herein.

### **1.2        REFERENCE STANDARDS**

- .1        The following is a list of standards that may be referenced in this section:
  - .1        American Association of State Highway and Transportation Officials (AASHTO):
    - .1        M147, Standard Specification for Materials for Aggregate and Soil Aggregate Subbase, Base, and Surface Courses.
    - .2        T11, Standard Method of Test for Materials Finer Than 75µm (No. 200) Sieve in Mineral Aggregates by Washing.
    - .3        T27, Standard Method of Test for Sieve Analysis of Fine and Coarse Aggregates.
    - .4        T89, Standard Specification for Determining the Liquid Limit of Soils.
    - .5        T90, Standard Specification for Determining the Plastic Limit and Plasticity Index of Soils.
    - .6        T96, Standard Specification for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
    - .7        T99, Standard Specification for the Moisture-Density Relations of Soils Using a 2.5 kg (5.5 pound) Rammer and a 305 mm (12 in) Drop.
    - .8        T180, Standard Specification for Moisture-Density Relations of Soils Using a 4.54 kg (10-lb) Rammer and a 457 mm (18-in) Drop.
    - .9        T190, Standard Specification for Resistance R-Value and Expansion Pressure of Compacted Soils.
    - .10       T265, Standard Method of Test for Laboratory Determination of Moisture Content of Soils.
    - .11       T310, Standard Specification for In-Place Density and Moisture Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).
  - .2        ASTM International
    - .1        ASTM C136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
    - .2        ASTM C117, Standard Test Method for Material Finer Than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.
    - .3        ASTM D4318, Standard Test Method for Liquid Limit, Plastic Limit and Plasticity Index of Soils.
    - .4        ASTM D698, 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        D1557, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft<sup>3</sup> (2,700 kN-m/m<sup>3</sup>)).
    - .6        C88, Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate surfacing crushed stone
    - .7        D1883, Test Method for CBR (California Bearing Ratio) of Laboratory Compacted Soils.

- .8 D2419, Test Method for Sand Equivalent Value of Soils and Fine Aggregate.
- .9 D2488, Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)
- .10 D4791, Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-8.1, Sieves, Testing, Woven Wire, Inch Series.
  - .2 CAN/CGSB-8.2, Sieves, Testing, Woven Wire, Metric.
- .3 British Columbia Ministry of Transportation
  - .1 Current edition of British Columbia Ministry of Transportation and Highways' Standard Specifications for Highway Construction.

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

- .1 Submit submittals in accordance with Section 01 33 00- Submittal Procedures.
- .2 Contractor shall cooperate with Departmental Representative in obtaining and providing samples of all specified materials.
- .3 Contractor shall submit certification from the supplier certifying the surfacing crushed stone, or approved equal, meets the requirements of these Specifications.
- .4 Contractor shall submit samples for the following:
  - .1 Aggregate strength
  - .2 Aggregate particle size distribution curves
  - .3 Aggregate color

### **1.4 QUALITY ASSURANCE**

- .1 In accordance with section 01 43 00 - Quality Control.

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

- .1 Deliver, store and handle materials in accordance with with manufacturer's written instructions.
- .2 Store crushed stone as and where directed by Departmental Representative.

## **PART 2 PRODUCTS**

### **2.1 AGGREGATE BASE COURSE**

- .1 Aggregate Base Course shall be furnished and installed as required and specified under Section 32 00 02 Granular Base Course to a minimum 100 mm compacted depth or as specified in drawings.

### **2.2 ROAD GRANULAR MATERIAL**

- .1 Granular material for road surfacing repair work shall be in accordance with the specifications for high fines surfacing aggregate (HFSA) as outlined in section 202 in the British Columbia Ministry of Transportation Highway Construction Standards.

### **2.3 PEA GRAVEL**

- .1 Pea gravel shall consist of inert materials that are hard, durable, with stone free from surface coatings and deleterious materials.

- .2 R-value minimum of 70 determined by ASTM D 2488 Methodology (R-value is a measure of wear resistance).
- .3 Gradation shall meet the gradation below or approved equal as approved by Departmental Representative.

Sieve Designation	Percent Passing (%)
20 mm	100
12.7 mm	100
4.75 mm	46-66
0.425 mm	8-24
0.075 mm	5-10

- .4 Percentage (%) Fracture shall be 75 min.
- .5 Sand Equivalent shall be 40 min.

### **PART 3 EXECUTION**

#### **3.1 EQUIPMENT**

- .1 Equipment shall be capable of performing the Work as described in this Specification. Equipment that is inadequate to obtain the results specified shall be replaced or supplemented as required to meet the requirements of this Specification. Any equipment that is used in an improper manner may be cause for rejection of the Work if in the opinion of Departmental Representative the Work fails to meet the requirements of this Specification.
- .2 Equipment used for compaction shall be the rolling type, vibratory type, or combination of both types, and shall be of sufficient capacity to meet the compaction requirements herein.

#### **3.2 LAYOUT OF WORK**

- .1 The Contractor shall stake or otherwise delineate the proposed alignment of the path according to the drawings. Obtain approval of Departmental Representative prior to proceeding with excavation and subgrade preparation.
- .2 Keep people, bicycles, and other vehicles away from the compacted surface until it dries to stable moisture content.
- .3 Cut or fill a bench for the crushed stone as shown on the drawings.
- .4 Cut existing grade to a minimum of 100mm deep or as shown on the drawings. Compact subgrade to obtain a firm, uniform, and compacted subgrade. Keep cut sides vertical and true to line horizontally with a uniform width.

#### **3.3 SUBGRADE PREPARATION**

- .1 Prepare subgrade in accordance with Section 32 00 01 - Subgrade Preparation.

#### **3.4 GEOTEXTILE FILTER**

- .1 Install geotextile filter in accordance with Section 31 32 19- Geotextiles.
- .2 Place geotextile over prepared soft areas, overlapping ends and edges at least 300mm.

#### **3.5 GRANULAR SUB-BASE**

- .1 Install granular sub-base in accordance with Section 32 11 16.01 - Granular Sub-Base.

### **3.6 GRANULAR BASE**

- .1 Install granular base in accordance with Section 32 00 02 - Granular Base Course.

### **3.7 PLACEMENT AND COMPACTION**

- .1 The Contractor is responsible for controlling placement of the material; no additional compensation will be made for material placement in excess of the specified thickness or width.
- .2 Do not install surfacing crushed stone material during rain or snow. Do not install surfacing crushed stone on sub-grade that has standing water.
- .3 If the required compacted depth of the surfacing crushed stone exceeds 150mm, place course in two or more layers of approximately equal thickness.
- .4 Add water to  $\pm 2\%$  wet of optimum moisture content. Use roller or mechanical hand tamper for compaction. Compact shall be 95% Standard Proctor Density (ASTM D698-70) to a uniform thickness.
- .5 Use plate compactor on edges and inaccessible areas. Loose material shall not be present on final surface.
- .6 Top of path shall be flush with adjacent grade. Remove any excess gravel on edges. Ensure that there are no low spots, high spots, or standing water on or adjacent to path.
- .7 Crushed stone surfacing shall be a minimum of 150 mm thick compacted to 98% standard proctor dry density, over geotextile fabric on a prepared subgrade.
- .8 Make any corrections necessary to the existing base as per elevations shown on the drawings
- .9 Make sure proper drainage is available to ensure no standing water on the surface or adjacent to crusher fines.

### **3.8 SURFACE FINISHING**

- .1 Use a smooth steel wheel roller for final rolling of surface of crushed stone. Water surface and evenly spread loose stones before final rolling. Make minimum of two complete passes over area to embed stones. Correct soft spots developed during rolling.
- .2 Compacted surface shall be smooth and free from waves and other irregularities. Unsatisfactory portions of base course shall be removed, reworked, re-laid, and rerolled at no additional expense to Departmental Representative.

### **3.9 INSPECTION**

- .1 Finished surface shall be uniform and solid, with no evidence of chipping or cracking.
- .2 Compacted paving material shall be firm to the full depth of pavement with no soft areas.
- .3 Loose material shall not be present on the surface. No ruts shall be visible on the surface.
- .4 Sections that do not meet this specification, shall be repaired or replaced at the Contractor's expense

### **3.10 FIELD QUALITY CONTROL**

- .1 Inspection and testing of crushed stone paving: carried out by designated testing laboratory.
- .2 In accordance with Section 01 45 00 - Quality Control and Section 01 29 83 – Payment Procedures for Testing and Laboratory Services.



**3.11 REPAIRS AND REPAIRWORK**

- .1 Excavate damaged area to depth of surfacing crushed stone paving material and square off sidewalks.
- .2 If area is dry, moisten damaged portion lightly and scarify.
- .3 Apply surfacing crushed stone to excavated area to finished grade.
- .4 Compact with a hand tamper or roller.
- .5 Repaired surface shall be smooth and free from waves and other irregularities. Unsatisfactory portions of base course or surface course shall be torn up, reworked, re-laid, and rerolled at no additional expense to Departmental Representative.

**3.12 PROTECTION**

- .1 Prevent damage to trees, buildings, fences, curbs, sidewalks, roads, landscaping, and adjacent property.
  - .1 Repair damages incurred.

**3.13 CLEANING**

- .1 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11- Cleaning.

**END OF SECTION**

## **PART 1 GENERAL**

### **1.1 REFERENCE STANDARDS**

- .1 American Society for Testing and Materials International (ASTM)
  - .1 ASTM C117, Standard Test Method for Materials Finer than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.
  - .2 ASTM C136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
  - .3 ASTM D698, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft-lbf/ft<sup>3</sup>) (600 kN-m/m<sup>3</sup>).
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-8.1, Sieves, Testing, Woven Wire, Inch Series.
- .3 Canadian Standards Association (CSA International)
  - .1 CSA-A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

### **1.2 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submittals in accordance with Section 01 33 00- Submittal Procedures.
- .2 Product Data: submit WHMIS MSDS in accordance with Section 02 81 01- Hazardous Materials.
- .3 Inform Consultant and Departmental Representative of proposed source of materials and provide access for sampling at least two (2) weeks prior to commencing work.
- .4 If materials have been tested by an accredited testing agency within previous 2 months and have passed tests equal to requirements of this specification, submit test certificates from testing laboratory showing suitability of materials for this project.

### **1.3 DELIVERY, STORAGE AND HANDLING**

- .1 Waste Management and Disposal:
  - .1 Separate waste materials for recycling in accordance with Section 01 47 21- Construction/Demolition Waste Management and Disposal.

## **PART 2 PRODUCTS**

### **2.1 MATERIALS**

- .1 Concrete mixes and materials: in accordance with Section 03 30 00- Cast-in-Place Concrete.
- .2 Reinforcing steel: in accordance with Section 03 20 00- Concrete Reinforcing.
- .3 Joint filler: in accordance with Section 03 30 00- Cast-in-Place Concrete.
- .4 Granular base: material to Section 31 23 33.01 – Excavation, Trenching and Backfilling following requirements:
  - .1 Type 1 or 2 fill.
  - .2 Crushed stone or gravel.
  - .3 Gradations: within limits specified when tested to ASTM C136 and ASTM C117. Sieve sizes to CAN/CGSB-8.1.
- .5 Non-staining mineral type form release agent: chemically active release agents containing compounds that react with free lime to provide water-soluble soap.

## **PART 3 EXECUTION**

### **3.1 SUBGRADE PREPARATION**

- .1 Do grade preparation work in accordance with Section 32 00 01 - Subgrade Preparation.
- .2 Construct embankments using excavated material free from organic matter or other objectionable materials.
  - .1 Dispose of surplus and unsuitable excavated material off site.
- .3 Place fill in maximum 150mm layers and compact to at least 98% of maximum dry density to ASTM D698.

### **3.2 GRANULAR BASE**

- .1 Obtain Departmental Representative's approval of subgrade before placing granular base.
- .2 Place granular base material to lines, widths, and depths as indicated.
- .3 Compact granular base in maximum 150 mm layers to at least 98% of maximum density to ASTM D698.

### **3.3 CONCRETE**

- .1 Obtain Departmental Representative approval of granular base and reinforcing steel prior to placing concrete.
- .2 Do concrete work in accordance with Section 03 30 00- Cast-in-Place Concrete.
- .3 Immediately after floating, give sidewalk surface uniform broom finish to produce regular corrugations not exceeding 2 mm deep, by drawing broom in direction normal to centre line.
- .4 Provide slope on concrete to provide positive drainage.
- .5 Provide edging as indicated with 10 mm radius edging tool.
- .6 Slip-form pavers equipped with string line system for line and grade control may be used if quality of work acceptable to Departmental Representative can be demonstrated. Hand finish surfaces when directed by Departmental Representative.
- .7 Exterior concrete shall be designed as follows:
  - .1 Durability and Class of Exposure: C-2
  - .2 Cement Type: HS
  - .3 Minimum Compressive Strength: 32 MPa at 28 days
  - .4 Max W/C Ratio: 0.45
  - .5 Aggregate Size: 20 mm maximum
  - .6 Air Content Range: 5 – 8%
- .8 Concrete shall conform to the requirements of CAN/CSA A23.1.

### **3.4 TOLERANCES**

- .1 The finished surfaces of all concrete work shall be true to the required cross-section with a tolerance of plus or minus 6 mm from the required elevation and dimensions. Surface of curbs, gutters or sidewalks shall not show any depressions or bumps exceeding 3 mm under a straight edge 3 m long placed parallel to the curb or sidewalk. Concrete not meeting the requirements specified shall be removed to the nearest joint and replaced at the Contractor's expense.

### 3.5 EXPANSION AND CONTRACTION JOINTS

- .1 Install tooled transverse contraction joints after floating, when concrete is stiff, but still plastic, at intervals shown on the drawings.
- .2 Install expansion joints as indicated on the drawings..
- .3 When sidewalk is adjacent to curb, make joints of curb, gutters and sidewalk coincide.

### 3.6 ISOLATION JOINTS

- .1 Install isolation joints around manholes and catch basins and along length adjacent to concrete curbs, catch basins, buildings, or permanent structure.
- .2 Install joint filler in isolation joints in accordance with Section 03 30 00- Cast-in-Place Concrete.
- .3 Seal isolation joints with sealant approved by Departmental Representative.

### 3.7 CURING

- .1 Cure concrete by adding moisture continuously in accordance with CSA-A23.1/A23.2 to exposed finished surfaces for at least 1 day after placing, or sealing moisture in by curing compound as directed by Departmental Representative.
- .2 Where burlap is used for moist curing, place two prewetted layers on concrete surface and keep continuously wet during curing period.
- .3 Apply curing compound evenly to form continuous film, in accordance with manufacturer's requirements.

### 3.8 FINISHES

- .1 Formed surfaces exposed to view: sack rubbed finish in accordance with CSA A23.1/A23.2.
- .2 Pavements, walks, curbs and exposed site concrete
  - .1 Screed plane surfaces and use wood floats.
  - .2 Provide round edges and joint spacing using standard tools.
  - .3 Trowel smooth to provide lightly brushed non-slip finish.

### 3.9 BACKFILL

- .1 Allow concrete to cure for 7 days prior to backfilling.
- .2 Backfill to designated elevations with material as directed by Departmental Representative.
  - .1 Compact and shape to required contours as directed by Departmental Representative..

### 3.10 FIELD TESTS

- .1 Tests shall be made of the concrete to ensure that it meets these specifications. Testing shall be done to conform to the following standard specifications:

Test	ASTM
Sampling of Fresh Concrete	1c
Obtaining and Testing Drilled Cored for Compressive Strength	14c
Test for Slump of Concrete	5c
Compressive and Flexural Test	8c
Compressive Strength of Moulded Concrete Cylinders	9c

Test	ASTM
Measurement of Air Content	7c
Making and Curing Concrete Compression and Flexural Test Specimens	3c

- .1 Three concrete cylinders shall constitute one test and shall be made from the same batch or load. They shall be stored undisturbed on site for 24 hours, covered with a plastic sheet to prevent loss of moisture. They shall then be delivered to an approved testing laboratory, and laboratory cured with one cylinder tested at seven days and the other two at twenty-eight days. A set of three cylinders shall be taken for every 100 m3 of concrete poured, or as directed by the Departmental Representative. Test cylinders shall be 150 mm or 100 mm in diameter.
- .2 When construction begins, the Departmental Representative reserves the right to request additional cylinders to be made in order to establish a concrete strength pattern as quickly as possible.
- .3 The Departmental Representative shall make the cylinders and slump tests.
- .2 Penalties for Insufficient Strength
  - .1 Where there are variations from specified design strength, the following adjustments will be made based on the 28 day, laboratory cured cylinders:
    - .1 When concrete strength of any set exceeds 95% of design strength, full payment for the work shall be made at the contract unit prices.
    - .2 When concrete strength of any set is greater than 80% but less than 95% of design strength, the price paid to the Contractor for the work represented by that set of cylinders shall be determined by the following formula:

$$P - \left[ \frac{2P(A - B)}{A} \right]$$

Where:

P = unit price

A = specified strength

B = average 28 day cylinder strength.

- .3 If concrete strength of any set is less than 80% of design strength, the work represented by that set of cylinders will be rejected.
- .4 Where the average strength of all tests for the total work falls below design strength, but above 95% of design strength, that work not already having a price adjustment under the preceding clauses shall be subject to the following adjustment. The price paid by the Contractor shall be determined by the following formula:

$$P - \left[ \frac{2(A - B)}{A} \right]$$

Where:

P = unit price

A = specified strength

B = average 28 day cylinder strength.

- .3 Protection: the Contractor shall be responsible for keeping all animals and pedestrians off the newly constructed sidewalks or curb until completely set. The Contractor shall also be responsible for keeping all vehicles off the work for a period of 5 days after the concrete has been finished.

### **3.11 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.

### **3.12 CONCRETE DETERIORATION**

- .1 Concrete that shows surface scaling, deterioration or loss of cement or aggregate during the maintenance period will be rejected and require removal and replacement by the Contractor at no cost to Departmental Representative.

### **3.13 SIDEWALK, CURB, AND GUTTER FAILURES**

- .1 Replacement of affected sections shall be required when one or more of the following exist:
  - .1 Any crack greater than 3 mm in width with no vertical displacement or chipping or spalling edges.
  - .2 Any crack with vertical displacement or chipping or spalling edges.
  - .3 Any longitudinal crack greater than or equal to 1.5 mm in width.
  - .4 A displacement at a joint of greater than or equal to 12 mm.
  - .5 A dished surface of sidewalk and/or gutter.
  - .6 A reverse crossfall or crossfall greater than 8% or less than 0.7%.
  - .7 A random cracking of any size.
  - .8 Any feature considered detrimental to pedestrian safety or appearance of the sidewalk and/or curb and gutter.
  - .9 A corner cut exists.

**END OF SECTION**

## **PART 1 GENERAL**

### **1.1 DESCRIPTION**

- .1 The Contractor is responsible for all painted curbs, roadway lines and pavement messages. This specification is related to the Work to be completed by the Contractor.
- .2 The Plan show details of the general line and message painting required for the Project.

### **1.2 REFERENCE STANDARDS**

- .1 British Columbia Ministry of Transportation
  - .1 Current edition of British Columbia Ministry of Transportation and Highways' Standard Specifications for Highway Construction.
  - .2 Current edition of British Columbia Ministry of Transportation and Highways' Manual of Standard Traffic Signs and Pavement Markings.
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).

### **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 2 copies of WHMIS MSDS in accordance with Section 01 35 29.06- Health and Safety Requirements.
- .3 Samples:
  - .1 Submit to Departmental Representative following material sample quantities at least 2 weeks prior to commencing work.
    - .1 Two 1 L samples of each type of paint.
    - .2 One 1 kg sample of glass beads.
  - .2 Mark samples with name of project and its location, paint manufacturer's name and address, name of paint, specification number and formulation number and batch number.

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

- .1 Deliver, store and handle materials in accordance with 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, in dry location, indoors, in clean, dry, well-ventilated area, in accordance with manufacturer's recommendations.
  - .2 Store and protect from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.

## **PART 2 PRODUCTS**

### **2.1 MATERIALS**

- .1 Paint and Markings:

- .1 Shall be in accordance with the British Columbia Ministry of Transportation and Highways' Manual of Standard Traffic Signs and Pavement Markings and Standard Specifications for Highway Construction.
- .2 Thinner shall be in accordance with CAN/CGSB-1.5.

### **PART 3 EXECUTION**

#### **3.1 EXAMINATION**

- .1 Verification of Conditions: verify conditions of substrates and surfaces to receive pavement markings are acceptable for product 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.
- .2 Distributor: capable of applying reflective glass beads as overlay on freshly applied paint.

#### **3.3 APPLICATION**

- .1 Pavement markings: laid out by the Contractor.
- .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.

#### **3.4 TOLERANCE**

- .1 Paint markings: within plus or minus 12 mm of dimensions indicated.
- .2 Remove incorrect markings in accordance with Section 32 01 11.01- Pavement Cleaning and Marking Removal.

#### **3.5 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.
  - .1 Remove insulation material spilled during installation and leave work area ready for application of wall board.
- .3 Waste Management: separate waste materials for 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.



**3.6 PROTECTION**

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

**END OF SECTION**

## **PART 1 GENERAL**

### **1.1 DEFINITIONS**

- .1 Stripping:
  - .1 Refer to section 31 14 13 Soil Stripping and Stockpiling. The contractor shall use the stripped material. If required, topsoil brought into the National Park must be certified weed and invasive seed free.
- .2 Topsoil:
  - .1 The top layer of soil containing organic material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping and seeding.
- .3 Weeds:
  - .1 Includes, but not limited to, dandelions, jimsonweed, quack grass, horsetail, morning glory, rush grass, mustard, lambs quarter, chickweed, crabgrass, Canadian thistle, tansy, ragwort, Bermuda grass, bindweed, bent grass, perennial sorrel, brome grass, red root, pigweed, buck weed, scentless chamomile, toadflax, foxtail and perennial sow thistle.

## **PART 2 PRODUCTS**

### **2.1 TOPSOIL**

- .1 Topsoil will be retained to facilitate recovery of construction areas and revegetation. The contractor shall submit representative samples of the topsoil to be used to a professional soil laboratory for analysis and recommendations. A copy of the laboratory report shall be submitted to the departmental representative for review and approval. Testing shall be at the contractors expense. The soil analysis report will include the topsoil source and weed/seed analysis. Recommendations will clearly state the type and quantity of soil additives and application procedure to be used.
- .2 Imported topsoil subject to approval by Departmental Representative prior to ordering. Topsoil must be certified weed and seed free of another weed-free material may be used instead of topsoil. If requested, the suitability of the material may require verification.

## **PART 3 EXECUTION**

### **3.1 TOPSOIL**

- .1 Strip, stockpile and protect existing native topsoil and then spread native topsoil upon completion of the backfilling.
- .2 Do not place topsoil when either topsoil or subgrade is frozen, excessively wet, extremely dry, or in a condition inhibiting proper grading, cultivation, or compaction.
- .3 Scarify the subgrade to a depth of 75 mm.
- .4 The Departmental Representative shall approve the subgrade prior to placing topsoil and approve finished grade before the Contractor proceeds with the next phase of work.
- .5 Spread topsoil uniformly on prepared subsoil to achieve minimum 150mm depth thickness.
- .6 Cultivate topsoil to a depth of 75 mm, breaking down lumps. Remove stones larger than 50 mm, weeds, roots and other foreign matter.
- .7 Manually spread topsoil around trees and plants to prevent damage by grading and levelling equipment.
- .8 Float the area until surface is smooth. Remove all lumps, rocks, roots and other debris from the finished material and from the site.

- .9 Fine grade to eliminate rough or low areas and to ensure positive drainage.
- .10 Compact topsoil with suitable rollers to the satisfaction of Departmental Representative.
- .11 Final topsoil grades for seeded areas shall be flush to finished grade at surface structures.
- .12 Departmental Representative shall approve topsoil preparation prior to seeding.

### **3.2 CLEAN-UP**

- .1 Clean soil and debris resulting from work done under this section off roadway, walkway and surrounding areas at the end of each working day or as reviewed by Departmental Representative.

**END OF SECTION**

## **PART 1 GENERAL**

### **1.1 DEFINITIONS**

- .1 Topsoil:
  - .1 The top layer of soil containing organic material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping and seeding.
- .2 Weeds:
  - .1 Includes, but not limited to, dandelions, jimsonweed, quack grass, horsetail, morning glory, rush grass, mustard, lambs quarter, chickweed, crabgrass, Canadian thistle, tansy, ragwort, Bermuda grass bindweed, bent grass, perennial sorrel, brome grass, red root, pigweed, buck weed, scentless chamomile, toadflax, foxtail and perennial sow thistle.

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

- .1 Deliver grass seed in the original containers, tagged with identification as to the analysis of seed mixture, percentages of seed, year of seed production, net weight and date.
- .2 Deliver seed to site only when required.

### **1.3 SUBSTITUTION**

- .1 Departmental Representative will review all requests by the Contractor for substitution of seed mixes.

## **PART 2 PRODUCTS**

### **2.1 SEED**

- .1 Grass seed shall meet the minimum requirements for Common No.1 Seed as defined by the Grade Tables under the Canada Seeds Act & Regulations, and having minimum germination of 85% and minimum purity of 97%.
- .2 Native Grass Seed Mix:
  - .1 40% Argrostis Scarbra (Tickle Grass)
  - .2 40% Bromus Ciliatus (Fringed Brome Grass)
  - .3 20% Agropyron Trachycaulus Var. Subsecundus (Awned Wheat Grass)
- .3 The seed mix percentages are by weight.
- .4 Parks Canada Agency will supply the seed, contractor to place using hydro seeding method.

### **2.2 BINDER**

- .1 Use Turfmaster Hydro Seal or equivalent compatible binder additive at the manufacturer's recommended rate, sufficient to mix consistent slurry.
- .2 Binder shall be mixed and supplied by a recognized supplier and shall have tested rates or purity.

### **2.3 MULCH**

- .1 Material shall be wood cellulose fibre containing no contaminants.
- .2 Fibre shall be supplied by a recognized supplier and shall have a certified weight and composition.
- .3 Minimum application rate is 16.0 kg of air dry fibre per 100 m<sup>2</sup>.
- .4 Fibre shall be measured as it is fed into the seeder.

## **2.4 WATER**

- .1 Clean and free of any substance that may inhibit vigorous growth of grass.

## **2.5 EQUIPMENT**

- .1 Cultivators: capable of scarifying, disking or harrowing.
- .2 Dry Seeders: of the "Brillion" type, capable of rolling and covering the seed with 3 mm to 6 mm of soil; or of the cyclone type, with flexible wire mat drag.
- .3 Hydro Seeders: capable of thoroughly mixing water, seed, and pulverized wood fibre and of uniformly spraying the mix at designated rate.
- .4 Rollers: of suitable size and mass.

## **PART 3 EXECUTION**

### **3.1 PLANTING SEASON**

- .1 Grass Seeding: recommended season May 1 to September 15.

### **3.2 PREPARATION**

- .1 Remove weeds and debris from topsoil already in place.
- .2 Examine the site, verify the grades and check that the topsoil has been placed as specified.
- .3 The work shall be done in calm weather, during the normal planting season for the type of seed mixture supplied.
- .4 Notify Departmental Representative prior to the start of the seeding operations.
- .5 Cultivate existing topsoil and apply additional topsoil as required to obtain minimum required depths of topsoil. Additional topsoil shall be spread evenly and lightly compacted.
- .6 Float and level out the finished topsoil surface.

### **3.3 MECHANICAL SEEDING**

- .1 Do not seed when prepared topsoil is covered with frost, snow or standing water. Proceed with seeding operations only during favourable weather conditions in accordance with sound horticultural practices.
- .2 Slopes flatter than 3 horizontal to 1 vertical: apply seed by mechanical dry spread (Brillion or Cyclone type) at a rate of 24 kg/1,000 m<sup>2</sup>. Apply in two passes, each pass at a rate of 12 kg/1,000 m<sup>2</sup> at 90 degrees to each other. Lightly roll seeded area.
- .3 Hand broadcast seeding is unacceptable under any conditions except for site specific repair work and pre-approved work in naturalization areas.
- .4 Thoroughly harrow the site after seed application on ground flatter than 3 horizontal to 1 vertical.

### **3.4 HYDRO SEEDING**

- .1 Use a hydro seeder to seed slopes 3 horizontal to 1 vertical or steeper.
- .2 Mix seed with water, and mulch in the following quantities to cover 4,000 m<sup>2</sup>:
  - .1 Grass Seed: 96 kgs
  - .2 Water: 6,400 litres
  - .3 Mulch: 640 kgs
- .3 Hydro seeding should not be carried out in wind velocities which cause seed mix to be blown.

- .4 Measure quantities of materials to be fed into the seeder, either by weight or by using another approved system.
- .5 Application rates:
  - .1 Grass seeds 2.4 kg per 100 m<sup>2</sup> or as specified for the seed type.
  - .2 Water 160 L/100 m<sup>2</sup>.
  - .3 Mulch 16 kg/100 m<sup>2</sup> or sufficient to apply the specified amount of seed per 100 m<sup>2</sup>.
- .6 Thoroughly mix seed, mulch, binder (if specified) and water in a slurry and uniformly apply in one operation. Apply seed mixture then cover with approved mulch.

### **3.5 SEED GERMINATION, DRY SEED AND HYDRO SEED APPLICATIONS**

- .1 If seed fails to germinate within four growing months, re-cultivate and re-seed until germination takes place.

### **3.6 WARRANTY**

- .1 All grass shall have a one year warranty period from issuance of the Construction Completion Certificate.
- .2 Areas showing deterioration, bare spots or thin areas shall be re-seeded at the Contractor's expense.

### **3.7 MAINTENANCE**

- .1 Maintenance shall include all measures necessary to establish and maintain seeded areas in an acceptable, vigorous and healthy growing condition for a period of one year from the issuance of a Construction Completion Certificate and until the issuance of the Final Acceptance Certificate. Maintenance shall include:
  - .1 Mowing at the end of the growing season to a minimum height of 60 mm and a maximum height of 75 mm. Do not cut more than 1/3 blade height at any one mowing. Remove heavy clippings immediately.
  - .2 Replacing areas that show root growth failure, deterioration, bare or thin spots or which have been damaged by any means.
  - .3 Top dressing and rolling to repair ruts or erosion.
- .2 Departmental Representative may review the use of herbicides for weed control. They shall be applied in accordance with the manufacturer's recommendations by a licensed applicator. Damage resulting from the Contractor's improper use of herbicides shall be remedied at the Contractor's own expense.

### **3.8 FINAL INSPECTION**

- .1 Final inspection of seeded areas will be made prior to the end of the warranty period.
- .2 At the time of inspection all the areas shall be alive and in a healthy satisfactory growing condition, free from weeds.

### **3.9 CLEAN-UP**

- .1 Clean roadway, walkway and surrounding areas of soil, seed and other debris resulting from work done under this section at the end of each working day or as reviewed by Departmental Representative.

**END OF SECTION**

## **PART 1 GENERAL**

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

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 For every one tree removed due to Contractor negligence, three (3) tree plantings in kind will be required at Contractors expense.

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

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 – Common Product Requirements.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging / nursery wrapping, labelled with manufacturer's name and address.
- .3 Protect plant material from frost, excessive heat, wind and sun during delivery.
- .4 Protect plant material from damage during transportation:
  - .1 Delivery distance is less than 30 km and vehicle travels at speeds under 80 km/h, tie tarpaulins around plants or over vehicle box.
  - .2 Delivery distance exceeds 30 km or vehicle travels at speeds over 80 km/h, use enclosed vehicle where practical. Vehicle shall be refrigerated in the event of hot weather.
- .5 Storage and Handling Requirements:
- .6 Immediately store and protect plant material which will not be installed within 1 hour in accordance with supplier's written recommendations and after arrival at site in storage location approved by Departmental Representative.
- .7 Protect stored plant material from frost, wind and sun and as follows:
  - .1 For bare root plant material, preserve moisture around roots by heeling-in or burying roots in topsoil and watering to full depth of root zone.
  - .2 For pots and containers, maintain moisture level in containers until installation.
  - .3 For balled and burlapped and wire basket root balls, place to protect branches from damage. Maintain moisture level in root zones until installation.
- .8 Store and manage hazardous materials in accordance with Manufacturer's written instructions.

### **1.3 WARRANTY**

- .1 Contractor hereby warrants that plant material will remain free of defects for 2 full growing season.
- .2 End-of-warranty inspection will be conducted by Departmental Representative.
- .3 Departmental Representative reserves the right to extend Contractor's warranty responsibilities for an additional one year if, at end of initial warranty period, leaf development and growth is not sufficient to ensure future survival.

## **PART 2 PRODUCTS**

### **2.1 PLANT MATERIAL**

- .1 Plant material including trees and shrubs shall be provided as specified by the Departmental Representative.
- .2 Trees and shrubs shall be species not cultivars.
- .3 Coniferous trees shall be a minimum of 2.5m height; deciduous trees shall be a minimum of 40mm caliper.

- .4 Requests for substitutions, whether for different size, species, or other reason, shall be made in writing by the contractor to the Departmental Representative. No substitutions shall be permitted unless approved by Departmental Representative in writing. The Contractor shall allow at least ten (10) days for such requests to be processed by the Departmental Representative.
- .5 The following lists are provided for tender and bid purposes. Tree and shrubs may include:
  - .1 Shrubs –
  - .2 Juniperous Communus – Common Juniper
  - .3 Arctostaphylos Rubra – Alpine Bearberry
- .6 Type of root preparation, sizing, grading and quality: comply to Canadian Standards for Nursery Stock, latest edition.
- .7 Plant material: free of disease, insects, insect or rodent damage, sunscald, hail damage, cankers, frost cracks, or other defects or injuries and structurally sound with strong fibrous root system. All parts of the plant material shall be moist and show live, green cambium tissue when cut.
- .8 Trees: with straight trunks, well and characteristically branched for species. Conifers shall show branching within 400mm of root crown. Deciduous trees shall show branching within 1/3 of the total height of the tree. Trees shall have a well-balanced crown and no weak crotches.
- .9 Trees shall have one sturdy, reasonably straight, vertical, and well-developed leader, where this is characteristic of the species.
- .10 Bare root stock: nursery grown, in dormant stage, not balled and burlapped or container grown.
- .11 Collected stock: maximum 40 mm in caliper, with well-developed crowns and characteristically branched; no more than 40% of overall height may be free of branches.
- .12 During collection, ensure 10% maximum seed crop (or plants) are collected from healthy population of many individuals, and from several plants of same species.
- .13 Leave remainder for natural dispersal and as food for dependent organisms.
- .14 Plant material brought in from other provinces or states must be approved in writing by Departmental Representative prior to delivery and inspected and approved by Departmental Representative prior to installation.
- .15 Branches shall be carefully bound in such a way as to prevent damage, breakage, or bruising during transportation. Plants with broken or abraded trunks or branches or which are badly desiccated may be rejected.
- .16 Plant material that has been sheared or pruned to produce an untypical shape, height and stem diameter, or shoot density may be rejected.
- .17 Plant material may be rejected when the ball of earth surrounding the roots has been cracked or broken preparatory to or during the process of planting, or when the burlap, staves, and ropes, required in connection with their shipping or transplanting, have been removed.
- .18 Plant material shall be subject to inspections for conformity to specification requirements and approval by Departmental Representative at their place of growth and/or upon delivery. Such inspection and approval does not relieve the Contractor of Contractor's responsibilities under this contract.
- .19 Plant material supplied by the Contractor and rejected by Departmental Representative shall be replaced with acceptable plant material at the Contractor's sole expense.
- .20 Contractor shall provide plant material list from nursery of origin (i.e., where the trees or shrubs were grown) identifying species and quantity to be supplied for project to Departmental Representative for review and written approval in advance of delivery.



- .21 Contractor to provide plant material invoice or bill of sale from nursery of origin identifying species and quantity supplied for project to Departmental Representative for review and approval prior to installation.

## **2.2 WATER**

- .1 Free of impurities that would inhibit plant growth.

## **2.3 MULCH**

- .1 Deciduous / coniferous wood mulch shall consist of maple, poplar, birch, pine, spruce, douglas-fir chipped wood or bark or other wood material subject to review and approval by Departmental Representative. Do not use ash or elm.
- .2 Chip size shall be 50 – 76 mm
- .3 Mulch shall be free of non-organic material, wood preservatives, paint, nails, screws, or other metal, and rotting or diseased wood. Mulch shall be free of soil, sawdust, or peat moss (no more than 5% by dry weight). Mulch may be recycled wood. Mulch may be chipped wood and branches from tree cutting on site.
- .4 Provide sample to Departmental Representative for review and approval prior to construction.

## **2.4 STAKES**

- .1 Wood, pointed one end, 38 x 38 x 2300 mm.

## **2.5 GUYING COLLAR**

- .1 Tube: plastic, 13 mm diameter, nylon reinforced.

## **2.6 TRUNK PROTECTION**

- .1 Trunk protection may be wire mesh or plastic strip.
- .2 Wire mesh: galvanized, electrically welded 1.4 mm wire with 25 x 25 mm mesh and fastener.
- .3 Plastic: perforated spiralled strip.

## **2.7 TREE PROTECTION**

- .1 Page wire fence 2.2 to 2.4m high c/w post staking and guying.
- .2 16 gauge galvanized 50mm x 50mm stucco wire fence or silt fence, attached to page wire fence.

## **2.8 FERTILIZER**

- .1 Not used

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- .1 Verification of Conditions: verify conditions of substrate previously installed under other Sections or Contracts are acceptable for planting installation in accordance with manufacturer's written instructions.
- .2 Visually inspect substrate in presence of Departmental Representative.
- .3 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

- .4 Proceed with installation only after unacceptable conditions have been remedied.

### **3.2 PLANTING PERIODS**

- .1 Installation of plant material must be done May 1 through Victoria Day or Labour Day through October 15.

### **3.3 PRE-PLANTING PREPARATION**

- .1 Proceed only after receipt of written acceptability of plant material from Departmental Representative.
- .2 Remove damaged roots and branches from plant material.
- .3 Locate and protect utility lines.

### **3.4 EXCAVATION AND PREPARATION OF PLANTING BEDS**

- .1 For individual planting holes:
- .2 Stake out location and obtain approval from Departmental Representative prior to excavating.
- .3 Excavate to depth and width as indicated.
- .4 Do not bury removed wrapping, wire, rope, or other material in tree pit.
- .5 Remove subsoil, rocks, roots, debris and toxic material from excavated material that will be used as planting soil for trees and individual shrubs. Dispose of excess material.
- .6 Scarify sides of planting hole.
- .7 Remove water which enters excavations prior to planting. Notify Departmental Representative if water source is ground water.

### **3.5 PLANTING**

- .1 For bare root stock, place 50 mm backfill soil in bottom of hole.
- .2 Plant trees and shrubs with roots placed straight out in hole.
- .3 For jute burlapped root balls, cut away top one third of wrapping and wire basket without damaging root ball.
- .4 Do not pull burlap or rope from under root ball.
- .5 For container stock or root balls in non-degradable wrapping, remove entire container or wrapping without damaging root ball.
- .6 Plants vertically in locations as indicated.
- .7 Orient plant material to give best appearance in relation to structure, roads and walks.
- .8 For trees and shrubs:
- .9 Backfill soil in 150 mm lifts.
  - .1 Tamp each lift to eliminate air pockets.
  - .2 When two thirds of depth of planting pit has been backfilled, fill remaining space with water.
  - .3 After water has penetrated into soil, backfill to finish grade.
- .10 Form watering saucer as indicated.
- .11 For ground covers, backfill soil evenly to finish grade and tamp to eliminate air pockets.
- .12 Mulch trees and shrubs with 50mm depth mulch.
- .13 Water plant material thoroughly.
- .14 After soil settlement has occurred, fill with soil to finish grade.
- .15 Do not dispose of plant wrapping in tree or shrub pit.

### **3.6 TREE AND SHRUB PROTECTION**

- .1 Install trunk protection on deciduous trees as indicated.
- .2 Install trunk protection before installation of tree supports.
- .3 Install tree protection around all trees and shrubs immediately after planting to prevent animal damage. A fence 2.2 to 2.4m high is recommended against deer and elk.
- .4 It is advisable to screen young plants from wind over the winter.

### **3.7 TREE SUPPORTS**

- .1 Install tree supports as indicated.
- .2 Use single stake tree support for deciduous trees less than 3 m in height and evergreens less than 2 m in height.
- .3 Place stake on prevailing wind side and 150 mm minimum from trunk.
- .4 Drive stake 150 mm minimum into undisturbed soil beneath roots.
- .5 Ensure stake is secure, vertical and unsplit.
- .6 Install 150 mm long guying collar 1500 mm above grade.
- .7 Thread Type 1 guying wire through guying collar tube.
- .8 Twist wire to form collar and secure firmly to stake. Cut off excess wire.
- .9 After tree supports have been installed, remove broken branches with clean, sharp tools.

### **3.8 MAINTENANCE DURING ESTABLISHMENT PERIOD**

- .1 Immediately following plant material installation, any dead, broken, damaged, diseased, weak crotches, or interfering branches that have not caused the plant material's rejection shall be pruned. Pruning shall preserve the natural character or form of the plant material. Pruning tools shall be sharp and clean.
- .2 Perform the following maintenance operations from time of planting to acceptance by Departmental Representative.
- .3 Water to maintain soil moisture conditions for optimum establishment, growth and health of plant material without causing erosion.
  - .1 For evergreen plant material, water thoroughly in late fall prior to freeze- up to saturate soil around root system.
  - .2 Keep trunk protection and guy wires in proper repair and adjustment.
  - .3 Remove and replace dead plants and plants not in healthy growing condition. Make replacements in same manner as specified for original plantings.

### **3.9 MAINTENANCE DURING WARRANTY PERIOD**

- .1 From time of Substantial Completion acceptance by Departmental Representative to end of warranty period, perform following maintenance operations.
- .2 Water to maintain soil moisture conditions for optimum growth and health of plant material without causing erosion.
- .3 Remove dead, broken or hazardous branches from plant material.
- .4 Keep trunk protection and tree supports in proper repair and adjustment.
- .5 Remove trunk protection, tree supports and level watering saucers at end of warranty period.
- .6 Remove and replace dead plants and plants not in healthy growing condition.
- .7 Make replacements in same manner as specified for original plantings.
- .8 Submit monthly written reports to Departmental Representative identifying:
  - .1 Maintenance work carried out.

- .2 Development and condition of plant material.
- .3 Preventative or corrective measures required which are outside Contractor's responsibility.

**3.10 SUBSTANTIAL PERFORMANCE**

- .1 Warranty period for trees and shrubs is two (2) years from Substantial Completion.
- .2 Trees and shrubs shall be reviewed immediately after initial planting and during the growing season by the Departmental Representative.
- .3 Final inspection of plants installed will be made by the Departmental Representative prior to the end of the Warranty Period.
- .4 At the time of final inspection, all installed plant material shall be alive and in a healthy, satisfactory growing condition. Any deficiency in this respect shall be remedied at the Contractor's own expense.
- .5 Deficiencies may include: dead plants, an unhealthy or unsightly condition, and/or has lost its natural shape due to dead branches, excessive pruning, inadequate or improper maintenance.
- .6 A warranty period of two (2) years will apply to replacement trees from date of their installation.
- .7 Where dead trees are identified, the dead material shall be removed within four (4) weeks of notification. When necessary, approved soil and grass seed shall be added to the pit to reclaim the site and eliminate potential tripping hazards at the time of removal.

**3.11 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 – Cleaning.
- .2 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.

**3.12 CLOSEOUT ACTIVITIES**

- .1 Submit maintenance reports for trees, shrubs, and other plantings.

**END OF SECTION**

# Geotechnical Site Investigation

# A

To: Brent Rutten, P.Eng., Bianca Portoraro, E.I.T.

Date: February 15, 2018

Project #: 60551150

From: Julien Egron, P.Eng.

Anwar Majid, M.A.Sc., P.Eng.

# Memorandum

Subject: **Kicking Horse & Monarch Campground Improvements – Yoho National Park  
Geotechnical Site Investigation**

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## 1. Introduction

### 1.1 General

Parks Canada Agency (Parks Canada) is planning to rehabilitate the Kicking Horse and Monarch Campgrounds in Yoho National Park, British Columbia. The improvements may consist of reconstruction and rehabilitation of existing facilities within the two campgrounds. The site location is shown on **Figure 1**.

The main objective of the site investigation was to determine the subsurface soil and groundwater conditions for the structures (kiosk, shower building, firewood storage, and water storage tank) to be constructed as part of this project, and to provide geotechnical recommendations to support the design and construction of these structures. This memorandum documents the findings from the site investigation and laboratory testing, and provides geotechnical recommendations to support the design and construction of the geotechnical elements of the project, including foundations for the kiosk, shower building, and firewood storage.

The analyses and recommendations presented in this memorandum are based on the data obtained from four testholes drilled across the site. This memorandum does not reflect any variations in subsurface conditions that may occur at locations other than the testhole locations. In the performance of subsurface explorations, specific information is obtained at specific locations at specific times; however, it is well known that variations in soil conditions exist on most sites between testhole locations. The nature and extent of variations may not become evident until the course of construction. If variations are then evident, it will be necessary to re-evaluate the recommendations presented in this report after performing on-site observations during the construction period and noting the characteristics of any variations. This report is subject to the general statement regarding normal variability of subsurface conditions provided at the end of the memorandum.

### 1.2 Scope of Work

The scope of work for the geotechnical investigation consisted of the following tasks:

1. Obtain all permits from Parks Canada to allow AECOM to conduct the geotechnical investigation including drilling within the campgrounds;

2. Coordinate for underground utility locates with BC One Call and a private locator to clear the testhole locations for drilling;
3. Conduct a site investigation by drilling four testholes to a maximum depth of 10 meters below ground surface (mBGS) (or refusal) to determine subsurface stratigraphy and groundwater conditions at the proposed structure locations;
4. Install standpipes in select testholes to measure the depth of the groundwater table;
5. Conduct laboratory testing on select soil samples collected during the investigations for soil classification and determination of engineering properties; and,
6. Prepare a geotechnical evaluation report that documents the findings from the site investigations and laboratory testing, and provides geotechnical recommendations to support the design and construction of geotechnical elements of the project including foundations for the structures.

## 2. Site Investigation

A site investigation was conducted on December 11 and 12, 2017 by drilling four testholes (TH17-01 to TH17-04). The testholes were drilled at the locations of the proposed structures as below:

- Testhole TH17-01 was drilled at the kiosk location;
- Testholes TH17-02 and TH17-03 were drilled at the shower building location; and,
- Testhole TH17-04 was drilled at the water storage tank location.

Testhole depths varied from 4.88 mBGS to 11.13 mBGS. The testholes were drilled using a truck-mounted auger rig owned and operated by Earth Drilling Company Ltd. The drill rig was equipped with solid stem augers, ODEX percussion system (to drill through the gravel, cobbles/boulders), and Standard Penetration Testing (SPT) equipment. Logs of the drilled testholes are presented in **Appendix A**. Locations of the drilled testholes are shown on **Figure 2**.

Testholes were logged by Julien Egron, P. Eng., of AECOM. The testholes were logged based on observations of drill cuttings and drill behaviour. This included visual classification of the soils and interpretation of subsurface moisture and groundwater conditions. The soils were classified according to the modified Unified Soil Classification (mUSC) system. Soil samples were collected at regular intervals and where stratigraphy changed. The samples included disturbed grab samples from the drill cuttings or split spoon sampler. Standard Penetration Tests (SPTs) were performed at 1.5 m intervals, and blow counts per 300 mm penetration (SPT “N” blow counts) were recorded to provide an indication of the soil consistency.

A 25 millimeter (mm) slotted standpipe was installed in testhole TH17-03 to measure the depth of the groundwater table. The testholes were backfilled after completion of drilling with drill cuttings overlain by a bentonite cap to reduce infiltration. The installation details of the standpipe are shown on the testhole log in **Appendix A**.

### 2.1 Laboratory Testing

Soil samples collected during the site investigation were tested in AECOM’s Materials Testing Laboratory for soil classification and determination of engineering properties. The laboratory testing included determination of moisture contents, Atterberg Limits, grain size distribution, and chemical analysis (pH, resistivity, sulphate, and chloride content). The test results are shown on the testhole logs in **Appendix A** and are also presented separately in **Appendix B**. A summary of the tests performed on soil samples is provided in **Table 2-1**.

**Table 2-1. Summary of Laboratory Testing**

Tests	Number	Data Location
Moisture Contents	All Samples	Testhole Logs
Atterberg Limits	1	Testhole Logs & Appendix B
Grain Size Analyses	8	Testhole Logs & Appendix B
pH, Resistivity, Sulphate, and Chloride Content	5	Testhole Logs & Appendix B

## 3. Subsurface Stratigraphy

### 3.1 General

The subsurface stratigraphy at the testhole locations consisted of either asphalt or gravel road surface underlain by silt till, gravel, and sand. Testholes were drilled to at least the proposed depth of 10.0 mBGS, except testholes TH17-02 and TH17-04 which terminated at 8.53 mBGS and 4.88 mBGS, respectively, due to auger refusal in gravel/cobbles/boulders.

Detailed descriptions of the subsurface conditions encountered at the testhole locations are provided on the testhole logs in **Appendix A**. A description of the terms and symbols used on the logs is also included in **Appendix A**. A summary of the soil units and their index properties are presented in the following sections.

### 3.2 Road Surface

#### 3.2.1 Asphalt

Asphalt, approximately 51 mm thick, was encountered at surface in testhole TH17-01 drilled near the entrance/exit kiosk of the campground.

#### 3.2.2 Granular Base Course

Granular base course (GBC) was encountered underlying the asphalt in testhole TH17-01. The GBC layer was approximately 710 mm thick. The GBC was silty, sandy, grey, and frozen.

#### 3.2.3 Road Surface Gravel

Road surface gravel was encountered in testholes TH17-02, TH17-03, and TH17-04. The gravel was approximately 75 mm in all testholes. The road surface gravel was silty, sandy, brown/grey, and frozen.

### 3.3 Silt Till

Silt till layers, ranging in thickness from 0.8 m to 1.4 m thick, were encountered in testholes TH17-01, TH17-02, and TH17-03 underlying the gravel road surface. The silt till was sandy, to containing some sand, some-to-trace clay, trace-to-some gravel/cobbles, and trace coal inclusions. The silt till was brown, damp, and frozen to 0.76 mBGS. The SPT "N" blow counts in the silt till layers varied from 6 to 36, which indicated the silt till is firm to hard.

The moisture content of the silt till samples ranged from 16.4 % to 22.5 %, with an average value of 19.2 %.



Atterberg Limit and grain size distribution tests were conducted on select silt till samples. A summary of the test results is presented in **Table 3-1**.

**Table 3-1. Summary of Test Results – Silt Till**

Testhole No.	Sample No.	Atterberg Limits (%)			Particle Size Distribution (%)				mUSC
		Liquid Limit	Plastic Limit	Plastic Index	Gravel	Sand	Silt	Clay	
TH17-01	2	23.4	22.8	0.6	9.2	18.2	61.0	61	ML
TH17-02	1	-	-	-	10.7	31.2	46.9	11.2	ML

### 3.4 Gravel

Gravel was the predominant soil unit encountered in all testholes below the silt till or road surface gravel. Gravel was encountered below the silt till layer in testholes TH17-01 to TH17-03, and below the gravel road surface in testhole TH17-04. All testholes terminated in gravel. The gravel was sandy and contained trace silt and trace cobbles/boulders. The gravel was brown-to-grey and dry-to-humid. The SPT “N” blow counts in this soil unit varied from 17 to refusal, indicating the gravel is compact-to-very dense. The gravel layer contains and cobbles boulders; therefore, cobbles and boulders should be expected in the excavations.

The moisture content of the gravel samples ranged from 0.7 % to 7.1 % with an average of 2.5 %. Six particle size distribution tests were conducted on select gravel samples. A summary of the test results is presented in **Table 3-2**. ODEX percussion system was used to drill through the gravel which breaks down the gravel/cobbles/boulders into fragments; therefore, gradation results may show more sand particles than in-situ conditions.

**Table 3-2. Summary of Test Results – Gravel**

Testhole No.	Sample No.	Depth (m)	Moisture Content (%)	Grain Size Distribution (%)			mUSC
				Gravel	Sand	Silt/Clay	
TH17-01	7	4.9	1.7	58	38	4	GW
TH17-01	11	8.2	3.3	69	23	8	GP-GM
TH17-02	7	5.2	1.9	64	32	4	GW
TH17-03	3	2.1	1	66	31	3	GW
TH17-03	11	8.2	2.9	48	43	9	GP-GM
TH17-04	3	2.1	1.2	78	20	2	GW

### 3.5 Groundwater Conditions

A standpipe was installed in testhole TH17-03 to measure the depth of groundwater. The standpipe was observed to be dry upon completion of drilling and prior to leaving site. All other testholes were observed to be dry upon drilling completion.

Groundwater depths should be expected to fluctuate seasonally and in response to precipitation, and may be at different depths when construction commences. Groundwater depths should be measured periodically prior to construction to monitor seasonal fluctuations in the groundwater elevations.

### 3.6 Soil Chemistry

Electrochemical tests were conducted on five soil samples to determine water soluble sulphate concentrations, chloride content, pH, and resistivity. A summary of the test results, expected degree of corrosiveness, and potential for sulphate attack of the subsurface soils on concrete is presented in **Table 3-3**.

**Table 3-3. Summary of Electrochemical Testing Results**

Testhole No.	Sample No.	Depth (mBGS)	pH	Resistivity (ohm-cm)	Sulphate (%)	Chloride Content		Potential for Sulphate Attack	Degree of Corrosiveness	mUSC
						(mg/L)	(mg/kg)			
TH17-01	2	1.52	7.88	7390	< 0.1 %	< 24.3	< 11.2	Low	Moderately Corrosive	ML
TH17-01	7	4.88	7.94	10900	< 0.1 %	23	5.9	Low	Mildly Corrosive	GW
TH17-02	1	0.762	7.66	8550	< 0.1 %	32	8.4	Low	Moderately Corrosive	ML
TH17-03	3	2.13	7.91	11200	< 0.1 %	33	8.8	Low	Mildly Corrosive	GW
TH17-04	3	2.13	7.48	6920	< 0.1 %	42	11.7	Low	Moderately Corrosive	GW

The degrees of corrosiveness and potential for sulphate attack, as shown in **Table 3-3**, are in accordance with the Handbook of Corrosion Engineering (Roberge, 1999) and the Canadian Standard Association Guidelines.

### 3.7 Site Seismicity

Seismic loading is required for the design of structures. The level of importance of seismic loading at any site is related to factors such as the subsoil conditions and their behavior during an earthquake, the magnitude, duration, and frequency of strong ground motion, and the probable intensity and likelihood of the occurrence of an earthquake. The seismic loads used in the 2015 National Building Code of Canada (NBCC) are based on a 2 % probability of exceedance in 50 years, i.e., a return period of 2,475 years. This means that within a 50 year period there is a 2 % probability that the ground motions specified in the 2015 NBCC will be exceeded.

Based on the requirements set out in the NBCC, a determination of the soil's relative response to the seismic activity is required. The NBCC deals with the seismic classification of soils based on average properties of the top 30 m of the soil profile. This classification is based on the average standard penetration resistance, shear wave velocity, or undrained shear strength.

The average standard penetration resistance in overburden soils in the four testholes varied from 6 to refusal, with an average of 48 in the upper 10 m. Based on the subsurface stratigraphy encountered at the site, and SPT "N" blow counts, the subject site is classified as Site Class C (very dense soil and soft rock) based on the NBCC and Canadian Foundation Engineering Manual (2006).

The Peak Ground Acceleration (PGA) for this site is 0.127g, where g is 9.81 m/s<sup>2</sup> and Peak Ground Velocity (PGV) is 0.100 m/s (NBCC 2015).

### 3.8 Frost Susceptibility of Native Soils

The surficial soils encountered at the site primarily consist of silt till and sandy gravel. The qualitative frost susceptibility of a soil is typically assessed using guidelines developed by Casagrande (1932) on the basis of the percentage by weight of the soil finer than 0.02 mm and plasticity index. This classification system has been adapted by the U.S. Army Corps of Engineers and the Canadian Foundation Engineering Manual (CFEM 2006).

Soils are classified as F1 through F4 in order of increasing frost susceptibility. Based on the percentage by weight of the soil finer than 0.02 mm and plasticity index, the surficial soils encountered at the site are classified as F2 and are slightly frost susceptible.

## **4. Considerations and Recommendations**

### **4.1 General**

The subsurface soils at the site generally consist of asphalt or gravel at road surface underlain by silt till underlain by sandy gravel. Groundwater was not encountered in any of the testholes and is expected to be below the drilled depths. Cobbles and boulders were encountered in the testholes during the site investigation and should be expected in excavations during construction. Based on the subsurface conditions, the site is suitable for construction of proposed structures, subject to the recommendations provided in the following sections.

It is understood that all structures are in un-heated premises. Based on our discussion with the designers, un-insulated thickened perimeter slab-on-grade floors are being considered for the kiosk and firewood storage. Un-insulated thickened perimeter slab-on-slab floors are considered suitable for these structures, provided some movements caused by seasonal frost heave are acceptable.

Shallow foundations (strip/spread footings) are being considered for the shower building. Shallow foundations are considered suitable for the shower building, provided these foundations are founded on dense gravel at a depth of approximately 2.2 mBGS. Insulation will be required to protect foundations from frost heave movements.

Details for the water storage reservoir (tank) were not available during preparation of this report. The tanks are typically installed on a gravel pad or concrete slab in accordance with manufacturer recommendations. Recommendations for foundations for the water tank are not provided in this report; however, AECOM should be involved in review of the drawings for the foundations of the water tank when available.

Basements are not incorporated in any of the structures; therefore, recommendations for buried structures are not provided in this report.

Recommendations for foundations of the kiosk, firewood storage, and shower building are provided in the following sections.

### **4.2 Thickened Perimeter Slab-on-Grade Floors**

Un-insulated slab-on-grade floors with thickened perimeters are being considered for the kiosk and firewood storage. Based on the subsurface soil and groundwater conditions, the un-insulated thickened perimeter slab-on-grade floors may be used for the kiosk and firewood storage foundations, subject to the following recommendations and provided movements due to frost heave are acceptable.

- The subgrade below the thickened perimeter slab-on-grade floor should be prepared by removing all organics and soft/loose/wet/frozen/unsuitable soils. After removal of organics and all other unsuitable soils, the subgrade should be scarified to a minimum depth of 150 mm, moisture conditioned to within 2 % of the Optimum Moisture Content (OMC) and compacted to 98 % of the Standard Proctor Maximum Dry Density (SPMDD). The subgrade preparation should extend at least 1 m outside from the edge of the slab on all sides.

- A minimum thickness of 300 mm of 20 mm minus crushed gravel should be placed under the slab footprint on the prepared subgrade. The crushed gravel should extend at least 1 m outside from the edge of the slab on all sides. The gravel should be placed in two lifts (150 mm compacted thicknesses) and compacted to 100 % of the SPMDD to within 2 % of the OMC.
- The minimum width and thickness of the thickened perimeter should be 350 mm and the minimum slab thickness should be 150 mm. The slab and thickened perimeter should be adequately reinforced. The thickened section (350 mm) should be connected to the slab (150 mm) at a slope of 1H:1V.
- Fill around the slab perimeter should be placed no higher than 100 mm from the top of the slab and should slope away from the building at a minimum gradient of 3 %. The exposed ground surface outside the structures should be landscaped, top-soiled, and seeded to reduce erosion and infiltration.
- An ultimate soil resistance of approximately 125 kPa can be used for the thickened perimeter if the subgrade is prepared as described above and the minimum thickness and width of the thickened perimeter are 350 mm. A resistance factor of 0.5 should be applied on the ultimate soil resistance to obtain the factored soil resistance.
- Walls and columns should be supported on the thickened perimeter and not on the 150 mm thick slab.

### 4.3 Shallow Foundations – Strip/Spread Footings

Strip/spread footings can be used for the shower building, provided the base of the footings are founded on dense gravel at a depth of approximately 2.2 mBGS and footings are insulated to protect them from seasonal frost heave movements.

The ultimate soil resistance for dense gravel at or below a depth of 2.2 mBGS is estimated to be approximately 400 kPa for a minimum footing width of 1 m and a minimum soil cover of 2.2 m on either side of the footing. A resistance factor of 0.5 should be applied on the ultimate soil resistance to obtain factored soil resistance.

The settlement is estimated to be less than or equal to 25 mm if applied loading on footing does not exceed 200 kPa.

The soil resistance and estimated settlement provided above are based on following assumptions:

- The footings are founded on dense-to-very dense gravel at or below a depth of 2.2 mBGS;
- The minimum soil cover above the footing base on either side is 2.2 m;
- The building will be un-heated and insulation will be provided to protect footings from frost heave;
- The minimum footing width is 1.0 m;
- A mud slab, approximately 150 mm thick, will be placed below the footing above the prepared subgrade to protect the subgrade from softening, drying and wetting, and any other disturbance;
- Any structural fill placed below the footing is compacted to 100 % of the SPMDD to within  $\pm 2$  % of the OMC;
- All fill placed above the footing base is compacted to 98 % of the SPMDD to within  $\pm 2$  % of the OMC;
- The fill placed above the footing base consists of low-to-medium plastic clay or native gravel and sand; and,
- A layer of compacted clay, approximately 300 mm thick, is placed at surface to reduce surface infiltration.

The subgrade below foundations should be prepared by removing all organic soils, soft/wet/loose soils, and other unsuitable soils such as frozen soils, debris, etc. Any soft, loose, or unsuitable soils encountered at the

footing bearing elevation should be over-excavated and backfilled with a well-graded mixture of sand and gravel compacted to 98 % of the SPMDD to within  $\pm 2$  % of the OMC. The exposed subgrade should be scarified to a minimum depth of 150 mm, moisture conditioned, and re-compacted to make a uniform surface under the footings. The prepared subgrade should be inspected by qualified geotechnical personnel to confirm that the subgrade is adequately prepared. A mud slab should be poured immediately on the prepared subgrade after subgrade inspection to protect the subgrade from disturbance, wetting, and desiccation. The subgrade should be protected from freezing during and after construction. This can be achieved by placing the footing base below the seasonal frost zone or by providing insulation if burial depth is less than seasonal frost penetration depths.

Any surface water or groundwater infiltration into the excavation should be diverted away from the foundation base to avoid subgrade softening. In warm, dry weather, care should be taken to prevent soil at the base of the excavation from drying.

#### **4.4 Conventional Slab-on-Grade Floors**

Lightly loaded slab-on-grade floors may be considered in the shower building, provided certain precautions are taken.

Any unsuitable soil (organic soil, soft and wet soils, and soils containing organics, debris, etc.) encountered at or below the slab base elevation should be removed from the slab footprint and replaced with general engineered fill compacted to 98 % of the SPMDD to within  $\pm 2$  % of the OMC. The exposed native subgrade, after organic stripping, should be scarified to a minimum depth of 200 mm, moisture conditioned, and compacted to 98 % of the SPMDD to within  $\pm 2$  % of the OMC. The prepared subgrade after stripping, scarification, and re-compaction should be proof-rolled to identify any soft/weak soil pockets. Any soft/weak spots identified during proof-rolling should be over-excavated and replaced with general engineered fill. The general engineered fill should be compacted to at least 98 % of the SPMDD to within  $\pm 2$  % of the OMC, unless otherwise specified. If seasonally frozen ground is present at the time of slab construction, it should be over-excavated and replaced with compacted general engineered fill. The exposed subgrade should be protected from rain, snow, drying, seasonal frost, and ingress of water. The subgrade should not be allowed to freeze during or after construction to reduce potential for frost heave movement.

Recommendations for frost design for slab-on-grade floors in unheated areas are provided in **Section 4.5**. Insulation should be provided underneath and around the floor slabs to protect them from seasonal frost heave.

The final grade should be restored by the placement of general engineered fill. A leveling course of crushed gravel should be provided directly under the slab. To limit potential stress concentrations, the leveling course should not contain very coarse material. The leveling course may be comprised of a minimum 300 mm thick compacted layer of 20 mm minus crush. The leveling course should be compacted to 100 % of the SPMDD.

If the floor slab loading is expected to exceed 10 kPa, supports vibrating equipment, or if the floor slab traffic is expected to be high, AECOM should be given the opportunity to re-evaluate the recommendations for slab-on-grade floors.

The slab-on-grade floors should contain an adequate number of construction joints to control cracking of the slab concrete. The slab-on-grade floors should be adequately reinforced to reduce the possibility of uncontrolled slab cracking.

The slab-on-grade floor and walls and columns supported on the foundation system should be structurally independent of each other. Non-load bearing walls placed directly on slab-on-grade floors should also be structurally independent of the walls and columns supported on the foundation system.

Some relative movement between slab-on-grade floors and adjacent walls or foundations and differential movements within the slabs is anticipated. Generally, if the recommendations outlined in this report are followed, these movements should be acceptably small. It is possible that some cracking of the slab or distortion of any internal partition walls supported by the slab may occur. Such damage may be visible, particularly if a brittle surface finishing, such as ceramic tiles, is adopted. The risk of such damage should be weighed against the additional cost associated with alternative slab support systems, such as structurally supported slabs.

#### **4.5 Seasonal Frost Penetration Depths and Frost Design Considerations**

The seasonal frost penetration depth was estimated for surficial soils following the procedure described in the CFEM (2006) and a design freezing index of 2,000 °C-days. The seasonal frost penetration depth is estimated to be approximately 4 m for gravel. The estimated frost depth assumes no snow cover, peat, or vegetation on the surface. The presence of snow, vegetation, and peat may reduce the seasonal frost penetration depths.

Pipelines, foundations, and other infrastructure elements below the finished grade should be protected from frost heave either by burial below the seasonal frost zone or by shallow burial accompanied with insulation and/or heat tracing. The minimum burial depth of un-insulated utility lines, water pipelines, and foundations should not be less than seasonal frost penetration depth provided above. Insulation should be provided if burial depth is less than the seasonal frost penetration depth.

Grade supported structures, such as slab-on-grade floors, and any other structures (shallow foundations, pipelines, etc.) with soil cover less than the seasonal frost penetration depth, may be subject to frost heave movements if insulation is not provided.

The shower building is un-heated and the burial depth of the footing is expected to be less than the seasonal frost penetration depth; therefore, insulation is required to protect the footings and slab-on-grade floors from seasonal frost heave movement. A minimum thickness of 200 mm of rigid insulation is recommended under the slab-on-grade floors in un-heated areas. The insulation should be underlain by a 300 mm thick layer or more of compacted, frost-stable gravel under the slab. The insulation should extend outwards a minimum of 2.0 m from the wall or from the edge of the slab. The minimum burial depth of insulation outside the walls/slab edge from finished grade to the top of insulation should be 300 mm. Vertical insulation, 200 mm thick, should also be provided on the foundation wall. The insulation should be designed in accordance with the expected loading conditions during and after construction. Where insulation is required to withstand high bearing pressures, high strength insulation (Styrofoam HI-40, HI-60, HI-80, or equivalent) with appropriate design compressive strengths may be used.

The insulation should be sloped down away from the structure at 1 %. A compacted clay layer approximately 300 mm thick is recommended at surface to reduce infiltration.

The minimum burial depth of un-insulated utility lines, and water and sewer pipelines should not be less than the seasonal frost penetration depth. Insulation should be provided if pipelines are buried with soil cover less than the seasonal frost penetration depths. The insulation should be made of rigid polystyrene composition (Styrofoam HI-40, HI-60, HI-80, or equivalent). The insulation should be at least 150 mm thick. A minimum burial depth of 1.5 m is recommended below the finished grade. A 300 mm thick compacted clay layer should be placed on surface to reduce infiltration. The insulation should be placed on 300 mm thick layer of 20 mm minus crush to protect it from damage from the underlying soil. The insulation should extend at least 2.5 m outwards from the pipe centreline on each side.

## **4.6 Temporary Excavations and Dewatering**

The composition and consistency of the soils encountered at site were such that conventional hydraulic excavators should be able to excavate these materials, although a ripper may be required to excavate seasonally frozen soil. A breaker hammer may be required if large boulders are encountered within the excavations. Bedrock was not encountered within the drilled depths and is not within the excavations.

Construction should be in accordance with good practices and should conform to Occupational Health and Safety guidelines. Excavations should be sloped or adequately shored. The appropriate side slopes for the excavations will depend on the soil type, controlling groundwater flow into the excavations, and the time the excavation is left open.

The temporary cuts in gravel encountered at site should not be steeper than 1.5H:1V for excavations up to 3 m deep above the groundwater table. Localized instability of excavation walls may occur due to seepage and sloughing, and/or if excavations are deeper than 3 m. In these cases, side slopes would need to be made flatter under the direction of a qualified geotechnical engineer. Steeper slopes may be considered, provided they are adequately shored and braced in accordance with Occupational Health and Safety Regulations. Stability and maintenance of temporary slopes is the Contractor's responsibility.

The recommendations above for side slopes are for short term construction. The stability of cut slopes will deteriorate with time; therefore, temporary side slopes should be monitored for any signs of deterioration, especially after periods of rain and snow melt, and appropriate measures should be taken to mitigate deterioration of the side slopes. Small earth falls from the side slopes are a potential source of danger to workers and must be guarded against.

Dewatering may be required if seepage is encountered in the excavations. The Contractor should be prepared to handle the groundwater to maintain excavation stability and suitable subgrade.

Temporary surcharge loads, such as construction materials, equipment, or excavated soils, should not be allowed within a distance equal to the depth of excavation from the unsupported excavated face. Vehicles delivering material should be kept back from excavation faces at a safe distance.

## **4.7 Backfill Placement and Compaction**

Following organic stripping and subgrade preparation, fill can be placed in layers not exceeding 150 mm in compacted thickness. The fill should be compacted to at least 98 % of the SPMDD at  $\pm 2$  % of OMC unless otherwise specified. The fill should be placed in lifts that are compatible with the compaction equipment used. The ability of compaction equipment to uniformly compact layers thicker than 150 mm should be confirmed with a test strip program.

Soils used for filling purposes may consist of general engineered fill. General engineered fill materials should be comprised of inorganic well graded granular soils or inorganic low-to-medium plastic clay/clay till. Granular soils used as general engineered fills should consist of clean, well-graded mixture of sand and gravel, with a maximum particle size of 80 mm. Native inorganic soils obtained from the site can be used for backfilling and site grading purposes, provided the soils are adequately moisture conditioned and oversize particles are removed. High plastic clays are not considered suitable as fill material.

Inorganic soils obtained from excavations at the site may have natural moisture content different than their OMC; therefore, the soils should be properly moisture conditioned prior use as fill.

Structural fill should be used in areas where the performance of fill is more critical. Structural fill should consist of well-graded granular material (gravel and sand). Structural fill may be obtained from screened pit run or crushed material depending on specific requirements. The structural fill should be compacted to 100 % of the SPMDD.

Fill materials should not be placed in a frozen state or placed on a frozen subgrade. All lumps of material should be broken down during placement. The maximum particle size in fill material should not exceed half the layer thickness. Fill material should not contain deleterious materials such as debris, organics, coal particles, wood chunks, etc.

Bonding should be provided between backfill lifts if the previous lift has become desiccated. For fine-grained materials, the previous lift should be scarified to the base of the desiccated layer, properly moisture conditioned, and re-compacted and bonded thoroughly to the succeeding lift. For granular materials, the surface of the previous lift should be scarified to about a 75 mm depth followed by proper moisture conditioning and re-compaction.

It should be noted that the ultimate performance of the trench backfill is directly related to the uniformity of the backfill compaction. In order to achieve this uniformity, the lift thickness and compaction criteria must be strictly enforced.

## **4.8 Site Grading and Drainage**

The site should be properly graded to drain surface water away from the site as quickly as possible during and after construction. The finished grade for all areas should be prepared so that surface water is drained away from buildings and other structures by the shortest possible route.

The site should be graded to have overall grades of no less than 1 % to reduce ponding. The access roads should also be crowned to a minimum of 2 % (or super-elevated around curves) to shed water to adjacent ditches.

Ditches should be constructed along the roadways to promote drainage and reduce the potential for ponding near the roadways. Ditch gradients in excess of 2 % may cause ditch erosion, and ditch gradients less than 0.5 % may result in inadequate longitudinal drainage. Longitudinal gradients less than 0.5 % may also result in localized ponding, growth of aquatic plants, odour from stagnant water, and insects. The lower longitudinal gradient will reduce erosion but will result in increased silt deposition within the ditches.

Erosion protection for ditch slopes can be provided through the application of a layer of topsoil and grass seed. Erosion protection mats may be required to reduce ditch erosion in the short term. Silt fences may also be required during construction to reduce silt flow into the water bodies.

From a slope stability perspective, maximum ditch side slopes of 3H:1V are recommended. Ditch side slopes steeper than 3H:1V are not recommended as steeper ditch slopes may cause localized toe failures, especially in areas where longitudinal drainage causes undercutting of the slope toe.

The use of riprap is recommended at locations where heavy erosion and scour are to be avoided. These locations may include entrance and egress locations of culverts. Where utilized, all riprap should be placed on a medium weight, non-woven geotextile.

Downspouts from buildings and structures may be discharged onto landscaped or gravel surface areas, provided that water is carried by means of a concrete splash pad or extendable sections so that the point of discharge of water is at least 2 m from building walls. The ground surface adjacent to walls and key



infrastructure should be graded to slope away from buildings at a gradient of at least 4 % within 2 m of the building perimeter.

## 4.9 Sulphate Attack and Corrosion

The test results in **Table 3-3** indicate that the native soils have low potential for sulphate attack; however, it is common practice to use sulphate resistant concrete for any structures in contact with subsoils and groundwater. Therefore, it is recommended to use Type HS Sulphate Resistant cement for all concrete structures in contact with subsurface soils and groundwater (i.e., exposure class S-2 concrete – CSA A23.1).

The measured resistivity values of the soil samples ranged from 6920 to 11200 ohm-cm , and the pH value of the soil samples ranged from 7.48 to 7.94. Based on the resistivity values, the native soils are moderately-to-mildly corrosive. It is, therefore, recommended that all metals in contact with subsurface soils be designed for a corrosive environment.

## 5. Closure

We trust this memorandum satisfies your present requirements. We would be pleased to provide any further information required during the course of this project. Feel free to contact the undersigned should you have any questions.

Respectfully Submitted,  
**AECOM Canada Ltd.**

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Encl.: Statement of Qualification, General Statement – Normal Variability of Subsurface Conditions  
Figures  
Figure 1. Site Location Plan  
Figure 2. Testhole Location Plan  
Appendix A. Testhole Logs  
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## Statement of Qualifications and Limitations

The attached Report (the "Report") has been prepared by AECOM Canada Ltd. ("AECOM") for the benefit of the Client ("Client") in accordance with the agreement between AECOM and Client, including the scope of work detailed therein (the "Agreement").

The information, data, recommendations and conclusions contained in the Report (collectively, the "Information"):

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- may be based on information provided to AECOM which has not been independently verified;
- has not been updated since the date of issuance of the Report and its accuracy is limited to the time period and circumstances in which it was collected, processed, made or issued;
- must be read as a whole and sections thereof should not be read out of such context;
- was prepared for the specific purposes described in the Report and the Agreement; and
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This Statement of Qualifications and Limitations is attached to and forms part of the Report and any use of the Report is subject to the terms hereof.

# General Statement – Normal Variability of Subsurface Conditions

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

The analyses and recommendations represented in this report are based on the data obtained from the testholes drilled at the locations indicated on the site plans and from other information discussed herein. This report is based on the assumption that the subsurface conditions everywhere on the site are not significantly different from those encountered at the testhole locations. However, variation in the soil conditions between the testholes may exist. Also, general groundwater levels and conditions may fluctuate from time to time. The nature and extent of the variations may not become evident until construction. If subsurface conditions different from those encountered in the exploratory borings are observed or encountered during construction, or appear to be present beneath or beyond excavations, AECOM Canada Ltd. should be advised at once so that the conditions can be observed and reviewed and, where necessary, the recommendations reconsidered.

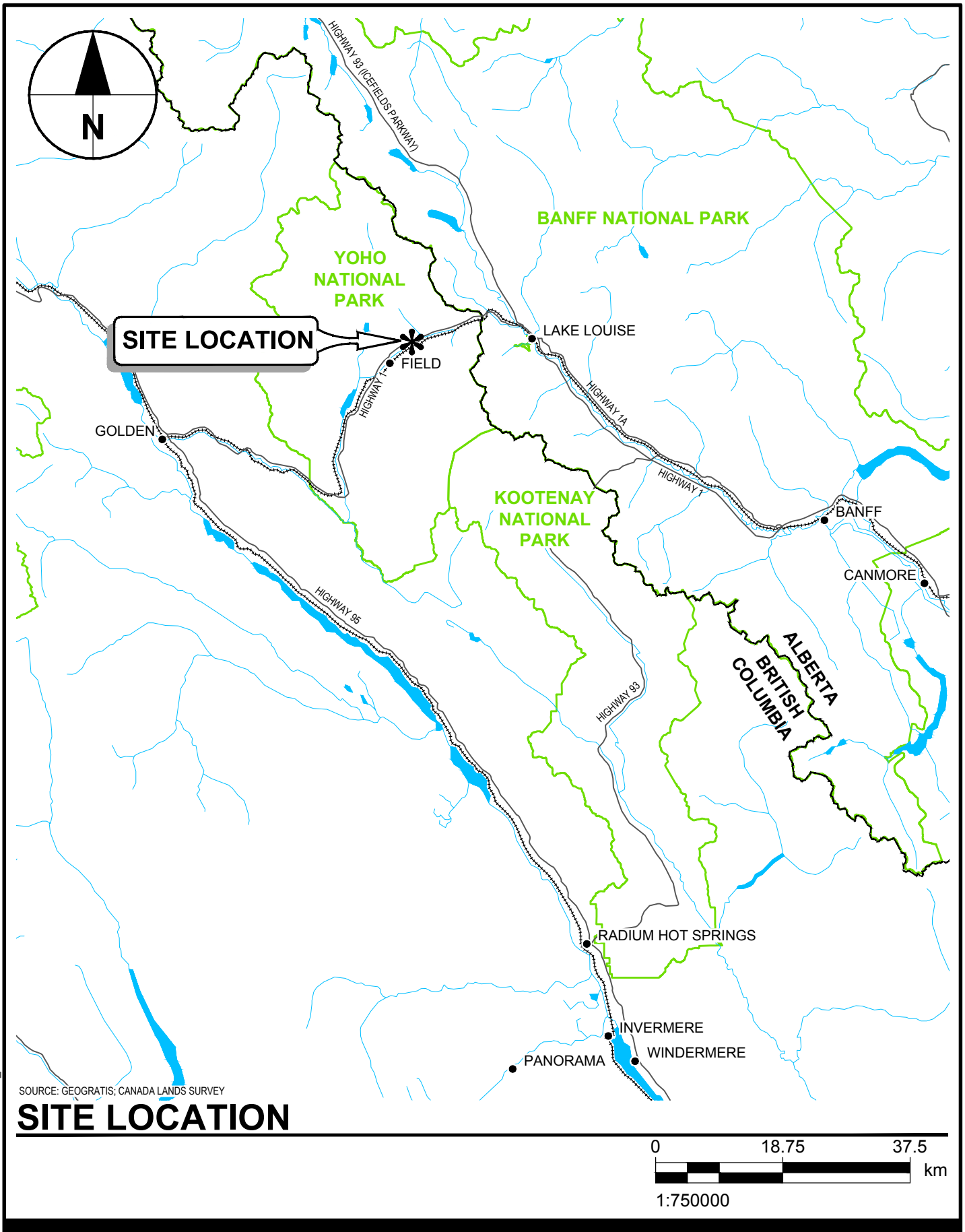
Since it is possible for conditions to vary from those identified at the testhole locations and from those assumed in the analysis and preparation of recommendations, a contingency fund should be included in the construction budget to allow for the possibility of variations which may result in modification of the design and construction procedures.

In order to observe compliance with the design concepts, specifications, or recommendations and to allow design changes in the event that subsurface conditions differ from those anticipated, it is recommended that all construction operations dealing with earthwork and the foundations be observed by an experienced geotechnical engineer. In addition, it is recommended that a qualified geotechnical engineer review the plans and specifications that have been prepared to check for substantial conformance with the conclusions and recommendations contained in the report.

# Figures

**Figure 1. Site Location Plan**

**Figure 2. Testhole Location Plan**



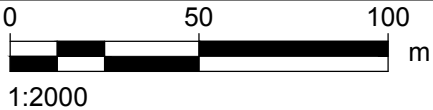
## SITE LOCATION





# LEGEND

TESTHOLE LOCATION (AECOM 2017)





# Appendix **A**

## Testhole Logs

## EXPLANATION OF FIELD & LABORATORY TEST DATA

The field and laboratory test results, as shown for each hole, are described below.

### 1. NATURAL MOISTURE CONTENT

The relationship between the natural moisture content and depth is significant in determining the subsurface moisture conditions. The Atterberg Limits for a sample should be compared to its natural moisture content and plotted on the Plasticity Chart in order to determine the soil classification.

### 2. SOIL PROFILE AND DESCRIPTION

Each soil strata is classified and described noting any special conditions. The modified Unified Soil Classification (UCS) system is used. The soil profile refers to the existing ground level at the time the hole was done. Where available, the ground elevation is shown. The soil symbols used are shown in detail on the soil classification chart.

### 3. TESTS ON SOIL SAMPLES

Laboratory and field tests are identified by the following and are on the logs:

- N - Standard Penetration Test (SPT) Blow Count. The SPT is conducted in the field to assess the in situ consistency of cohesive soils and the relative density of non-cohesive soils. The N value recorded is the number of blows from a 63.5 kg hammer dropped 760 mm which is required to drive a 51 mm split spoon sampler 300 mm into the soil.
- SO<sub>4</sub> - Water Soluble Sulphate Content. Expressed in percent. Conducted primarily to determine requirements for the use of sulphate resistant cement. Further details on the water soluble sulphate content are given in Section 6.
- $\gamma_D$  - Dry Unit Weight. Usually expressed in kN/m<sup>3</sup>.
- $\gamma_T$  - Total Unit Weight. Usually expressed in kN/m<sup>3</sup>.
- Q<sub>U</sub> - Unconfined Compressive Strength. Usually expressed in kPa and may be used in determining allowable bearing capacity of the soil.



- $C_U$  - Undrained Shear Strength. Usually expressed in kPa. This value is determined by either a direct shear test or by an unconfined compression test and may also be used in determining the allowable bearing capacity of the soil.
- $C_{PEN}$  - Pocket Penetrometer Reading. Usually expressed in kPa. Estimate of the undrained shear strength as determined by a pocket penetrometer.

The following tests may also be performed on selected soil samples and the results are given on separate sheets enclosed with the logs:

- Grain Size Analysis
- Standard or Modified Proctor Compaction Test
- California Bearing Ratio Test
- Direct Shear Test
- Permeability Test
- Consolidation Test
- Triaxial Test

## 4. SOIL DENSITY AND CONSISTENCY

The SPT test described above may be used to estimate the consistency of cohesive soils and the density of cohesionless soils. These approximate relationships are summarized in the following tables:

**Table 1 Cohesive Soils**

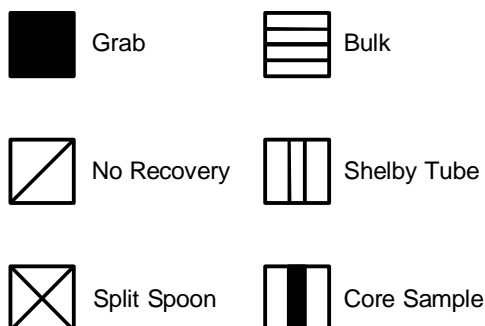
N	Consistency	$C_u$ (kPa) approx.
0 - 1	Very Soft	<10
1 - 4	Soft	10 - 25
4 - 8	Firm	25 - 50
8 - 15	Stiff	50 - 100
15 - 30	Very Stiff	100 - 200
30 - 60	Hard	200 - 300
>60	Very Hard	>300

**Table 2 Cohesionless Soils**

N	Density
0 - 5	Very Loose
5 - 10	Loose
10 - 30	Compact
30 - 50	Dense
>50	Very Dense

## 5. SAMPLE CONDITION AND TYPE

The depth, type, and condition of samples are indicated on the logs by the following symbols:



## 6. WATER SOLUBLE SULPHATE CONCENTRATION

The following table, from CSA Standard A23.1-09, indicates the requirements for concrete subjected to sulphate attack based upon the percentage of water-soluble sulphate as presented on the logs. CSA Standard A23.1-09 should be read in conjunction with the table.

**Table 3 Requirements For Concrete Subjected to Sulphate Attack\***

Class of exposure	Degree of exposure	Water-soluble sulphate (SO <sub>4</sub> ) <sup>†</sup> in soil sample, %	Sulphate (SO <sub>4</sub> ) in groundwater samples, mg/L <sup>‡</sup>	Water soluble sulphate (SO <sub>4</sub> ) in recycled aggregate sample, %	Cementing materials to be used <sup>§**</sup>	Maximum expansion when tested using CSA A3004-C8, %	
						At 6 months	At 12 months <sup>††</sup>
S-1	Very Severe	> 2.0	>10 000	> 2.0	HS** or HSb	0.05	0.10
S-2	Severe	0.20 – 2.0	1500 – 10 000	0.60 – 2.0	HS** or HSb	0.05	0.10
S-3	Moderate	0.10 – 0.20	150 - 1500	0.20 – 0.60	MS, MSb, LH, HS**, or HSb	0.10	

\*For sea water exposure, see Clause 4.1.1.5.

<sup>†</sup>In accordance with CSA A23.2-3B.

<sup>‡</sup>In accordance with CSA A23.2-2B.

<sup>§</sup>Where combinations of supplementary cementing materials and portland or blended hydraulic cements are to be used instead of the cementing materials listed, the performance requirements shall be used to demonstrate equivalent performance against sulphate exposure (see Clauses 4.1.1.6.2, 4.2.1.1, and 4.2.1.3, and 4.2.1.4). Such combinations shall not be designated as blended cements.

\*\*Type HS cement shall not be used in reinforced concrete exposed to both chlorides and sulphates. Refer to Clause 4.1.1.6.3.

<sup>††</sup>If the expansion is greater than 0.05% at 6 months but less than 0.10% at 1 year, the cementing materials combination under test shall be considered to have passed.


## **7. Soil Corrosivity**

The following table, from the Handbook of Corrosion Engineering (Roberge, 1999) indicates the corrosivity rating can be obtained from the soil resistivity, presented on the logs.

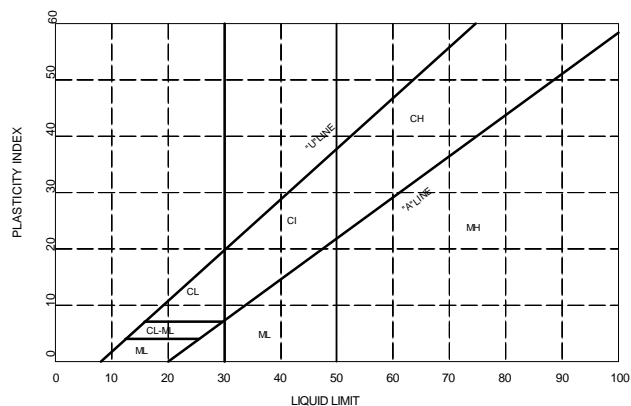
**Table 4 – Corrosivity Ratings Based on Soil Resistivity**

Soil Resistivity (ohm cm)	Corrosivity Rating
>20,000	Essentially noncorrosive
10,000 – 20,000	Mildly corrosive
5,000 – 10,000	Moderately corrosive
3,000 – 5,000	Corrosive
1,000 – 3,000	Highly Corrosive
<1000	Extremely Corrosive

## **8. GROUNDWATER TABLE**

The groundwater table is indicated by the equilibrium level of water in a standpipe installed in a testhole or test pit. This level is generally taken at least 24 hours after installation of the standpipe. The groundwater level is subject to seasonal variations and is usually highest in the spring. The symbol on the logs indicating the groundwater level is an inverted solid triangle ()

MAJOR DIVISION			LOG SYMBOLS	UCS	TYPICAL DESCRIPTION	LABORATORY CLASSIFICATION CRITERIA	
COARSE GRAINED SOILS	GRAVELS (MORE THAN HALF COARSE GRAINS LARGER THAN 4.75 mm)	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL GRADED GRAVELS, LITTLE OR NO FINES	$C_u = \frac{D_{60}}{D_{10}} > 4$ $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}} = 1 \text{ to } 3$	
				GP	POORLY GRADED GRAVELS AND GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	NOT MEETING ABOVE REQUIREMENTS	
		GRAVELS WITH FINES		GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES	CONTENT OF FINES EXCEEDS 12%	ATTERBERG LIMITS BELOW 'A' LINE $W_p$ LESS THAN 4
				GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES		ATTERBERG LIMITS ABOVE 'A' LINE $W_p$ MORE THAN 7
	SANDS (MORE THAN HALF COARSE GRAINS SMALLER THAN 4.75 mm)	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES	$C_u = \frac{D_{60}}{D_{10}} > 6$ $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}} = 1 \text{ to } 3$	
				SP	POORLY GRADED SANDS, LITTLE OR NO FINES	NOT MEETING ABOVE REQUIREMENTS	
		SANDS WITH FINES		SM	SILTY SANDS, SAND-SILT MIXTURES	CONTENT OF FINES EXCEEDS 12%	ATTERBERG LIMITS BELOW 'A' LINE $W_p$ LESS THAN 4
				SC	CLAYEY SANDS, SAND-CLAY MIXTURES		ATTERBERG LIMITS ABOVE 'A' LINE $W_p$ MORE THAN 7
FINE GRAINED SOILS	SILTS (BELOW 'A' LINE NEGLIGIBLE ORGANIC CONTENT)	$W_L < 50$		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY SANDS OF SLIGHT PLASTICITY	CLASSIFICATION IS BASED UPON PLASTICITY CHART (SEE BELOW)  WHENEVER THE NATURE OF THE FINE CONTENT HAS NOT BEEN DETERMINED, IT IS DESIGNATED BY THE LETTER 'F'. E.G. SF IS A MIXTURE OF SAND WITH SILT OR CLAY	
		$W_L > 50$		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS		
	CLAYS (ABOVE 'A' LINE NEGLIGIBLE ORGANIC CONTENT)	$W_L < 30$		CL	INORGANIC CLAYS OF LOW PLASTICITY, GRAVELLY, SANDY, OR SILTY CLAYS, LEAN CLAYS		
		$30 < W_L < 50$		CI	INORGANIC CLAYS OF MEDIUM PLASTICITY, SILTY CLAYS		
		$W_L > 50$		CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS		
	ORGANIC SILTS & CLAYS (BELOW 'A' LINE)	$W_L < 50$		OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY		
		$W_L > 50$		OH	ORGANIC CLAYS OF HIGH PLASTICITY		
	HIGHLY ORGANIC SOILS				Pt	PEAT AND OTHER HIGHLY ORGANIC SOILS	STRONG COLOUR OR ODOUR, AND OFTEN FIBROUS TEXTURE
BEDROCK				BR	SEE REPORT DESCRIPTION		
FILL				FILL	SEE REPORT DESCRIPTION		



NOTE:  
1. BOUNDARY CLASSIFICATION POSSESSING CHARACTERISTICS OF TWO GROUPS ARE GIVEN GROUP SYMBOLS, E.G. GW-GC IS A WELL GRADED GRAVEL MIXTURE WITH CLAY BINDER BETWEEN 5% AND 12%

SOIL COMPONENTS					
FRACTION		SIEVE SIZE (mm)		DEFINING RANGES OF PERCENTAGE BY WEIGHT OF MINOR COMPONENTS	
		PASSING	RETAINED	PERCENT	IDENTIFIER
GRAVEL	COARSE	75	19	50 - 35	AND
	FINE	19	4.75		
SAND	COARSE	4.75	2.00	35 – 20	_____Y
	MEDIUM	2.00	0.425		
		FINE	0.425	0.080	20 – 10
SILT (non-plastic) or CLAY (plastic)		0.080		10 - 1	TRACE
OVERSIZE MATERIALS					
ROUNDED OR SUB-ROUNDED COBBLES 75 mm TO 200 mm BOULDERS >200 mm			ANGULAR ROCK FRAGMENTS ROCKS ≥ 0.75 m³ IN VOLUME		

## MODIFIED UNIFIED SOIL CLASSIFICATION SYSTEM

August 2015

PROJECT: Kicking Horse-Monarch Campground Improvements			CLIENT: Parks Canada Agency			TESTHOLE NO: TH17-01		
LOCATION: Entrance Kiosk N 5,697,032.4 E 539,281.0						PROJECT NO.: 60551150		
CONTRACTOR: Earth Drilling Company Ltd.			METHOD: Solid Stem Auger/ODEX			ELEVATION (m):		
SAMPLE TYPE			<input checked="" type="checkbox"/> GRAB <input type="checkbox"/> SHELBY TUBE <input type="checkbox"/> SPLIT SPOON <input type="checkbox"/> BULK <input type="checkbox"/> NO RECOVERY <input type="checkbox"/> CORE					

DEPTH (m)	USC	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	◆ SPT (Standard Pen Test) ◆ (Blows/foot) 20 40 60 80 PLASTIC M.C. LIQUID 10 20 30 40	COMMENTS	DEPTH (m)
0	ASPH		ASPHALT (51 mm)						
	GM		GRAVEL (Granular Base Course) - silty, sandy, grey, frozen to 0.76 mBGS						
1			SILT TILL - some clay, some sand, trace gravel, brown, damp, firm, low plastic		1	7			
	ML		- trace coal inclusions						
			- gravel = 9.2 %, sand = 18.2 %, silt = 61.0 % clay = 11.6 %		2	6			
			- soluble sulphate < 0.1 % / 238 mg/L, pH = 7.88, resistivity = 7390 ohm-cm, chloride = 46 mg/L / < 11.2 mg/kg						
2			GRAVEL - sandy, trace silt, well graded, dry, very dense		3				
3			- SPT refusal on gravel/cobbles		4	83/76mm		- switched to ODEX	
			- grey		5				
4			- SPT refusal on gravel/cobbles		6	50/25mm		- no recovery	
	GW		- brown/grey, humid to dry		7				
			- gravel = 58.0 %, sand = 38.0 %, silt/clay = 4.0 %						
			- soluble sulphate < 0.1 % / 32.3 mg/L, pH = 7.94, resistivity = 10900 ohm-cm, chloride = 23 mg/L / 5.9 mg/kg		8	40			
6			- trace brown sand pockets, dense		9				
7					10	76/02mm			
8			GRAVEL - sandy, trace silt, trace cobble, brown, humid, very dense		11				
			- SPT refusal on gravel/cobbles						
			- damp to moist		12	17			
			- gravel = 69.0 %, sand = 23.0 %, silt/clay = 8.0 %						
9	GP-GM		- compact						
10									

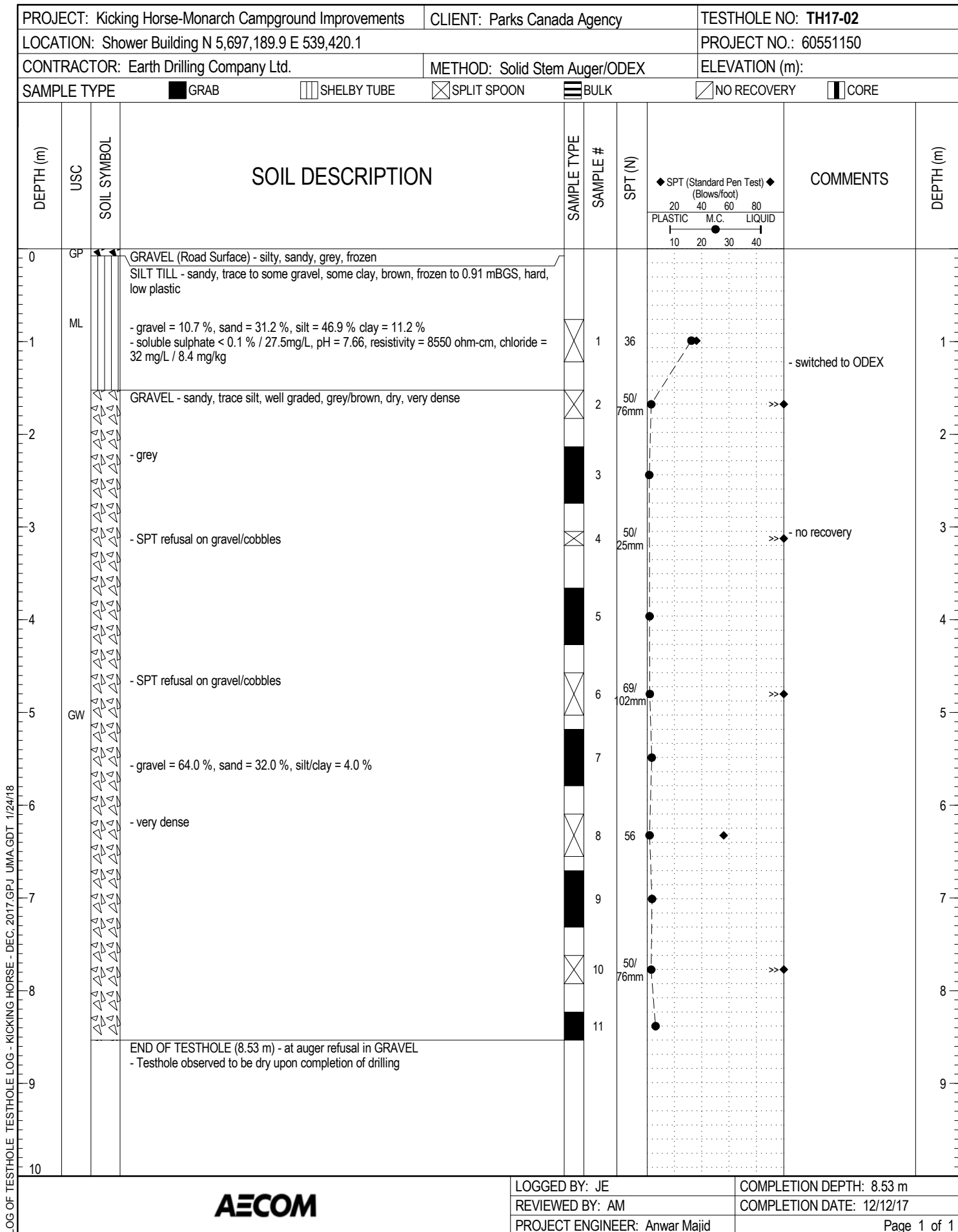
  

		LOGGED BY: JE	COMPLETION DEPTH: 10.82 m
		REVIEWED BY: AM	COMPLETION DATE: 12/11/17
		PROJECT ENGINEER: Anwar Majid	Page 1 of 2

PROJECT: Kicking Horse-Monarch Campground Improvements			CLIENT: Parks Canada Agency			TESTHOLE NO: <b>TH17-01</b>		
LOCATION: Entrance Kiosk N 5,697,032.4 E 539,281.0						PROJECT NO.: 60551150		
CONTRACTOR: Earth Drilling Company Ltd.			METHOD: Solid Stem Auger/ODEX			ELEVATION (m):		
SAMPLE TYPE <input checked="" type="checkbox"/> GRAB <input type="checkbox"/> SHELBY TUBE <input type="checkbox"/> SPLIT SPOON <input type="checkbox"/> BULK <input type="checkbox"/> NO RECOVERY <input type="checkbox"/> CORE								

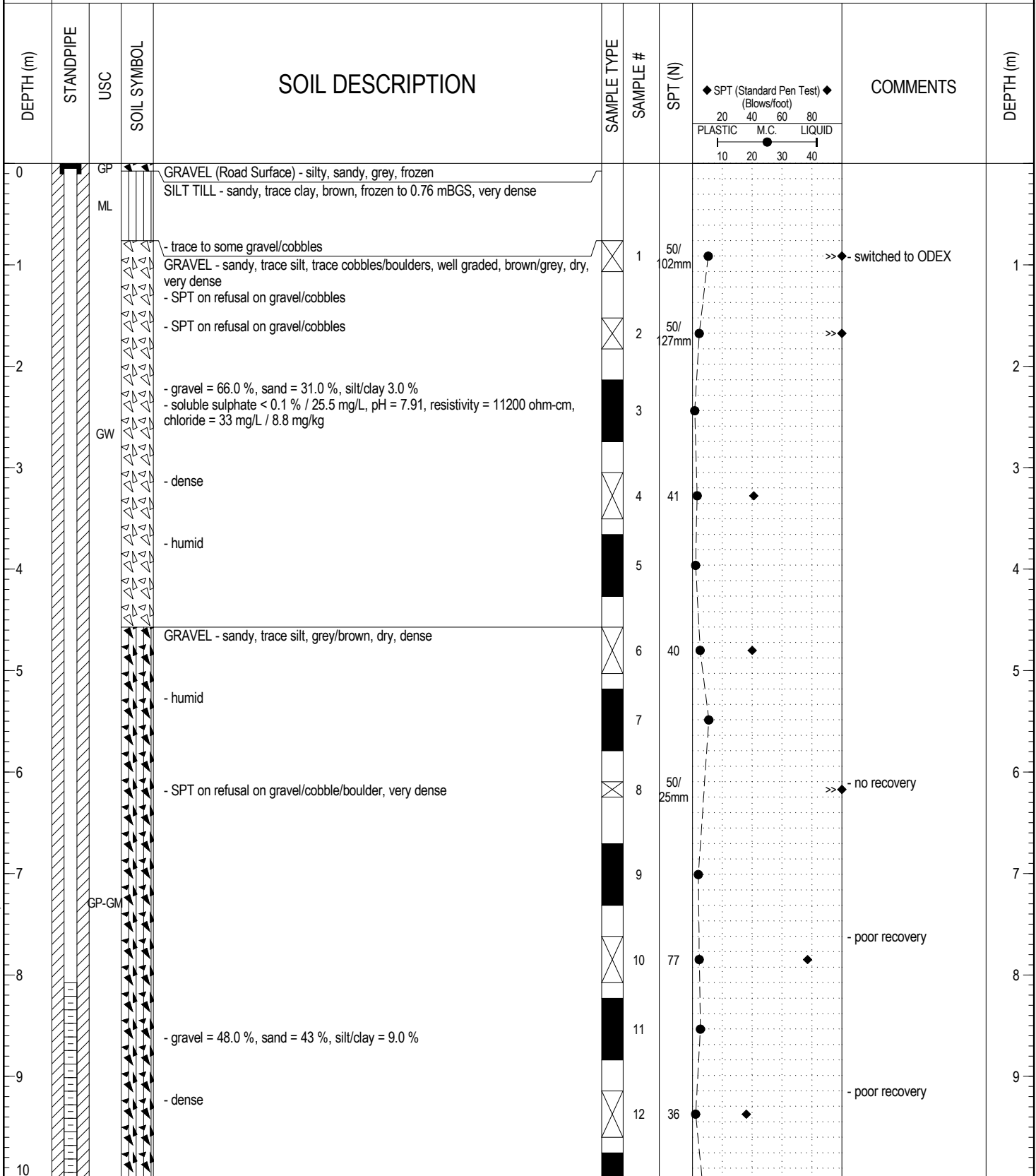
DEPTH (m)	USC	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	COMMENTS	DEPTH (m)
10		GP-GM	GRAVEL - continued from previous page	<input checked="" type="checkbox"/>	13	◆ SPT (Standard Pen Test) ◆ (Blows/foot) 20 40 60 80 PLASTIC M.C. LIQUID 10 20 30 40 50/76mm		
			- SPT refusal on gravel/cobble/boulder, dry, very dense	<input checked="" type="checkbox"/>	14			
11			END OF TESTHOLE (10.82 mBGS) - at proposed depth in GRAVEL - Testhole observed to be dry upon completion of drilling					11
12								12
13								13
14								14
15								15
16								16
17								17
18								18
19								19
20								20

<b>AECOM</b>	LOGGED BY: JE	COMPLETION DEPTH: 10.82 m
	REVIEWED BY: AM	COMPLETION DATE: 12/11/17
	PROJECT ENGINEER: Anwar Majid	Page 2 of 2



LOG OF TESTHOLE TESTHOLE LOG - KICKING HORSE - DEC. 2017 GPJ UMA GDT 1/24/18

PROJECT: Kicking Horse-Monarch Campground Improvements		CLIENT: Parks Canada Agency		TESTHOLE NO: TH17-03	
LOCATION: Shower Building N 5,697,201.4 E 539,439.4				PROJECT NO.: 60551150	
CONTRACTOR: Earth Drilling Company Ltd.			METHOD: Solid Stem Auger/ODEX		ELEVATION (m):
SAMPLE TYPE		GRAB	SHELBY TUBE	SPLIT SPOON	BULK
BACKFILL TYPE		BENTONITE	GRAVEL	SLOUGH	GROUT
					CUTTINGS
					SAND



LOG OF TESTHOLE TESTHOLE LOG - KICKING HORSE - DEC. 2017 GPJ UMA GDT 1/24/18

AECOM

LOGGED BY: JE	COMPLETION DEPTH: 11.13 m
REVIEWED BY: AM	COMPLETION DATE: 12/12/17
PROJECT ENGINEER: Anwar Majid	Page 1 of 2



PROJECT: Kicking Horse-Monarch Campground Improvements				CLIENT: Parks Canada Agency				TESTHOLE NO: <b>TH17-03</b>					
LOCATION: Shower Building N 5,697,201.4 E 539,439.4								PROJECT NO.: 60551150					
CONTRACTOR: Earth Drilling Company Ltd.				METHOD: Solid Stem Auger/ODEX				ELEVATION (m):					
SAMPLE TYPE		<input checked="" type="checkbox"/> GRAB		<input type="checkbox"/> SHELBY TUBE		<input type="checkbox"/> SPLIT SPOON		<input type="checkbox"/> BULK		<input type="checkbox"/> NO RECOVERY		<input type="checkbox"/> CORE	
BACKFILL TYPE		<input checked="" type="checkbox"/> BENTONITE		<input type="checkbox"/> GRAVEL		<input type="checkbox"/> SLOUGH		<input type="checkbox"/> GROUT		<input type="checkbox"/> CUTTINGS		<input type="checkbox"/> SAND	


DEPTH (m)	STANDPIPE	USC	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	COMMENTS	DEPTH (m)
10				GRAVEL - continued from previous page		13	<p>◆ SPT (Standard Pen Test) ◆ (Blows/foot)</p> <p>20 40 60 80</p> <p>PLASTIC M.C. LIQUID</p> <p>10 20 30 40</p>		10
11					14	44			
12				END OF TESTHOLE (11.13 m) - at proposed depth in GRAVEL - Testhole observed to be dry upon completion of drilling - Standpipe installed upon drilling completion - Standpipe was observed to be dry on December 12, 2017					12
13									13
14									14
15									15
16									16
17									17
18									18
19									19
20									20

		LOGGED BY: JE		COMPLETION DEPTH: 11.13 m	
		REVIEWED BY: AM		COMPLETION DATE: 12/12/17	
		PROJECT ENGINEER: Anwar Majid		Page 2 of 2	

PROJECT: Kicking Horse-Monarch Campground Improvements			CLIENT: Parks Canada Agency			TESTHOLE NO: <b>TH17-04</b>		
LOCATION: Water Storage Reservoir N 5,697,249.9 E 539,599.2						PROJECT NO.: 60551150		
CONTRACTOR: Earth Drilling Company Ltd.			METHOD: Solid Stem Auger/ODEX			ELEVATION (m):		
SAMPLE TYPE <input checked="" type="checkbox"/> GRAB <input type="checkbox"/> SHELBY TUBE <input type="checkbox"/> SPLIT SPOON <input type="checkbox"/> BULK <input type="checkbox"/> NO RECOVERY <input type="checkbox"/> CORE								

DEPTH (m)	USC	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	COMMENTS	DEPTH (m)
0	GP	▲▲▲	GRAVEL (Road Surface) - silty, sandy, grey/brown, dry, frozen GRAVEL - silty, sandy, well graded, trace organics near surface, grey/brown, damp, very dense					
1		▲▲▲	- SPT refusal on gravel/cobbles - some sand to sandy, trace silt, brown/grey, dry	×	1	50/ 51mm	>>> - switched to ODEX	1
2		▲▲▲	- SPT refusal on gravel/cobbles	×	2	85/ 76mm	>>>	2
3	GW	▲▲▲	- grey - gravel = 78.0 %, sand = 20.0 %, silt/clay = 2.0 % - soluble sulphate < 0.1 % / 15.2 mg/L, pH = 7.48, resistivity = 6920 ohm-cm, chloride = 42 mg/L / 11.7 mg/kg	■	3			3
4		▲▲▲	- SPT refusal on gravel/cobble/boulder	×	4	50/ 27mm	>>>	4
5		▲▲▲	- SPT refusal on gravel/cobbles	×	5			5
6		▲▲▲	END OF TESTHOLE (4.88 m) - at auger refusal in GRAVEL - Testhole observed to be dry upon completion of drilling	×	6	50/ 0mm	>>>	6
7								7
8								8
9								9
10								10



LOGGED BY: JE  
 REVIEWED BY: AM  
 PROJECT ENGINEER: Anwar Majid

COMPLETION DEPTH: 4.88 m  
 COMPLETION DATE: 12/11/17  
 Page 1 of 1

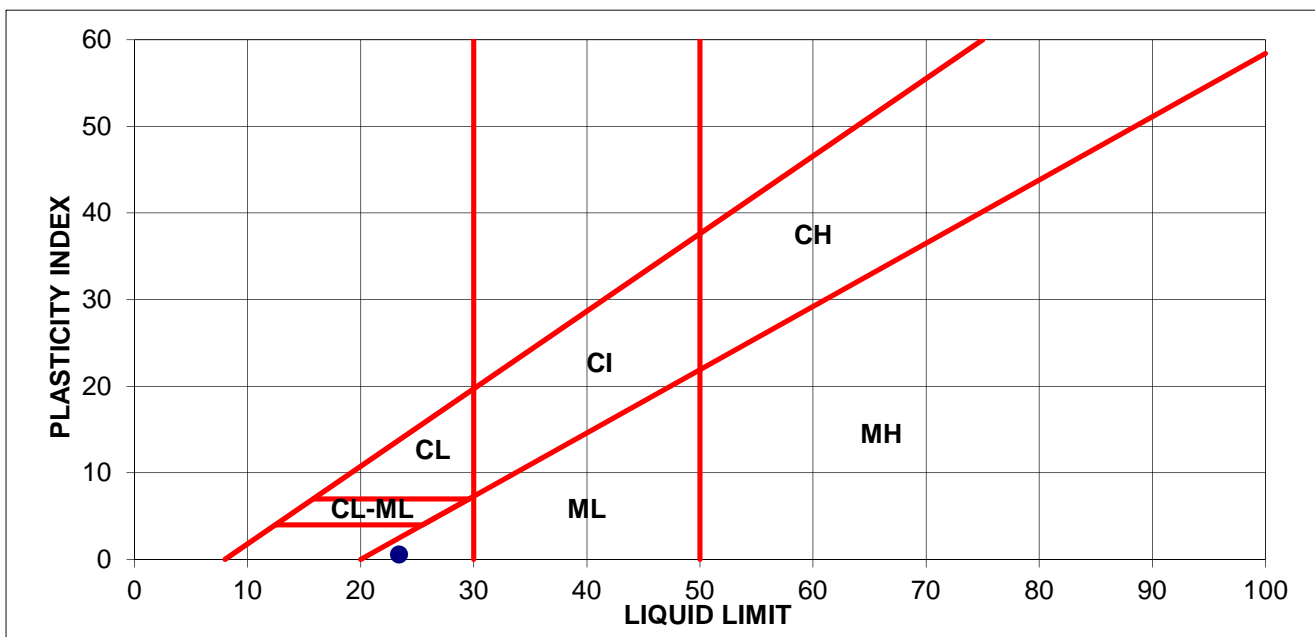
# Appendix **B**

## Laboratory Test Results

# ATTERBERG LIMITS (ASTM D4318)

CLIENT : Parks Canada Agency  
 PROJECT : Kicking Horse and Monarch Campground Improvements  
 JOB No. : 60551150  
 LOCATION :  
 TESTHOLE: 17-01  
 DATE : January 4, 2018  
 SAMPLE: 2  
 DEPTH :  
 TECHNICIAN : CK

LIQUID LIMIT						
Trial No.	1					
Number of Blows	16					
Container Number						
Wt. Sample (wet+tare)(g)	53.93					
Wt. Sample (dry+tare)(g)	45.64					
Wt. Tare (g)	12.04					
Wt. Dry Soil (g)	33.6					
Wt. Water (g)	8.3					
Water Content (%)	24.7%					
AVERAGE VALUES			PLASTIC LIMIT			
Liquid Limit	23.4		Trial No.	1		
Plastic Limit	22.8		Container Number			
Plasticity Index	0.6		Wt. Sample (wet+tare)(g)	37.58		
SAMPLE DESCRIPTION			Wt. Sample (dry+tare)(g)	33.33		
Classification:	ML		Wt. Tare (g)	14.68		
			Wt. Dry Soil (g)	18.7		
			Wt. Water (g)	4.3		
			Water Content (%)	22.8%		



# GRAIN SIZE ANALYSIS (ASTM D422)

CLIENT : Parks Canada Agency  
PROJECT : Kicking Horse and Monarch Campground Improvements  
JOB No. : 60551150  
LOCATION :  
TESTHOLE: 17-01  
DATE : January 8, 2018  
SAMPLE: 2  
DEPTH :  
TECHNICIAN : GU

TOTAL DRY WEIGHT OF SAMPLE	SIEVE NO. (µm)	SIZE OF OPENING		WEIGHT RETAINED (g)	PERCENT RETAINED	PERCENT FINER THAN	REMARKS
		APPROX. INCHES	mm				
<u>Before Washing</u>	150,000	6	150.0		0%	100%	
Wet + Tare	75,000	3	75.0		0%	100%	
Dry+Tare 467.2	50,000	2	50.0		0%	100%	
Tare 100.0	40,000	1 1/2	40.0		0%	100%	
Wt. Dry 367.2	25,000	1	25.0		0%	100%	
<u>Moisture Content</u>	20,000	3/4	20.0		0%	100%	
Wet + Tare	16,000	5/8	16.0	24.8	7%	93.2%	
Dry+Tare	12,500	1/2	12.5	31.9	9%	91.3%	
Tare	10,000	3/8	10.0	31.9	9%	91.3%	
MC (%)	5,000	0.185	5.0	33.9	9%	90.8%	
Passing							
<u>After Washing</u>	2,000	0.0937	2.0	35.1	10%	90.4%	
Wt. Dry+Tare	1,250	0.0469	1.25	35.8	10%	90.3%	
Tare	630	0.0234	0.63	38.4	10%	89.5%	
Wt. Dry	315	0.0116	0.315	41.1	11%	88.8%	
Tare No.	160	0.0059	0.160	56.4	15%	84.7%	
	75	0.00295	0.075	100.9	27%	72.5%	
PAN							
HYDROMETER DATA	READING	TIME (min)	DIAMETER (mm)	TEMP. (°C)	CORR. READING	PERCENT FINER THAN	REMARKS
Wt Dry+Tare 467.2	42	0.5	0.058	20	38	67.2%	
Wt Tare 100.0	37	1	0.043	20	33	58.2%	
Wt Dry 367.2	34	2	0.031	20	30	52.8%	
Sample Size : 50	29	5	0.020	20	25	43.9%	
Wt Retained 2 mm: 35.1	24	15	0.012	20	20	34.9%	
% Passing 2 mm: 90.4%	21	30	0.009	20	17	29.5%	
Specific Gravity : 2.70	19	60	0.006	20	15	26.0%	
Hydrometer No.: 43-9856	15	120	0.005	20	11	18.8%	
Solution (g/L) : 40	12	240	0.003	20	8	13.4%	
	10	1440	0.001	20	6	9.8%	
	9	2880	0.001	20	5	8.1%	

# GRAIN SIZE ANALYSIS (ASTM D422)

CLIENT : Parks Canada Agency  
PROJECT : Kicking Horse and Monarch Campground Improvements  
JOB No. : 60551150  
LOCATION :  
TESTHOLE : 17-01  
DATE : January 8, 2018

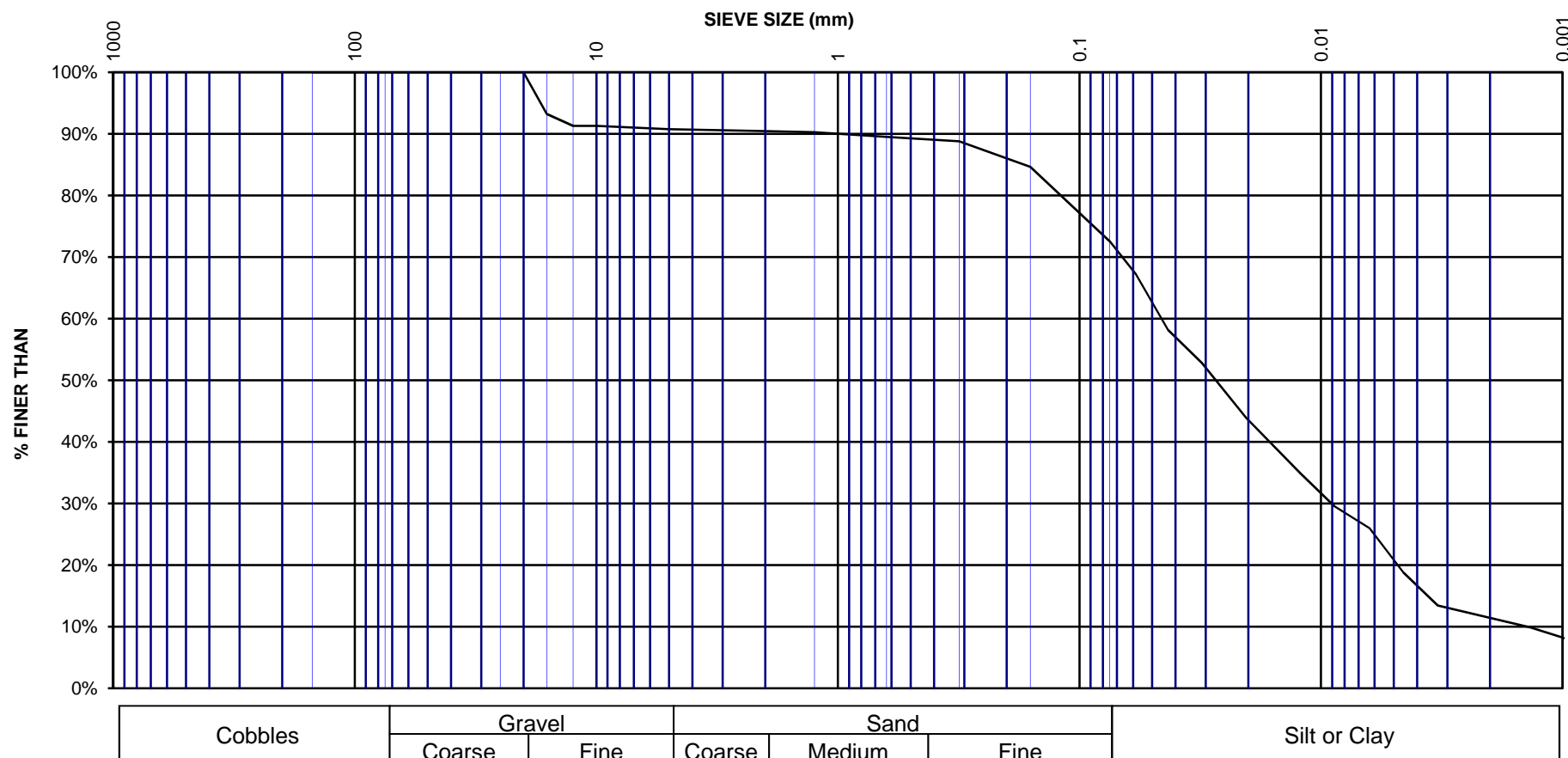
SAMPLE: 2  
DEPTH :  
TECHNICIAN : GU

**Gravel = 9.2%**

**Sand = 18.2%**

**Silt = 61.0%**

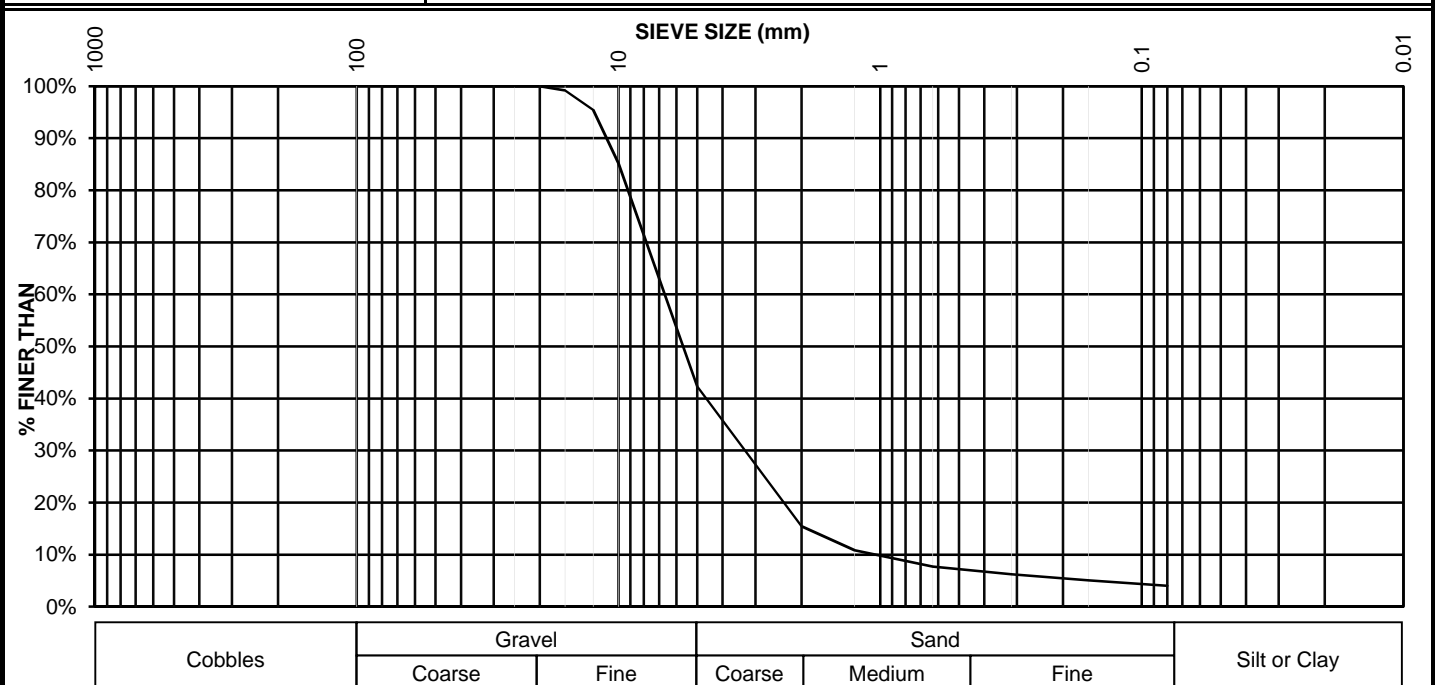
**Clay = 11.6%**



CLIENT :	Parks Canada Agency		
PROJECT :	Kicking Horse and Monarch Campground Improvements		
JOB No. :	60551150	DESIGNATION:	
LOCATION :		SAMPLE:	7
TESTHOLE:	17-01	DEPTH :	
DATE :	10-Jan-18	TECHNICIAN :	GU

TOTAL DRY WEIGHT OF SAMPLE	SIEVE NO. (µm)	SIZE OF OPENING		WEIGHT RETAINED (g)	PERCENT RETAINED	PERCENT FINER THAN	SPECIFICATION	
		APPROX. INCHES	mm				LOWER	UPPER
<u>Before Washing</u>	100000	6	100.0			100%		
Wet + Tare	80000	3	80.0			100%		
Dry+Tare 1018.6	50000	2	50.0			100%		
Tare 256.0	40000	1 1/2	40.0			100%		
Wt. Dry 762.6	25000	1	25.0			100%		
<u>Moisture Content</u>	20000	3/4	20.0			100%		
Wet + Tare	16000	5/8	16.0	6.1	1%	99%		
Dry+Tare	12500	1/2	12.5	34.8	5%	95%		
Tare	10000	3/8	10.0	113.0	15%	85%		
MC (%)	5000	0.185	5.00	440.0	58%	42%		
Passing								
<u>After Washing</u>	2000	0.0937	2.00	644.7	85%	15%		
Wt. Dry+Tare	1250	0.0469	1.25	680.2	89%	11%		
Tare	630	0.0234	0.630	703.7	92%	8%		
Wt. Dry	315	0.0116	0.315	715.4	94%	6%		
Tare No.	160	0.0059	0.160	724.0	95%	5%		
	80	0.0029	0.080	732.0	96%	4%		
	PAN							

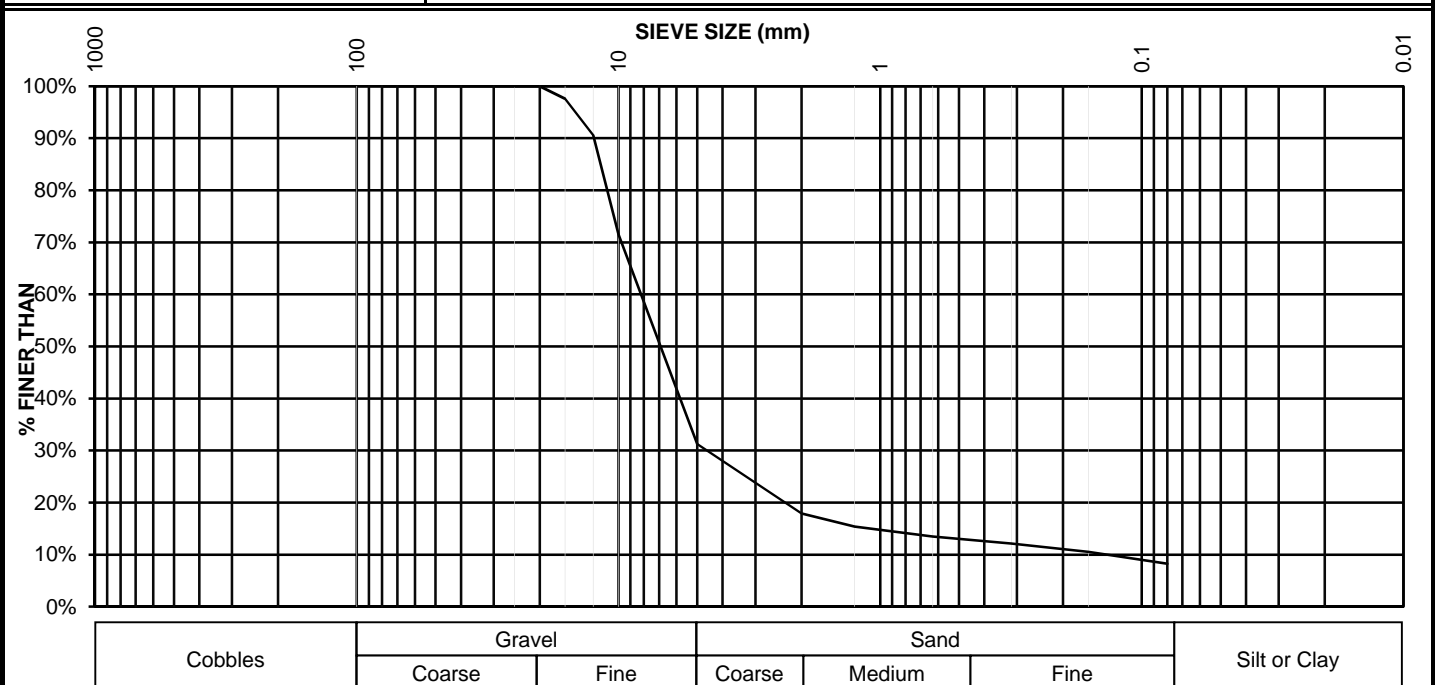
Classification:	GW	Description and Remarks:
Cc	1.7	
Cu	6	



CLIENT :	Parks Canada Agency		
PROJECT :	Kicking Horse and Monarch Campground Improvements		
JOB No. :	60551150	DESIGNATION:	
LOCATION :		SAMPLE:	11
TESTHOLE:	17-01	DEPTH :	
DATE :	10-Jan-18	TECHNICIAN :	GU

TOTAL DRY WEIGHT OF SAMPLE	SIEVE NO. (µm)	SIZE OF OPENING		WEIGHT RETAINED (g)	PERCENT RETAINED	PERCENT FINER THAN	SPECIFICATION	
		APPROX. INCHES	mm				LOWER	UPPER
<u>Before Washing</u>	100000	6	100.0			100%		
Wet + Tare	80000	3	80.0			100%		
Dry+Tare 970.2	50000	2	50.0			100%		
Tare 242.1	40000	1 1/2	40.0			100%		
Wt. Dry 728.1	25000	1	25.0			100%		
<u>Moisture Content</u>	20000	3/4	20.0			100%		
Wet + Tare	16000	5/8	16.0	17.5	2%	98%		
Dry+Tare	12500	1/2	12.5	68.8	9%	91%		
Tare	10000	3/8	10.0	207.3	28%	72%		
MC (%)	5000	0.185	5.00	500.8	69%	31%		
Passing								
<u>After Washing</u>	2000	0.0937	2.00	597.8	82%	18%		
Wt. Dry+Tare	1250	0.0469	1.25	615.9	85%	15%		
Tare	630	0.0234	0.630	629.8	86%	14%		
Wt. Dry	315	0.0116	0.315	639.7	88%	12%		
Tare No.	160	0.0059	0.160	651.4	89%	11%		
	80	0.0029	0.080	667.9	92%	8%		
	PAN							

Classification:	GP-GM	Description and Remarks:
Cc	18.5	
Cu	61	





# GRAIN SIZE ANALYSIS (ASTM D422)

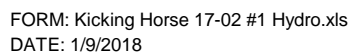
CLIENT : Parks Canada Agency  
PROJECT : Kicking Horse and Monarch Campground Improvements  
JOB No. : 60551150  
LOCATION :  
TESTHOLE: 17-02  
DATE : January 8, 2018  
SAMPLE: 1  
DEPTH :  
TECHNICIAN : GU

TOTAL DRY WEIGHT OF SAMPLE	SIEVE NO. (µm)	SIZE OF OPENING		WEIGHT RETAINED (g)	PERCENT RETAINED	PERCENT FINER THAN	REMARKS
		APPROX. INCHES	mm				
<u>Before Washing</u>	150,000	6	150.0		0%	100%	
Wet + Tare	75,000	3	75.0		0%	100%	
Dry+Tare 406.6	50,000	2	50.0		0%	100%	
Tare 100.0	40,000	1 1/2	40.0		0%	100%	
Wt. Dry 306.6	25,000	1	25.0	27.0	9%	91.2%	
<u>Moisture Content</u>	20,000	3/4	20.0	27.0	9%	91.2%	
Wet + Tare	16,000	5/8	16.0	27.0	9%	91.2%	
Dry+Tare	12,500	1/2	12.5	27.0	9%	91.2%	
Tare	10,000	3/8	10.0	27.0	9%	91.2%	
MC (%)	5,000	0.185	5.0	32.7	11%	89.3%	
Passing							
<u>After Washing</u>	2,000	0.0937	2.0	39.0	13%	87.3%	
Wt. Dry+Tare	1,250	0.0469	1.25	44.4	14%	85.5%	
Tare	630	0.0234	0.63	60.4	20%	80.3%	
Wt. Dry	315	0.0116	0.315	84.0	27%	72.6%	
Tare No.	160	0.0059	0.160	104.3	34%	66.0%	
	75	0.00295	0.075	128.4	42%	58.1%	
PAN							
HYDROMETER DATA	READING	TIME (min)	DIAMETER (mm)	TEMP. (°C)	CORR. READING	PERCENT FINER THAN	REMARKS
Wt Dry+Tare 406.6	37	0.5	0.061	20	33	56.2%	
Wt Tare 100.0	34	1	0.044	20	30	51.0%	
Wt Dry 306.6	31	2	0.032	20	27	45.8%	
Sample Size : 50	27	5	0.021	20	23	38.9%	
Wt Retained 2 mm: 39.0	23	15	0.012	20	19	32.0%	
% Passing 2 mm: 87.3%	20	30	0.009	20	16	26.8%	
Specific Gravity : 2.70	17	60	0.006	20	13	21.6%	
Hydrometer No.: 43-9856	14	120	0.005	20	10	16.4%	
Solution (g/L) : 40	12	240	0.003	20	8	13.0%	
	10	1440	0.001	20	6	9.5%	
	9	2880	0.001	20	5	7.8%	

CLIENT :	Parks Canada Agency
PROJECT :	Kicking Horse and Monarch Campground Improvements
JOB No. :	60551150
LOCATION :	
TESTHOLE:	17-02
DATE :	January 8, 2018

SAMPLE: 1  
DEPTH :  
TECHNICIAN : GU

**Clay = 11.2%**

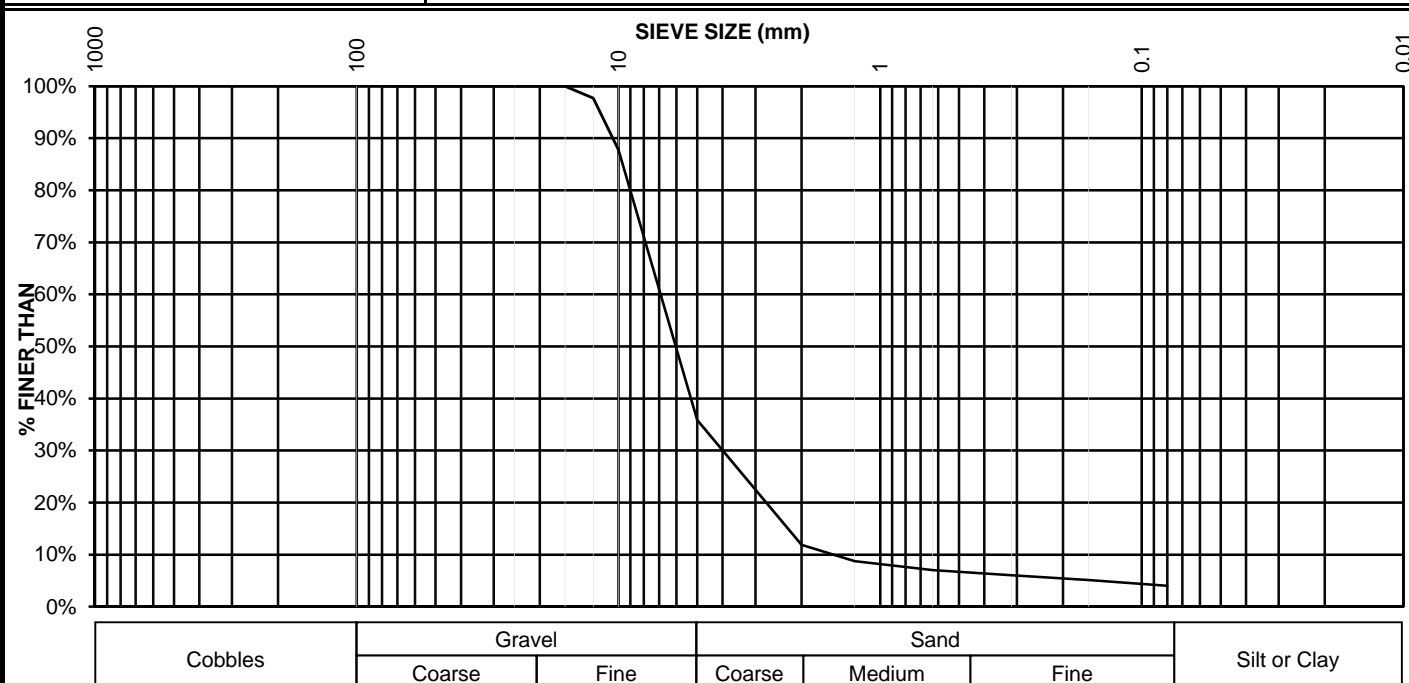


# SIEVE ANALYSIS (ASTM C136)

CLIENT :	Parks Canada Agency		
PROJECT :	Kicking Horse and Monarch Campground Improvements		
JOB No. :	60551150	DESIGNATION:	
LOCATION :		SAMPLE:	7
TESTHOLE:	17-02	DEPTH :	
DATE :	10-Jan-18	TECHNICIAN :	GU

TOTAL DRY WEIGHT OF SAMPLE	SIEVE NO. (µm)	SIZE OF OPENING		WEIGHT RETAINED (g)	PERCENT RETAINED	PERCENT FINER THAN	SPECIFICATION	
		APPROX. INCHES	mm				LOWER	UPPER
Before Washing	100000	6	100.0			100%		
Wet + Tare	80000	3	80.0			100%		
Dry+Tare 982.4	50000	2	50.0			100%		
Tare 335.5	40000	1 1/2	40.0			100%		
Wt. Dry 646.9	25000	1	25.0			100%		
Moisture Content	20000	3/4	20.0			100%		
Wet + Tare	16000	5/8	16.0			100%		
Dry+Tare	12500	1/2	12.5	15.1	2%	98%		
Tare	10000	3/8	10.0	79.5	12%	88%		
MC (%)	5000	0.185	5.00	414.9	64%	36%		
Passing								
After Washing	2000	0.0937	2.00	570.0	88%	12%		
Wt. Dry+Tare	1250	0.0469	1.25	590.4	91%	9%		
Tare	630	0.0234	0.630	601.5	93%	7%		
Wt. Dry	315	0.0116	0.315	607.7	94%	6%		
Tare No.	160	0.0059	0.160	613.9	95%	5%		
	80	0.0029	0.080	621.1	96%	4%		
	PAN							

Classification:	GW	Description and Remarks:
Cc	1.6	
Cu	5	

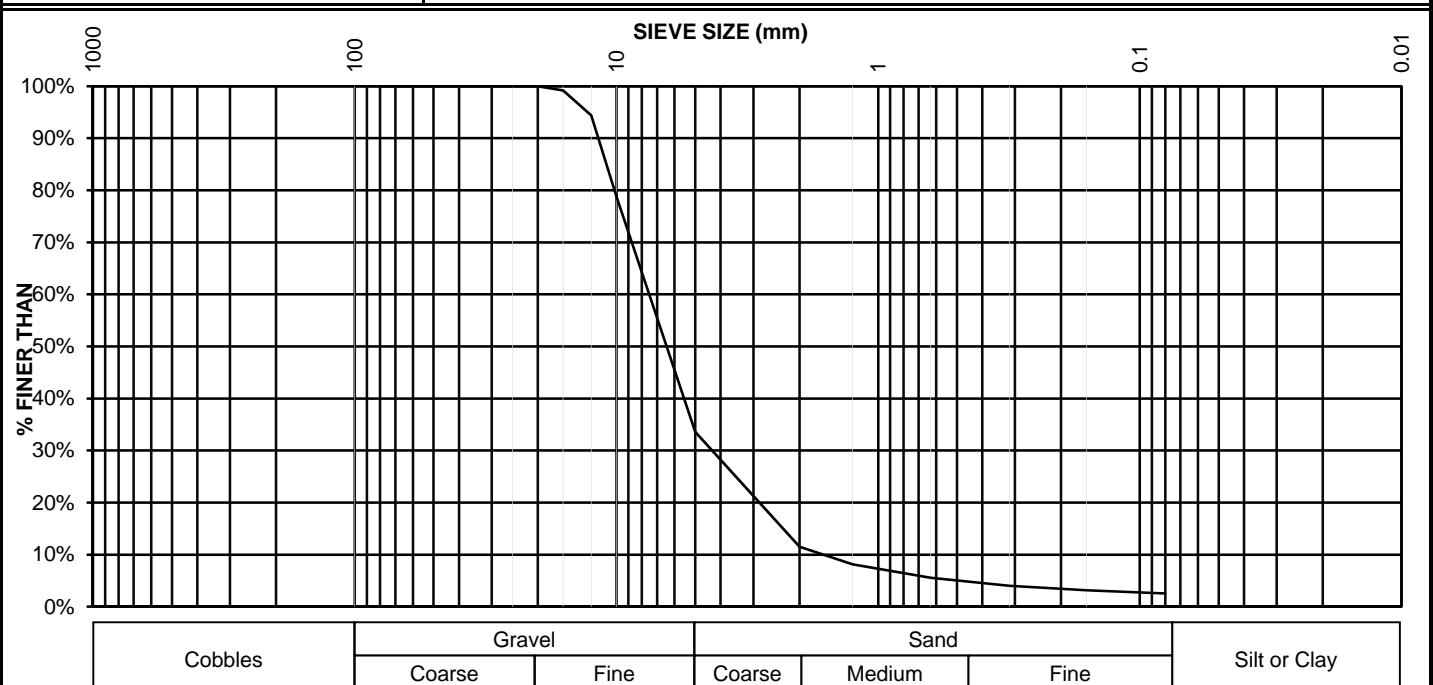


# SIEVE ANALYSIS (ASTM C136)

CLIENT :	Parks Canada Agency		
PROJECT :	Kicking Horse and Monarch Campground Improvements		
JOB No. :	60551150	DESIGNATION:	
LOCATION :		SAMPLE:	3
TESTHOLE:	17-03	DEPTH :	
DATE :	10-Jan-18	TECHNICIAN :	GU

TOTAL DRY WEIGHT OF SAMPLE	SIEVE NO. (µm)	SIZE OF OPENING		WEIGHT RETAINED (g)	PERCENT RETAINED	PERCENT FINER THAN	SPECIFICATION	
		APPROX. INCHES	mm				LOWER	UPPER
Before Washing	100000	6	100.0			100%		
Wet + Tare	80000	3	80.0			100%		
Dry+Tare 938.8	50000	2	50.0			100%		
Tare 264.0	40000	1 1/2	40.0			100%		
Wt. Dry 674.8	25000	1	25.0			100%		
Moisture Content	20000	3/4	20.0			100%		
Wet + Tare	16000	5/8	16.0	5.6	1%	99%		
Dry+Tare	12500	1/2	12.5	38.0	6%	94%		
Tare	10000	3/8	10.0	143.2	21%	79%		
MC (%)	5000	0.185	5.00	448.1	66%	34%		
Passing								
After Washing	2000	0.0937	2.00	597.3	89%	11%		
Wt. Dry+Tare	1250	0.0469	1.25	620.0	92%	8%		
Tare	630	0.0234	0.630	637.3	94%	6%		
Wt. Dry	315	0.0116	0.315	647.9	96%	4%		
Tare No.	160	0.0059	0.160	653.6	97%	3%		
	80	0.0029	0.080	657.8	97%	3%		
	PAN							

Classification:	GW	Description and Remarks:
Cc	1.5	
Cu	5	

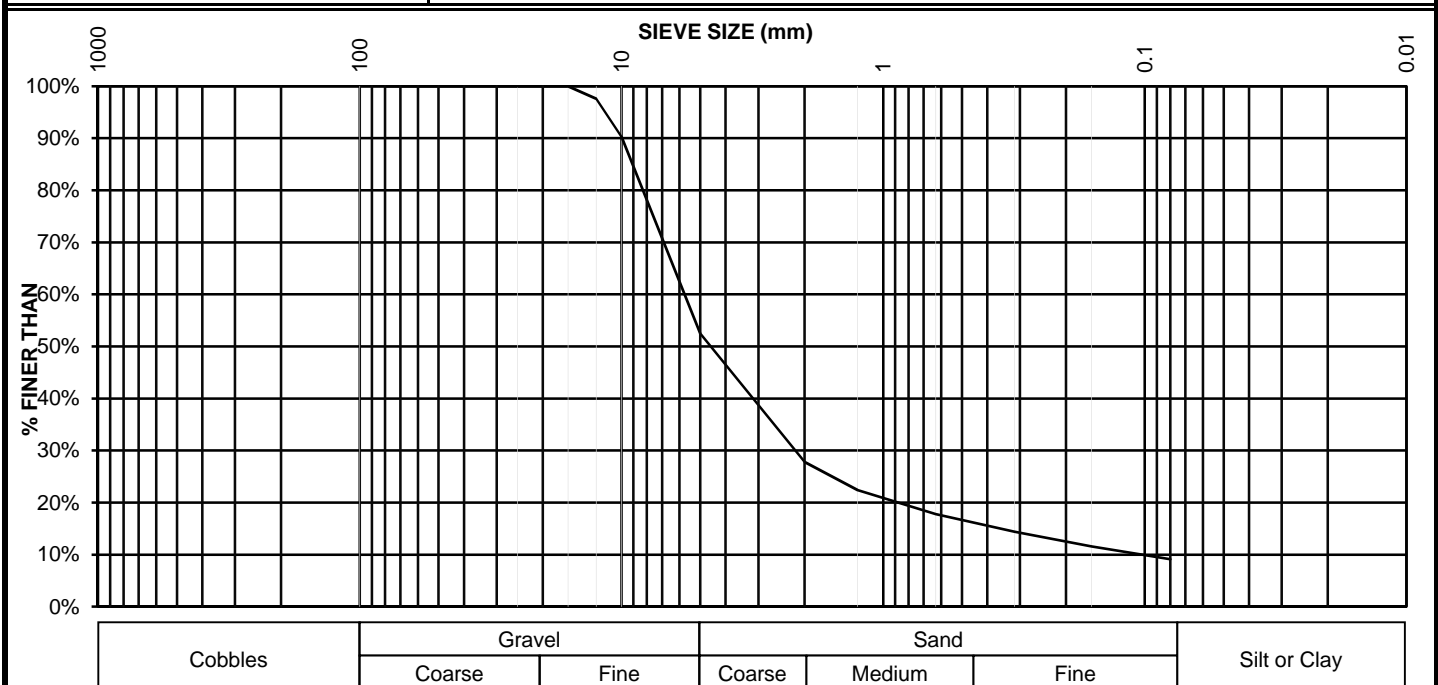


# SIEVE ANALYSIS (ASTM C136)

CLIENT :	Parks Canada Agency		
PROJECT :	Kicking Horse and Monarch Campground Improvements		
JOB No. :	60551150	DESIGNATION:	
LOCATION :		SAMPLE:	11
TESTHOLE:	17-03	DEPTH :	
DATE :	10-Jan-18	TECHNICIAN :	GU

TOTAL DRY WEIGHT OF SAMPLE	SIEVE NO. (µm)	SIZE OF OPENING		WEIGHT RETAINED (g)	PERCENT RETAINED	PERCENT FINER THAN	SPECIFICATION	
		APPROX. INCHES	mm				LOWER	UPPER
Before Washing	100000	6	100.0			100%		
Wet + Tare	80000	3	80.0			100%		
Dry+Tare 1005.2	50000	2	50.0			100%		
Tare 296.3	40000	1 1/2	40.0			100%		
Wt. Dry 708.9	25000	1	25.0			100%		
Moisture Content	20000	3/4	20.0			100%		
Wet + Tare	16000	5/8	16.0			100%		
Dry+Tare	12500	1/2	12.5	17.3	2%	98%		
Tare	10000	3/8	10.0	68.9	10%	90%		
MC (%)	5000	0.185	5.00	337.3	48%	52%		
Passing								
After Washing	2000	0.0937	2.00	512.0	72%	28%		
Wt. Dry+Tare	1250	0.0469	1.25	550.2	78%	22%		
Tare	630	0.0234	0.630	582.8	82%	18%		
Wt. Dry	315	0.0116	0.315	607.0	86%	14%		
Tare No.	160	0.0059	0.160	626.7	88%	12%		
	80	0.0029	0.080	644.2	91%	9%		
	PAN							

Classification:	GP-GM	Description and Remarks:
Cc	7.9	
Cu	55	

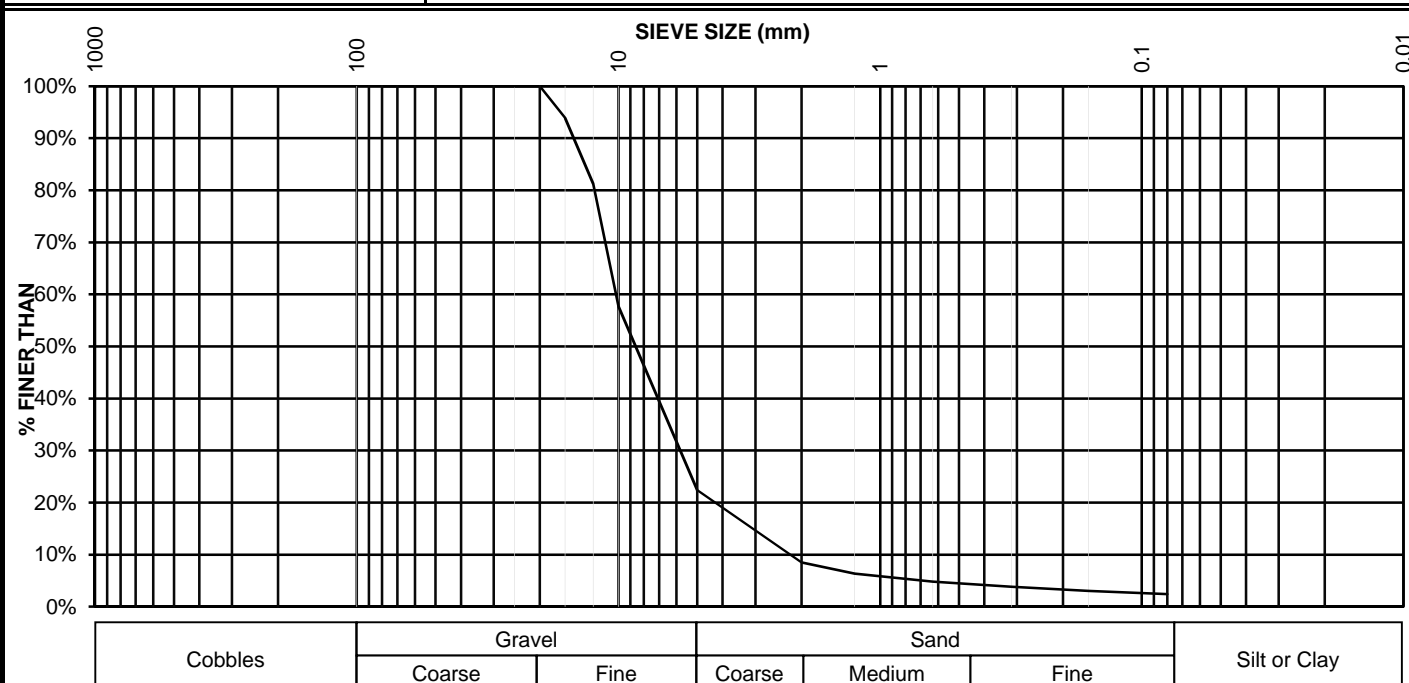


# SIEVE ANALYSIS (ASTM C136)

CLIENT :	Parks Canada Agency		
PROJECT :	Kicking Horse and Monarch Campground Improvements		
JOB No. :	60551150	DESIGNATION:	
LOCATION :		SAMPLE:	3
TESTHOLE:	17-04	DEPTH :	
DATE :	10-Jan-18	TECHNICIAN :	GU

TOTAL DRY WEIGHT OF SAMPLE	SIEVE NO. (µm)	SIZE OF OPENING		WEIGHT RETAINED (g)	PERCENT RETAINED	PERCENT FINER THAN	SPECIFICATION	
		APPROX. INCHES	mm				LOWER	UPPER
Before Washing	100000	6	100.0			100%		
Wet + Tare	80000	3	80.0			100%		
Dry+Tare 895.6	50000	2	50.0			100%		
Tare 238.3	40000	1 1/2	40.0			100%		
Wt. Dry 657.3	25000	1	25.0			100%		
Moisture Content	20000	3/4	20.0			100%		
Wet + Tare	16000	5/8	16.0	40.2	6%	94%		
Dry+Tare	12500	1/2	12.5	123.5	19%	81%		
Tare	10000	3/8	10.0	278.3	42%	58%		
MC (%)	5000	0.185	5.00	510.3	78%	22%		
Passing								
After Washing	2000	0.0937	2.00	601.5	92%	8%		
Wt. Dry+Tare	1250	0.0469	1.25	615.7	94%	6%		
Tare	630	0.0234	0.630	625.7	95%	5%		
Wt. Dry	315	0.0116	0.315	632.1	96%	4%		
Tare No.	160	0.0059	0.160	637.3	97%	3%		
	80	0.0029	0.080	641.3	98%	2%		
	PAN							

Classification:	GW	Description and Remarks:
Cc	1.6	
Cu	4	



# Hazardous Materials Assessments

# B



ALBERTA SAFETY & ENVIRONMENTAL SERVICES

February 14, 2018

Brent Rutten  
AECOM  
200 - 2100 8 Street East  
Saskatoon, Saskatchewan S7H 0V1

Dear Mr. Rutten,

**Re: Hazardous Materials Assessment - REVISED  
Kicking Horse Campground – Shower, Storage, Pumphouse and Kiosk Buildings  
Yoho Valley Road, near Field, British Columbia  
Project #: AS 8674**

## 1.0 INTRODUCTION

Alberta Safety & Environmental Services Ltd. (ASE Services) was requested by Brent Rutten of the AECOM to conduct a hazardous materials assessment of various buildings on the Kicking Horse Campground, located along Yoho Valley Road, near Field, British Columbia. The assessment was performed on January 8 and 9, 2018 by Ailsa Robertson and Cameron Toth with ASE Services.

The purpose of the assessment was to conduct a room-by-room assessment to sample and/or identify building materials that may contain asbestos, paint which may contain lead, as well as to identify the presence of mould growth, water damage and other potential hazardous materials, such as polychlorinated biphenyls (PCBs), mercury, miscellaneous chemicals, radioactive material and ozone-depleting substances (ODS), in relation to the WorkSafe BC Occupational Health and Safety Regulations and industry-accepted guidelines. The results of the assessment have been used to complete a detailed inventory so that hazardous materials will be properly identified for appropriate management by the owners of the buildings prior to demolition or renovation activities.

## 2.0 SCOPE OF WORK

The scope of work involved an assessment of the building environment for the presence of building materials that may contain the following:

- Asbestos;
- Lead paint;
- Mould growth and/or water damage;
- Polychlorinated biphenyls (PCB's);
- Mercury;
- Miscellaneous chemicals;
- Radioactive materials; and
- Ozone-depleting substances (ODS).

The reporting scope of work for the building environment includes:

- Photographs of identified materials;
- Site drawings outlining the location of all identified hazardous materials; and
- Preparation of this report detailing our findings, conclusions and recommendations.



### **3.0 OBSERVATIONS**

At the time of the assessment, ASE Services made the following observations:

- There were four (4) buildings slated for renovation or demolition;
- All buildings were unoccupied;
- All buildings were one story; and
- All buildings had a wood panel exterior.

#### **The Shower Building**

- The floors were unpainted concrete;
- The interior walls were mostly transite paneling with some partial cinderblock and ceramic tile in the shower area;
- The ceiling was wood with an attic space (no vermiculite); and
- The roof had asphalt shingles with tar.

#### **The Storage Building**

- The floors were unpainted plywood;
- The interior walls were wood paneling;
- The ceiling was wood paneling; and
- The roof had asphalt shingles with tar.

#### **The Pumphouse**

- The floors were unpainted concrete;
- The walls were wood paneling;
- The ceiling was wood paneling; and
- The roof had wooden shingles.

#### **The Kiosk**

- The floor was mostly laminate with some linoleum in the doorway;
- The walls were painted wood paneling;
- The ceiling was painted wood paneling; and
- The roof had asphalt shingles with tar.

### **4.0 METHODOLOGY**

The assessment included a room-by-room inspection of all accessible locations as well as an inspection of the exterior of the building. Samples of suspected asbestos-containing materials and suspected lead-containing paints were collected from the interior and exterior of the building. Observations were made for PCBs, mercury, radioactive materials, miscellaneous chemicals, and ozone-depleting substances in the building. The methodology used for each parameter of the hazardous materials survey is outlined below.

#### **4.1 Asbestos-Containing Materials**

Small, representative pieces of those materials suspected to contain asbestos were collected and placed in clear, sealable plastic bags. All samples were forwarded to Crisp Analytical Laboratories, L.L.C. in Carrollton, Texas, for analysis. The samples were analyzed using the EPA 600/R-93/116 analysis method. This is a comprehensive method outlining various techniques for determining the asbestos concentration in bulk building materials.

#### **4.2 Lead-Based Paint**

Small, representative samples of paint suspected to contain lead were collected and forwarded to iATL International Asbestos Testing Laboratories for analysis. The samples are analyzed using the ASTM D3335-85A "Standard Method to Test for Low Concentrations of Lead in Paint by Atomic Absorption Spectrophotometry" analysis method.

#### **4.3 Mould Contaminated and Water Damaged Materials**

The survey included a room-by-room inspection of all accessible locations in the buildings. Tape lift samples were collected to confirm the presence of mould. Mould tape sampling is performed by taking small, representative samples of those materials suspected to contain mould, and then place them on glass slides. All samples were analyzed by certified Bio-Chem Consulting (1980) Ltd. analysts to determine the type or class of mould growth involved. Observations were made for visible mould and water damage.

#### **4.4 Polychlorinated Biphenyls in Fluorescent Light Fixtures**

Building materials were visually assessed for the presence, or potential presence, of PCBs. Common building materials that could contain PCBs are fluorescent light ballasts, electrical transformers, and heat transfer equipment. Ballasts are inaccessible if the light fixture is not de-energized and the power locked out in accordance with the WorkSafe BC Occupational Health and Safety Regulations. Ballasts that were inaccessible at the time of assessment are considered to be PCB-containing until proven otherwise.

#### **4.5 Mercury in Thermostats and Pressure-Sensing Devices**

All thermostats and pressure-sensing devices were visually assessed for the presence of a mercury-containing bulb. All fluorescent light tubes are known to contain mercury dust unless otherwise stated by the manufacturer.

#### **4.6 Miscellaneous Chemicals**

At the time of assessment each room was inspected for miscellaneous chemicals such as paints, lubricants, oils, gasoline, and household and/or commercial cleaning products that may be impacted by demolition and potentially pose an environmental hazard.

#### **4.7 Radioactive Materials**

Ionization chambers in select smoke detectors contain a small amount of radioactive material to sense the presence of airborne particles or smoke. All smoke detectors that were inaccessible at the time of assessment are considered to contain radioactive material until proven otherwise.

#### **4.8 Ozone-Depleting Substances (ODS)**

At the time of assessment each room was visually inspected for equipment such as refrigerators, freezers and air conditioning units that may contain Ozone-Depleting Substances (ODS). Ozone-Depleting Substances contain the following chemical compounds:

- Chlorofluorocarbons (CFCs);
- Halons;
- Hydrochlorofluorocarbons (HCFCs);
- Bromochloromethane;
- Carbon Tetrachloride;
- Methyl Bromide; and
- Methyl Chloroform.

Stamp codes on the equipment indicate the type of chemical used in each piece of equipment. If stamp codes are not visible at the time of assessment the equipment is considered to be ODS-containing until proven otherwise. Please note that even equipment that uses ozone friendly chemicals must be removed, handled and disposed of and/or recycled properly as they could emit greenhouse gases.

## 5.0 RESULTS AND DISCUSSION

### 5.1 Samples Collected for Asbestos Content

Table 1 summarizes the laboratory sample results and provides an indication of the asbestos-containing materials present in the buildings. Results indicate that three (3) samples were positive for asbestos. Please refer to **Appendix II** for photographs, **Appendix III** for sample locations and **Appendix IV** for the laboratory report.

**Table 1: Summary of Asbestos Sample Analysis dated January 16, 2018**

Sample #	Sample Location	Sample Description	Type of Asbestos	Asbestos %	Photograph #
A-1	Shower Building Exterior	White Compound on Wood Panel	None Detected	Not Applicable	Not Applicable
A-2	Shower Building Exterior	Brown Window Caulking	None Detected	Not Applicable	Not Applicable
A-3	<b>Shower Building North West Window of Women's Bathroom</b>	<b>Hard White Caulking</b>	<b>Chrysotile</b>	<b>2</b>	<a href="#"><b>01</b></a>
A-4	Shower Building South Window of Handicap Bathroom	Grey Caulking	None Detected	Not Applicable	Not Applicable
A-5	<b>Shower Building Men's Wall Panel</b>	<b>Transite Panel</b>	<b>Chrysotile</b>	<b>27</b>	<a href="#"><b>02</b></a>
A-6	Shower Building Men's Urinal Base	Grey Scratch Coat	None Detected	Not Applicable	Not Applicable
A-7	Shower Building Electrical Room	DWJC Wall and Ceiling	None Detected	Not Applicable	Not Applicable
A-8	Shower Building Handicap Sink	Blue Countertop	None Detected	Not Applicable	Not Applicable
A-9	Shower Building Roof	Roof Shingle and Tar	None Detected	Not Applicable	Not Applicable
A-10	Pumphouse Boiler	Black Gasket	None Detected	Not Applicable	Not Applicable
A-11	Pumphouse Boiler	Black Expansion Cloth	None Detected	Not Applicable	Not Applicable
A-12	Pumphouse Boiler	Black Rubber Gasket	None Detected	Not Applicable	Not Applicable
A-13	Pumphouse Window	White Window Glazing	None Detected	Not Applicable	Not Applicable

Sample #	Sample Location	Sample Description	Type of Asbestos	Asbestos %	Photograph #
A-14	Kiosk Window	Soft White Putty	None Detected	Not Applicable	Not Applicable
A-15	Kiosk Window	Hard White Caulking	None Detected	Not Applicable	Not Applicable
A-16	Kiosk Window	Soft Beige Caulking	None Detected	Not Applicable	Not Applicable
<b>A-17</b>	<b>Kiosk Floor</b>	<b>White Linoleum</b>	<b>Chrysotile</b>	<b>24</b>	<a href="#"><u>03</u></a>
A-18	Kiosk Roof	Roof Shingle and Tar	None Detected	Not Applicable	Not Applicable

**Notes:**

- **Bolded text indicates that asbestos is present in the sample.**
- Composite sampling is a technique that can improve the temporal or spatial coverage of an area without increasing the sample number.

## 5.2 Paint Samples Collected to Determine Lead Content

Table 2 summarizes the laboratory sample results and provides an indication of the lead-containing paint present in the buildings. Results indicate that eleven (11) samples exceeded the criterion limit of 90 parts per million (ppm), or 0.009 percent by weight<sup>1</sup> and are considered lead-containing. Please refer to **Appendix II** for photographs, **Appendix III** for sample locations and **Appendix IV** for the laboratory report.

**Table 2: Summary of Lead Paint Sample Analysis dated January 17, 2018**

Sample #	Location/	Paint Colour	Lead Content (ppm)	Condition	Photograph #
L-1	<b>Shower Building – Exterior Wooden Walls</b>	<b>Dark Brown with Light Underneath</b>	12000	Poor	<a href="#"><u>04</u></a>
L-2	<b>Shower Building – Wooden Window Frame</b>	<b>Light brown with White Underneath</b>	26000	Fair to Poor	<a href="#"><u>05</u></a>
L-3	<b>Shower Building – Handicap Metal Bathroom Door</b>	Grey	98	Good	<a href="#"><u>06</u></a>
L-4	<b>Shower Building – Roof Trim</b>	Dark Red	33000	Good	<a href="#"><u>07</u></a>
L-5	<b>Shower Building – Metal Stall</b>	<b>White with Green Underneath</b>	10000	Good	<a href="#"><u>08</u></a>

<sup>1</sup> Government of BC. WorkSafe BC. *Lead-Containing Paints and Coatings: Preventing Exposure in the Construction Industry* (2011).

Sample #	Location/	Paint Colour	Lead Content (ppm)	Condition	Photograph #
L-6	Shower Building – Men's Wooden Ceiling	White	<65	Good	Not Applicable
L-7	<b>Shower Building – Exterior SE Wall, Metal Pipe</b>	<b>Yellow</b>	<b>89000</b>	<b>Fair</b>	<a href="#"><u>09</u></a>
L-8	<b>Storage Building – Wooden Interior Wall</b>	<b>White</b>	<b>340</b>	<b>Good</b>	<a href="#"><u>10</u></a>
L-9	<b>Pumphouse – Wooden Trim</b>	<b>White</b>	<b>980</b>	<b>Fair to Poor</b>	<a href="#"><u>11</u></a>
L-10	<b>Pumphouse – Exterior Wood Panelling</b>	<b>Brown</b>	<b>6600</b>	<b>Good</b>	<a href="#"><u>12</u></a>
L-11	<b>Kiosk – Exterior Wood Panel</b>	<b>Dark Brown</b>	<b>1800</b>	<b>Fair</b>	<a href="#"><u>13</u></a>
L-12	Kiosk – Exterior Wood Panel	Chocolate Brown	<66	Fair to Poor	Not Applicable
L-13	<b>Kiosk – Exterior Door and Window Frame</b>	<b>Tan</b>	<b>30000</b>	<b>Poor</b>	<a href="#"><u>14</u></a>
L-14	Kiosk – Wood Panel Ceiling	White	<63	Poor	Not Applicable

### 5.3 Mould Tape Lift Bulk Sampling & Visual Mould Growth & Water Damage Inspection

Table 3 summarizes the laboratory sample results and provides an indication of the mould growth present in the area sampled. Please refer to **Appendix II** for photographs, **Appendix III** for sample locations and **Appendix IV** for the laboratory reports.

**Table 3: Summary of Mould Tape Lift (Bulk) Sample Analysis dated January 11, 2018**

Sample #	Location/Description	Mould Growth Present	Relative Amount of Mould	Photograph #
M-2	<b>Shower Building – Women's Shower Room</b>	<b><i>Penicillium/Aspergillus</i> - like Hyphal Fragments</b> <b>Non-Specified Spore</b> <b><i>Cladosporium</i></b>	<b>Low</b> <b>Very High</b> <b>High</b> <b>Moderate</b>	<a href="#"><u>15</u></a>

Visual mould was observed on the walls, ceiling, and doorframe in the Men's and Women's shower areas of the Shower Building. The tape sample taken from the Women's bathroom confirmed the presence of mould on the doorframe to the shower area.

Water damage was observed on the exterior wood trim of the Pumphouse between the entrance doors.

#### **5.4 Polychlorinated Biphenyls (PCB's) in Fluorescent Light Ballasts**

Fluorescent light fixtures are identified by opening the casing of the light fixtures to visually identify a code stamp on the ballast. In order to safely open the light casing the lighting fixture must be fully de-energized and the power locked out in accordance with WorkSafe BC Occupational Health and Safety Regulations. Ballasts that were inaccessible at the time of assessment are considered to be PCB-containing until proven otherwise.

ASE Services identified approximately fourteen (14) fluorescent light ballasts throughout the shower building (see Photograph [16](#)); one (1) fluorescent light ballast in the storage building (see Photograph [17](#)); and one (1) fluorescent light ballast in the Pumphouse building (see Photograph [18](#)), all potentially containing PCB's.

#### **5.5 Mercury in Thermostats and Pressure-Sensing Devices**

Mercury and other heavy metals pose a danger to human and environmental health when improperly managed. Common sources of mercury include thermometers, light bulbs and tubes, and thermostats. Mercury thermostats are commonly used in residential and commercial office spaces.

ASE Services identified two (2) timers potentially containing a mercury bulb in the shower building at the time of assessment (see Photograph [19](#)). Additionally, ASE Services observed twenty-eight (28) fluorescent light tubes in the shower building, two (2) tubes in the storage building, and two (2) tubes in the pumphouse, all potentially containing mercury dust.

#### **5.6 Miscellaneous Chemicals**

Miscellaneous chemicals, including fertilizer, were observed in the storage building (see Photograph [20](#)).

#### **5.7 Radioactive Materials**

Radioactive materials were not observed in the buildings at the time of the assessment.

#### **5.8 Ozone-Depleting Substances**

Ozone-depleting substances (ODS) are human-made chemicals that contain chlorine, fluorine, bromine, carbon and hydrogen that do not readily degrade after being released into the atmosphere. At the time of assessment, one (1) air conditioning unit potentially containing ODS substances was observed in the Kiosk building (see Photograph [21](#)).

### **6.0 CONCLUSIONS**

Based on the observations and the sampling results, ASE Services makes the following conclusions:

1. Asbestos was determined to be present within the following building materials (see **Appendix III** for locations):
  - The hard, white window caulking on the North West windows of the Women's bathroom in the shower building;
  - The patterned transite panels in the Men's and Women's bathrooms in the shower building; and
  - The white linoleum floor in the doorway of the kiosk.

2. Lead was determined to be present within the following building materials:

**The Shower Building**

- Dark brown (with light brown) painted wood exterior wall panels;
- White painted wood exterior window frame;
- Grey painted metal door to handicap bathroom;
- Dark red painted wood roof trim;
- White (with green) painted metal stall in Men's and Women's bathrooms; and
- Yellow painted metal pipe on the South West Exterior side of the building.

**The Storage Building**

- White painted wood interior walls.

**The Pumphouse**

- White painted wood exterior trim; and
- Brown painted wood exterior wall panels.

**The Kiosk**

- Dark brown painted exterior wood panels; and
- Tan painted exterior wood window frames and trim.

3. Mould growth was determined to be present on all walls and ceiling in the Men's and Women's shower rooms.
4. At the time of the assessment, the light fixture ballast stamp codes were not visually inspected for the presence of PCB's and are therefore assumed positive until proven otherwise.
  - Approximately fourteen (14) fluorescent light ballasts potentially containing PCB's were observed throughout the Shower Building;
  - One (1) fluorescent light ballast, potentially containing PCB's was observed in the Storage Building; and
  - One (1) fluorescent light ballast, potentially containing PCB's was observed in the Pumphouse building.
5. Mercury was assumed present in the following locations:
  - Two (2) timers in the shower building;
  - Twenty-eight (28) fluorescent light tubes in the shower building;
  - Two (2) fluorescent light tubes in the storage building; and
  - Two (2) fluorescent light tubes in the pumphouse.
6. Miscellaneous chemicals, including fertilizer, were observed in the storage building.
7. No radioactive materials were observed at the time of assessment
8. At the time of assessment, one (1) air conditioning unit potentially containing ODS substances was observed in the Kiosk building.

## 7.0 RECOMMENDATIONS

Based on the above conclusions, ASE Services makes the following recommendations:

1. Prior to demolition all asbestos-containing materials that will be impacted must be properly removed and disposed of by a contractor competent in asbestos abatement. All asbestos-containing materials must be removed in accordance with the requirements outlined in the WorkSafe BC *Safe Work Practices for Handling Asbestos Manual* (2012). Please refer to the identified asbestos-containing materials listed in section 6.0.
2. If the identified lead containing paint is to be impacted during the course of any renovation or hand demolition activities, it should be removed and disposed of properly by a contractor competent in lead abatement, prior to any such renovation and or hand demolition. Please note: If the buildings are scheduled for demolition by mechanical means, lead paint in good condition (adhering to surface), does not need to be removed prior to demolition; however lead paint not in good condition (flaking) should be removed by a contractor competent in lead paint abatement.
3. ASE Services recommends that all potential and confirmed mould and water damaged materials, as indicated on the attached floor plans, be properly remediated. All affected areas should be removed a minimum of eighteen (18) inches past any visible mould growth and sprayed with an approved fungal inhibitor. The affected building materials in these areas should be remediated following the appropriate procedures as outlined in the WorkSafe BC Occupational Health and Safety *Mould and Indoor Air Quality Guidelines*.
4. Light fixture ballasts should be inspected for PCB's prior to the fixtures being de-energized and the power being locked out of the building. All light fixture ballasts that are proven to contain PCB's should be manifested and properly disposed of. If the identified thermostats are confirmed to contain mercury dust, they should be manifested and properly disposed of properly.
5. Any fluorescent light tubes and timers containing mercury dust should be manifested and disposed properly disposed of.
6. All miscellaneous chemicals must be properly packaged and labelled according to WHMIS regulations. Miscellaneous chemicals must be removed and properly disposed of prior to any demolition activities where these items will be impacted.
7. No further action is required at this time with regard to radioactive materials.
8. The code stamps of the identified equipment should be inspected to determine if they are ODS-containing. All equipment that is confirmed to contain ODS should be removed and properly disposed of prior to demolition activities. ODS-containing equipment should be manifested and properly disposed of.

Please note: even equipment that uses ozone friendly chemicals must be removed, handled and disposed of and/or recycled properly as they could emit greenhouse gases.

**Please note: Materials that are visually similar to those identified as asbestos- or lead-containing which are observed in locations other than those outlined in this report should be considered to contain asbestos or lead until proven otherwise.**

Any additional materials identified which were not previously sampled or visually assessed should be assumed as hazardous unless proven otherwise.



## 8.0 WARRANTY

This report is intended for the exclusive use of the company, organization, or individual to whom it is addressed. It may not be used or relied upon in any manner whatsoever, or for any purpose whatsoever, by any other person. ASE Services makes no representation of fact or opinion of any nature whatsoever to any person other than the company, organization, or individual to whom this report is addressed. The warranty stated above may not be assigned.

If you have any questions or require any additional information, please feel free to contact our project management team at (403) 475-0963.

Sincerely,

Alberta Safety & Environmental Services Ltd.

Reviewed by:



Grace-Ann Palmer, B.Sc.  
Project Manager

Drafted by:

Ailsa Robertson, B.Sc., EPt, Environmental Safety Consultant

### Attachments:

- Appendix I: Regulations and Guidelines
- Appendix II: Photographs
- Appendix III: Floor Plans
- Appendix IV: Laboratory Reports

**APPENDIX I**  
**REGULATIONS AND GUIDELINES**

## **Asbestos Containing Materials**

### Excerpt from WorkSafe BC Occupational Health and Safety Guidelines Part 6: Substance Specific Requirements – Asbestos

#### Definitions:

"asbestos-containing material" means the following:

(a) a manufactured article or other material, other than vermiculite insulation, that would be determined to contain at least 0.5% asbestos if tested in accordance with one of the following methods:

(i) Asbestos, Chrysotile by XRD, Method 9000 (Issue 2, dated August 15, 1994) in the NIOSH Manual of Analytical Methods, published by the United States National Institute for Occupational Safety and Health, Centers for Disease Control and Prevention;

(ii) Asbestos (bulk) by PLM, Method 9002 (Issue 2, dated August 15, 1994) in the NIOSH Manual of Analytical Methods, published by the United States National Institute for Occupational Safety and Health, Centers for Disease Control and Prevention;

(iii) Test Method for the Determination of Asbestos in Bulk Building Materials (EPA/600/R-93/116, dated July 1993) published by the United States Environmental Protection Agency;

(b) vermiculite insulation that would be determined to contain any asbestos if tested in accordance with the Research Method for Sampling and Analysis of Fibrous Amphibole in Vermiculite Attic Insulation (EPA/600/R-04/004, dated January 2004) published by the United States Environmental Protection Agency;

"low risk work activity" means a work activity that involves working with or in proximity to asbestos-containing material if, at the time the work activity is being carried out, both of the following apply:

(a) the asbestos-containing material is not being

(i) cut, sanded, drilled, broken, ground down or otherwise fragmented, or

(ii) disturbed such that the asbestos-containing material may release airborne asbestos fibre;

(b) it is not necessary to use personal protective equipment or engineering controls in respect of that activity to prevent exposure of a worker to airborne asbestos fibre;

#### Monitoring

6.12

(1) Repealed. [B.C. Reg. 312/2003, App. D, s. 4 (a).]

(2) During a high risk work activity, except where glove bags are used as the containment, the employer must sample for airborne asbestos fibre in

(a) areas outside of the containment but in its vicinity, at least daily if there are unprotected workers in the area,

(b) the clean room, at least daily during removal and cleanup operations, and

(c) contaminated areas inside the containment, as necessary during removal and cleanup to ensure that workers are adequately protected.

(3) The employer must make the results of all air samples taken during a high risk work activity available to the workers involved, within 24 hours of completing the collection of the samples.

(4) Except where glove bags are used as the containment, prior to dismantling a containment used in a high risk work activity and after all asbestos waste has been cleaned up, removed or otherwise controlled, the employer must ensure that

(a) clearance air sampling is conducted in previously contaminated areas inside the containment, and

(b) the airborne asbestos fibre levels in these areas do not exceed 0.02 f/cc.

[am. B.C. Regs. 312/2003, App. D, s. 4; 188/2011, App. B, s. 8.]

High risk work

6.16

(1) For high risk work activity the employer must provide and maintain a containment and a decontamination facility, except that a decontamination facility is not required if the containment is a glove bag.

(2) The employer must inspect a containment and a decontamination facility used for high risk work activity at least daily to ensure their effectiveness is maintained.

(3) The employer must ensure that the design of the decontamination facility includes

(a) a physical connection to the containment,

b) a shower facility, and

(c) provision for the safe entry and exit of workers.

(4) If the high risk work activity involves encapsulation of asbestos-containing material, the employer must ensure that the encapsulant penetrates the material and effectively binds the asbestos fibres together, and has not disturbed the bonding of the material to the supporting surface.

(5) At the completion of a high risk work activity and before dismantling the containment, the employer must

(a) visually inspect the area inside the containment to ensure that an effective cleanup has been completed, and

(b) treat all exposed surfaces inside the containment with a sealant to bind any remaining asbestos fibres and prevent them from becoming airborne.

[am. B.C. Reg. 188/2011, App. B, s. 8.]

#### From WorkSafeBC's "Asbestos Safe Work Procedures"

Occupational Exposure Limit – 0.1 fibres/mL.

Low Risk Work Activities:

Working with or in proximity to ACM, if the material is not being:

-cut, sanded, drilled, or otherwise fragmented

-disturbed such that fibers may be released

\*\*In other words, classified as low-risk if PPE and engineering controls are not needed to prevent worker exposure to airborne fibres.

#### Examples:

-Disturbing materials that contain less than 0.5% asbestos, provided that dust controls are in place.

-Repairs to drywall with asbestos-containing joint compound; provided that the mud itself is not disturbed

-Replacing a single asbestos-containing floor tile without breaking the tile

-Removing asbestos-containing waste material, contained within a clean, properly sealed bag

**Moderate Risk Work Activities:**

Work, other than that classified as high risk, that involve working with or in proximity to ACM that is being cut, sanded, or otherwise fragmented or disturbed. PPE and engineering controls are required to prevent worker exposure to airborne fibers.

**Examples:**

- Using hand tools to cut, shape, grind, remove etc. non-friable ACM's, such as cement pipe
- Impacting products as described above with a power tool, provided that the tool is equipped with a HEPA-filtered local exhaust ventilation (LEV) system.
- Removing asbestos tape or paper on ductwork
- Removing vinyl floor tile
- “Wrap and cut” removal
- Glove bagging
- See WorkSafeBC’s “Asbestos Safe Work Procedures” for more examples.

**Work Procedures**

- mark work area with barricades/fences, signage warning not to enter unless authorized
- poly drop sheets
- respirator with P100 filter
- Tyvek suit over street clothes, with head and foot coverings (laceless rubber boots or booties acceptable if site conditions permit)

#### Bulk material sample collection guide

Type of material	Area of homogeneous material*	Minimum number of bulk samples to be collected**
Surfacing materials, including textured coatings, drywall mud, plasters, and stucco	Less than 90 m <sup>2</sup> (approximately 1,000 ft <sup>2</sup> )	At least 3 samples of each type of surfacing material
	Between 90 and 450 m <sup>2</sup> (approximately 5,000 ft <sup>2</sup> )	At least 5 samples of each type of surfacing material
	Greater than 450 m <sup>2</sup>	At least 7 samples of each type of surfacing material
Sprayed insulation and blown-in insulation, including sprayed fireproofing and vermiculite insulation (including vermiculite insulation within concrete masonry units, or CMUs)	Less than 90 m <sup>2</sup> (approximately 1,000 ft <sup>2</sup> )	At least 3 samples
	Between 90 and 450 m <sup>2</sup> (approximately 5,000 ft <sup>2</sup> )	At least 5 samples
	Greater than 450 m <sup>2</sup>	At least 7 samples
Flooring, including vinyl sheet flooring (and backing) and floor tiles	Any size	At least 1 sample per flooring type in each room (and 1 from each layer of flooring)
Mechanical insulation, including duct taping, pipe insulation, elbows and boiler/tank insulation	Any size	At least 3 samples
Mastics and putties, including duct mastic (around penetrations) and window putty	Any size	At least 3 samples
Roofing materials, including felting and shingles	Less than 90 m <sup>2</sup> (approximately 1,000 ft <sup>2</sup> )	At least 1 sample (each layer of material must be sampled)
	Between 90 and 450 m <sup>2</sup> (approximately 5,000 ft <sup>2</sup> )	At least 2 samples (each layer of material must be sampled)
	Greater than 450 m <sup>2</sup>	At least 3 samples (each layer of material must be sampled)
Asbestos cement (transite) board and pipe	Any size	At least 1 sample
Other materials	Any size	At least 1 sample per type of material

\* Homogeneous material is considered uniform in texture and appearance, was installed at one time, and is likely to be of only one type of material or formulation.

\*\* If the material is assumed to contain asbestos, samples do not have to be collected. The professional judgment of a qualified person can be used to reduce the number of bulk samples of homogeneous materials. If fewer samples than the minimum recommended number are collected, surveyors should document the rationale for their position in the survey report.

#### High Risk Work Activities

Work with or in proximity to ACM that requires a high level of control (ex. containment and PAPR) to prevent worker exposure to airborne fibers.

##### Examples:

- Removing asbestos-containing textured materials from ceilings or walls
- Removal of vermiculite insulation
- Dismantling, repairing or altering a boiler, furnace or kiln on which asbestos-containing insulating materials have been applied.
- Using power tools to cut or drill ACM
- See WorkSafeBC's "Asbestos Safe Work Procedures" for more examples.

##### Work Procedures:

- Same as Alberta's high risk.

#### Air Monitoring

Moderate Risk – Occupationals, Outside Work Areas, Field Blanks.

\*Air clearances not required, but may be asked for depending on the work area, ex. a school or hospital.

High Risk – Occupationals, OWA, Clean Room, Field Blanks, Air Clearances. Following air clearance, workers must use moderate risk work procedures when taking down the containment.

\*Air Clearance Requirements – must be less than 0.02 fibers/mL. Must have at least 2,000 L, and 1 sample per 270m<sup>3</sup>, if the containment is smaller than 270m<sup>3</sup> then do at least two samples.

\*Inspections for High Risk – daily during work, final before glue out.

Asbestos Clearance Document: along with what we already put in our clearance documents, should also include

- Reference to hazardous materials survey (name of company or surveyor and date it was completed)
- NOP number
- Waste manifest documentation

### **Lead Based Paint**

Some paints used before 1950 contained as much as fifty percent lead by weight. Lead was often used as a pigment in white and pastel shades. Lead made paint dry faster, last longer and gave the colours a more vibrant look. In the 1950s the amount of lead used in paint decreased as other pigments were substituted. In 1976, federal regulations limited the level of lead in paint to 0.5 percent by weight. In 2009 they were limited the level of lead in paint again to 0.009 percent by weight. Exterior paints could still contain more lead. The yellow markings found on highways still use lead-based paint. By 1991, Canadian paint manufacturers had voluntarily stopped using lead altogether. Currently, paint considered to be lead containing are those with a content of 90 ppm (0.009%) or greater<sup>2</sup>.

Lead-based paint does not pose a danger if it is in good condition, and is not disturbed. However, if the paint is peeling or flaking, a potentially harmful situation exists. Even friction from opening and closing doors or windows with painted frames can produce paint dust. This dust can get onto children's hands and toys, and from there, into their mouths. Paint chips can easily be swallowed by young children. Ledges and trim that are accessible to teething toddlers should also be cause for concern.<sup>3</sup>

The requirements for lead can be found within the Occupational Health and Safety Regulation. Part 4 of the Occupational Health and Safety Code sets limits for exposure to Chemical Hazards, Biological Hazards and Harmful Substances. Part 4 of the Code (Sections 16 through 27) outlines the General Requirements for employers to ensure worker exposure to a harmful substance is kept as low as reasonably practicable. In summary, the general requirements portion addresses the following:

1. worker exposure to harmful substances;
2. worker exposure during shifts greater than 8-hours;
3. airborne concentration measurements;
4. potential worker exposure;

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<sup>2</sup> Government of BC. WorkSafe BC. *Lead-Containing Paints and Coatings: Preventing Exposure in the Construction Industry* (2011).

<sup>3</sup> Ibid.

5. worker overexposure;
6. worker decontamination;
7. emergency bath, showers, eye wash equipment;
8. prohibited activities;
9. codes of practice; and
10. storage of harmful substances.

Sections 41 through 43 outline the employer's requirements for lead at the work site. With respect to the Code it primarily applies to managing worker exposure to lead. Lead-based paint should be removed following very specific guidelines according to industry-accepted practices, as well as the Alberta Occupational Health and Safety Act, Regulations and adopted Code.

### **Polychlorinated Biphenyls**

PCBs are human-produced chemicals. They do not occur naturally. They are made by attaching chlorine molecules to a biphenyl molecule. There are 209 possible PCB compounds. All PCBs are heavy, colourless oils or resinous solids. They are very stable since they do not react with other chemicals. They have a high boiling point and do not conduct electricity. They are not soluble in water.

Polychlorinated biphenyls are no longer manufactured in North America. They are still found in older electrical transformers and capacitors, heat transfer equipment, and electro-magnets. However, when this equipment is serviced, other fluids replace the PCBs. PCBs or PCB-contaminated materials must be disposed of appropriately.

Storage sites are licensed and inspected regularly by provincial government inspectors. The owner or producer of the PCBs, or PCB-contaminated material, is responsible for their proper disposal or storage. The Waste Control Regulation under the Environmental Protection and Enhancement Act outlines the requirements for storage of PCB-containing materials not in use and their disposal. Once fluorescent light ballasts are not in service then they must be stored or disposed of in accordance with the Waste Control Regulation.

### **Mercury**

Mercury (Hg) is a very dense metal that expands and retracts evenly with changes in the temperature. Mercury exhibits super conductivity, which is the ability to conduct electrical currents with no resistance, and is the only metal that exists as a liquid at room temperature.

Mercury is released into the air, water and land, and it cycles between them due to its ability to change form with temperature. Mercury gets into the soil through natural breakdown of rocks, the disposal of mercury in landfills, and atmospheric deposition. It enters the water through runoff, atmospheric deposition, and when products containing mercury are poured down the drain. Mercury is released to the atmosphere through coal-fired utility, chlor-alkali plants, and incinerator emissions, as well as evaporation from water and land. Once mercury enters this cycle, it can remain in the environment for years as it accumulates. Mercury cannot be removed, but it can be prevented from ever entering the environment.

### **Miscellaneous Chemicals**

Miscellaneous chemicals may require special handling procedures as outlined under the Occupational Health and Safety Act and Environmental Protection and Enhancement Act. For the purpose of this survey miscellaneous chemicals included materials that had labeling or



packaging that falls under the Hazardous Product Act (Workplace Hazardous Materials Information System (WHMIS)) or Transportation of Dangerous Goods Act.

### **Ozone-depleting Substances**

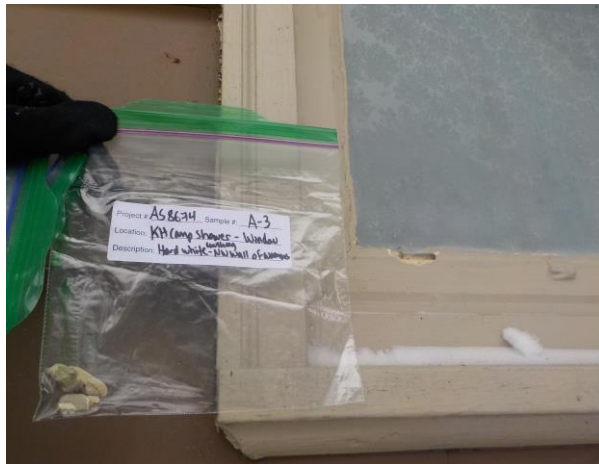
In September of 1993, Alberta enacted the *Ozone-Depleting Substances and Halocarbons Regulation* (AR 181/2000), which governs the use, handling and release of CFCs, HCFCs and halons and other ozone-depleting substances. Provincial regulations require all persons servicing air conditioning or refrigeration equipment to be certified in accordance with the Apprenticeship and Industries Training Act and the associated regulations.

Canada banned chlorinated fluorocarbons as a propellant in aerosol cans in the 1980s, reducing their direct release into the atmosphere. As of January 1, 1996, no CFCs may be produced or imported into Canada.

Hydrochlorofluorocarbons (HCFCs) are chemical compounds related to CFCs and about 95 percent less damaging to the ozone layer. They are mainly used as a refrigerant in domestic air conditioning systems and in manufacturing plastic, insulation and packaging. Because HCFCs do contribute to ozone depletion, Canada is phasing out the production and use of HCFCs between the years 2010-2020. Therefore, HCFCs should only be used as a short-term alternative for replacing CFCs.

Most household refrigerators contain a chlorofluorocarbon refrigerant, sometimes called CFC-12 or R-12. While units manufactured prior to 1993 can contain CFCs or HCFCs, new refrigerators manufactured after 1993 can contain an alternate refrigerant with lower or nonexistent ozone-depleting potential. Alternate refrigerants are continuously being developed. Labels attached to all household units should list the refrigerant being used.

**APPENDIX II**  
**PHOTOGRAPHS**



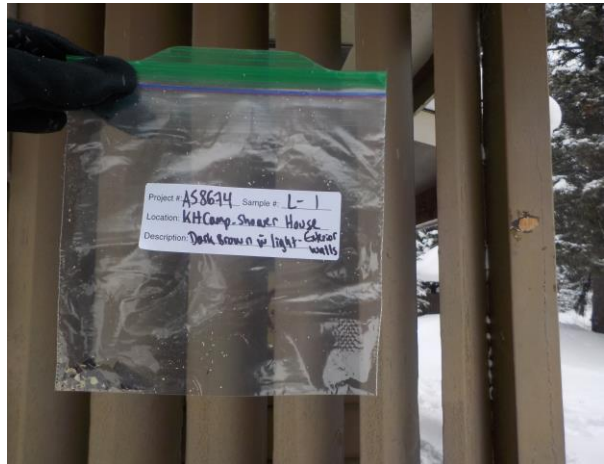
**Photograph 01:** Sample A-3 - Asbestos-Containing Hard White Caulking from the Exterior North West Windows of the Women's Bathroom in the Shower Building.



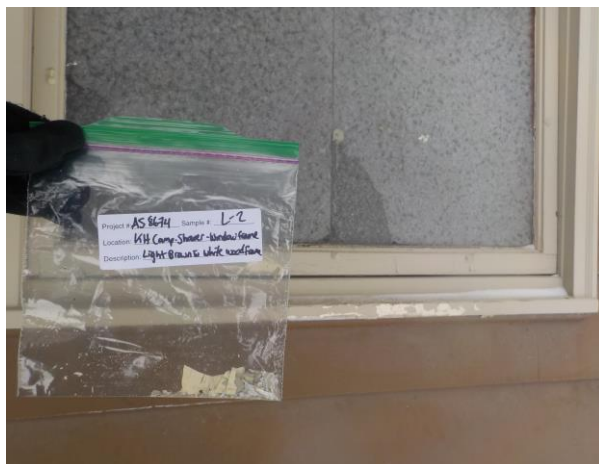
**Photograph 02:** Sample A-5 – Asbestos Containing Speckled Transite Wall Panel in the Men's and Women's Sections of the Shower Building.



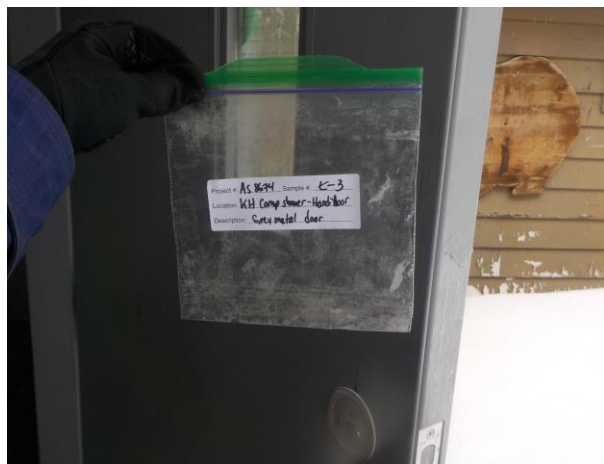
**Photograph 03:** Sample A-17 – Asbestos Containing White Linoleum Floor in the Kiosk Doorway.



**Photograph 04:** Sample L-1 – Lead Containing Dark Brown with Light Brown Paint on the Exterior Walls of the Shower Building.



**Photograph 05:** Sample L-2 – Light Brown with White Paint on the Window Frame of the Shower Building.



**Photograph 06:** Sample L-3 - Grey Paint on Metal Door of Handicap Bathroom in the Shower Building.



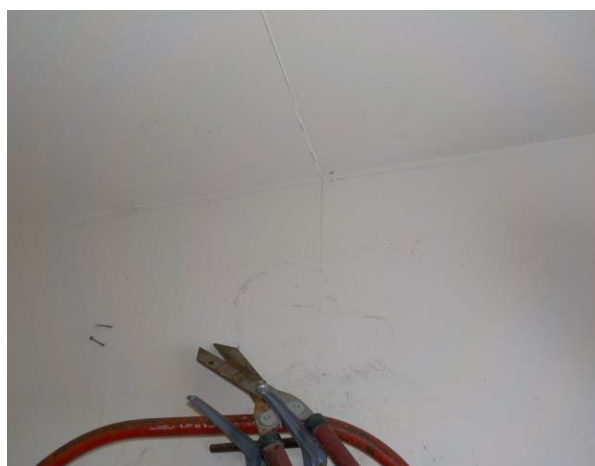
**Photograph 07:** Sample L-4 – Dark Red Painted Roof Trim on the Shower Building.



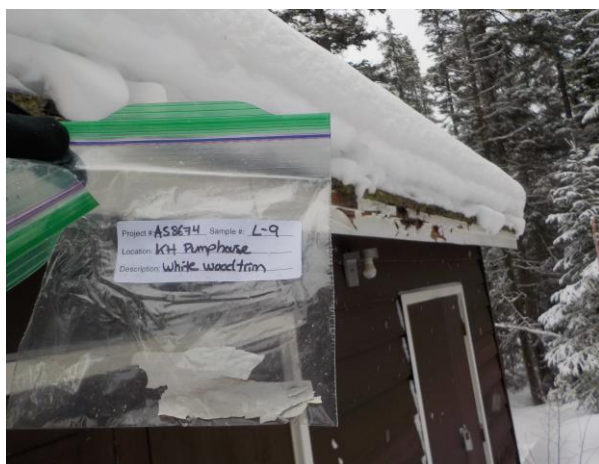
**Photograph 08:** Sample L-5 – White with Green Painted Metal Stall in the Shower Building.



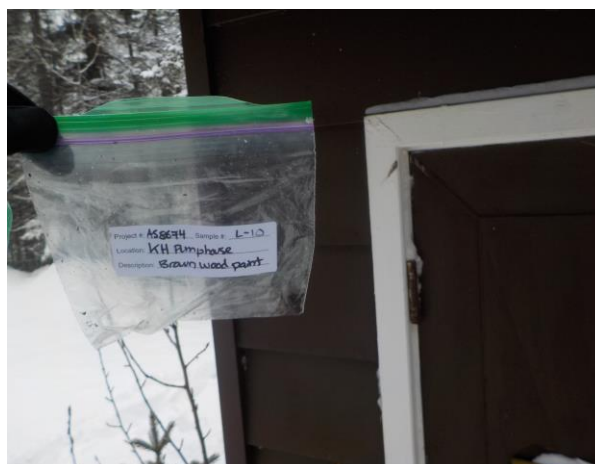
**Photograph 09:** Sample L-7 – Yellow Painted Metal Pipe on the South East Exterior Side of the Shower Building.



**Photograph 10:** Sample L-8 – White Painted Wood Interior Wall of the Storage Room.



**Photograph 11:** Sample L-9 – White Painted Wood Trim on the Pumphouse.



**Photograph 12:** Sample L-10 – Brown Painted Wood Panels on the Exterior of the Pumphouse.





**Photograph 13:** Sample L-11 – Dark Brown Painted Wood Panels on the Exterior of the Kiosk.



**Photograph 14:** Sample L-13 – Tan Painted Wood Trim on the Exterior of the Kiosk.



**Photograph 15:** Sample M-2 – Mould Tape Sample Collected from the Women's Bathroom Doorframe in the Shower Building.



**Photograph 16:** Fluorescent Light Ballasts Potentially Containing PCB's and Fluorescent Light Tubes Potentially Containing Mercury Dust in the Shower Building.



**Photograph 17:** Fluorescent Light Ballasts Potentially Containing PCB's and Fluorescent Light Tubes Potentially Containing Mercury Dust in the Storage Building.



**Photograph 18:** Fluorescent Light Ballasts Potentially Containing PCB's and Fluorescent Light Tubes Potentially Containing Mercury Dust in the Pump House.



**Photograph 19:** Timer Potentially Containing Mercury Dust in the Shower Building

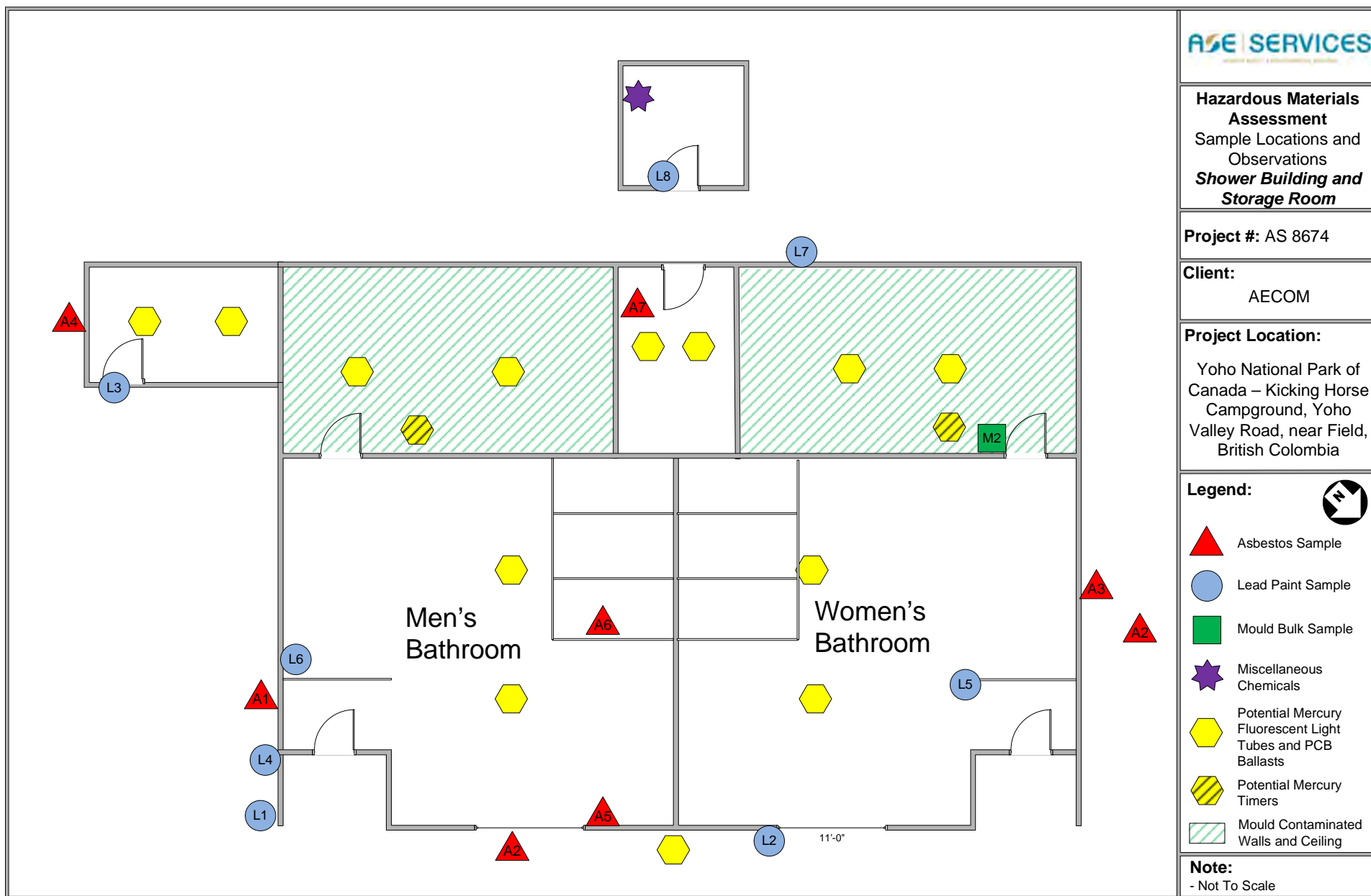


**Photograph 20:** Miscellaneous Chemicals in the Storage Building



**Photograph 21:** Air Conditioner with Ozone-Depleting Substances in the Kiosk.

**APPENDIX III**  
**FLOOR PLANS**



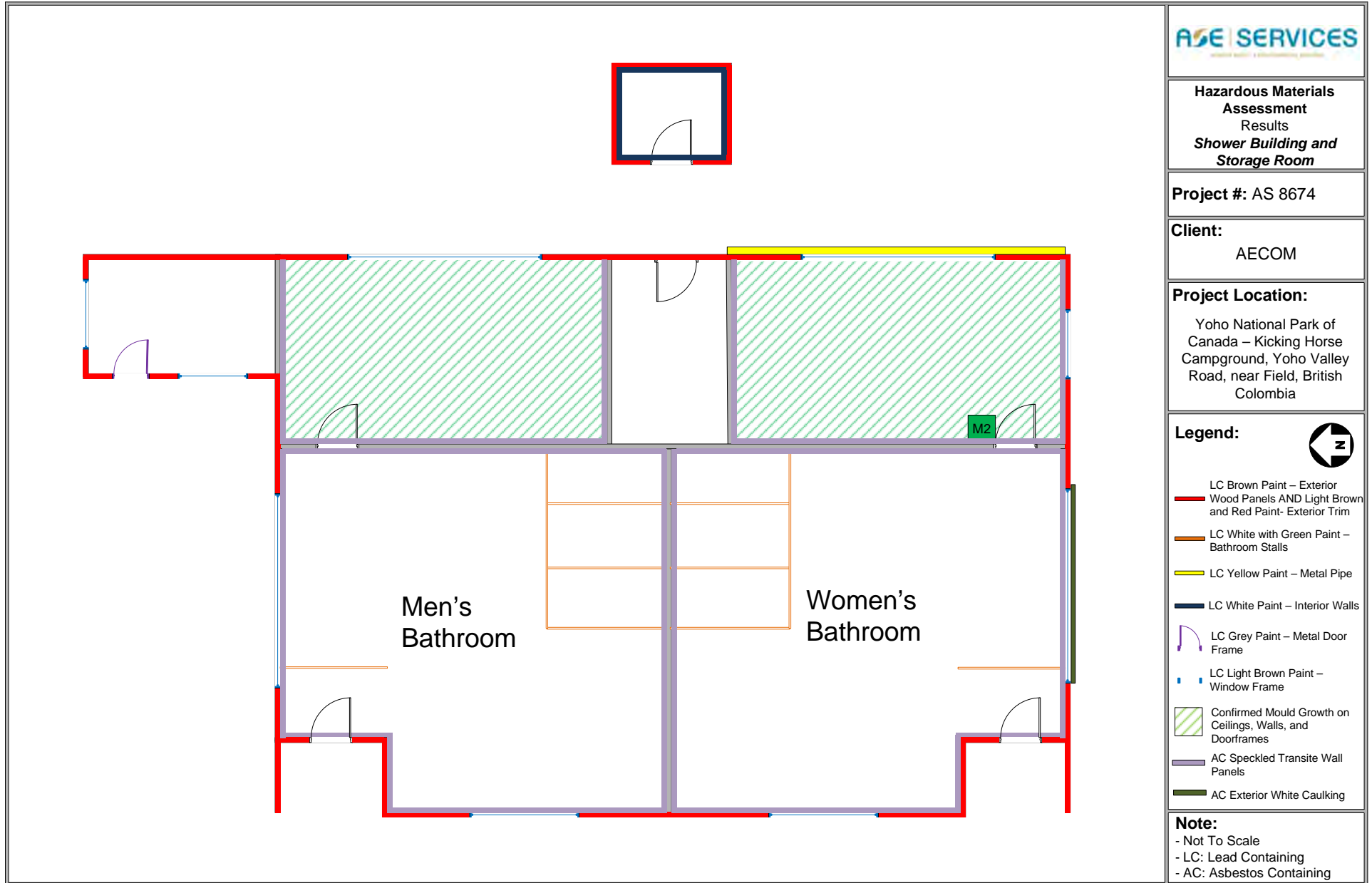
**Hazardous Materials Assessment**  
Sample Locations and Observations  
**Shower Building and Storage Room**

**Project #:** AS 8674

**Client:**  
AECOM

**Project Location:**  
Yoho National Park of Canada – Kicking Horse Campground, Yoho Valley Road, near Field, British Columbia





**Hazardous Materials Assessment**  
 Sample Locations and Observations  
**Pumphouse**







**Project #:** AS 8674

**Client:**  
 AECOM

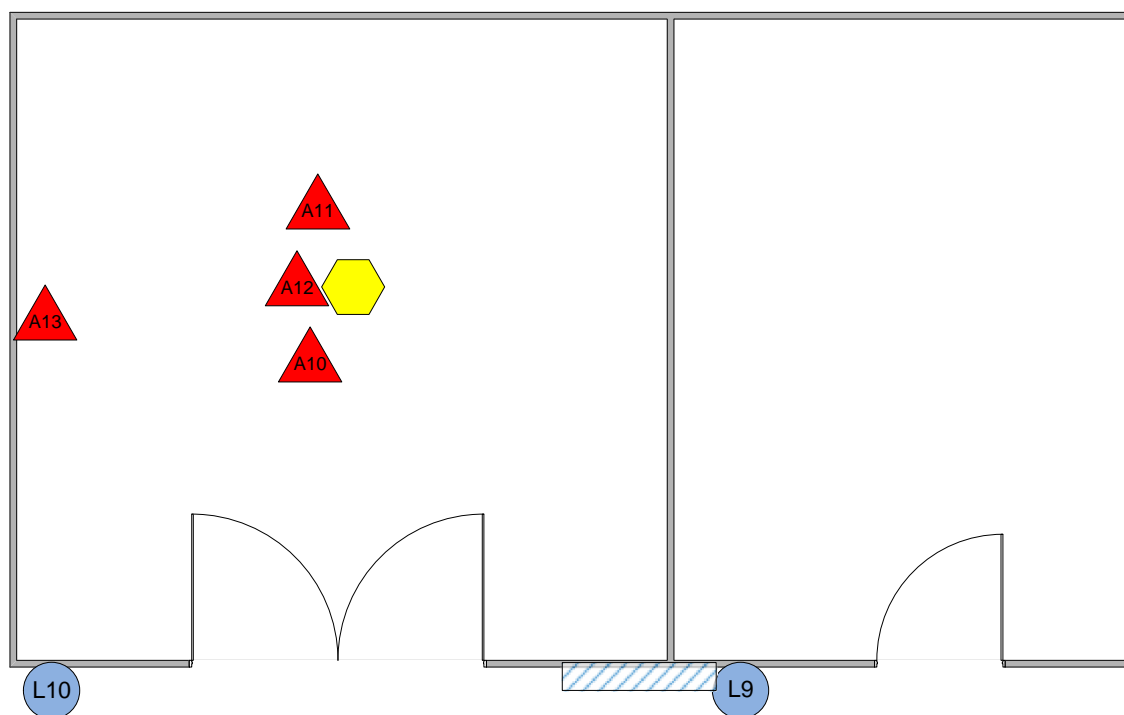
**Project Location:**  
 Yoho National Park of Canada – Kicking Horse Campground, Yoho Valley Road, near Field, British Columbia

**Legend:**



-  Asbestos Sample
-  Lead Paint Sample
-  Mould Bulk Sample
-  Miscellaneous Chemicals
-  Potential Mercury Fluorescent Light Tubes and PCB Ballasts
-  Water Damaged Wood Trim

**Note:**  
 - Not To Scale





**Hazardous Materials  
Assessment  
Results**

***Pumphouse***

**Project #:** AS 8674


**Client:**  
AECOM

**Project Location:**

Yoho National Park of  
Canada – Kicking Horse  
Campground, Yoho  
Valley Road, near Field,  
British Colombia

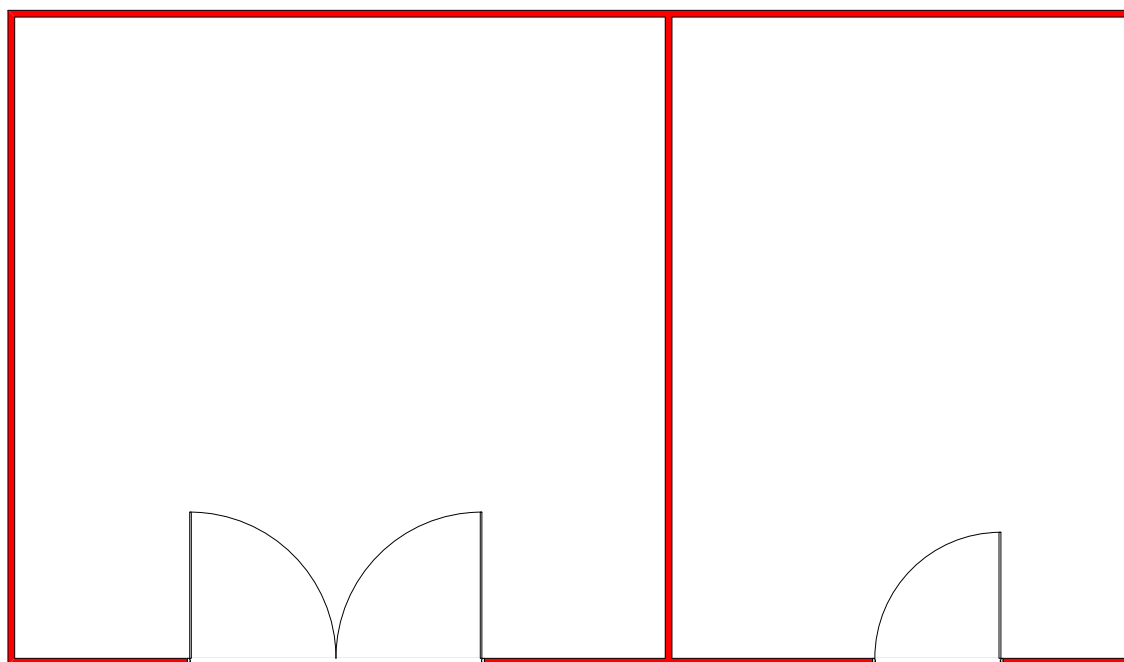
**Legend:**



 LC Brown Paint – Exterior  
Wood Panels AND Light  
Brown - Exterior Trim

**Note:**

- Not To Scale
- LC: Lead Containing
- AC: Asbestos Containing



**Hazardous Materials Assessment**  
 Sample Locations and Observations  
*Kiosk*







**Project #:** AS 8674

**Client:**  
 AECOM

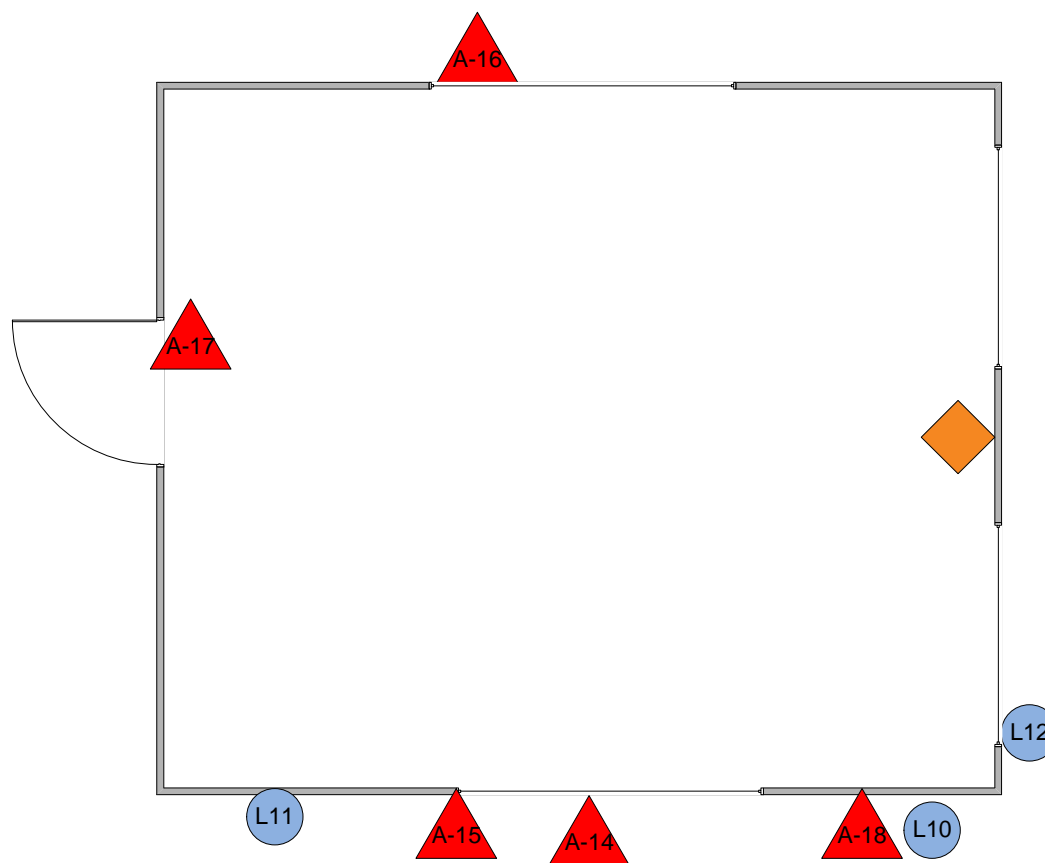
**Project Location:**  
 Yoho National Park of Canada – Kicking Horse Campground, Yoho Valley Road, near Field, British Colombia

**Legend:**



-  Asbestos Sample
-  Lead Paint Sample
-  Mould Bulk Sample
-  Miscellaneous Chemicals
-  Potential Mercury Fluorescent Light Tubes and PCB Ballasts
-  ODS – Air Conditioner

**Note:**  
 - Not To Scale



**Hazardous Materials  
 Assessment  
 Results**

**Kiosk**

**Project #:** AS 8674

**Client:**  
 AECOM

**Project Location:**

Yoho National Park of  
 Canada – Kicking Horse  
 Campground, Yoho  
 Valley Road, near Field,  
 British Colombia

**Legend:**

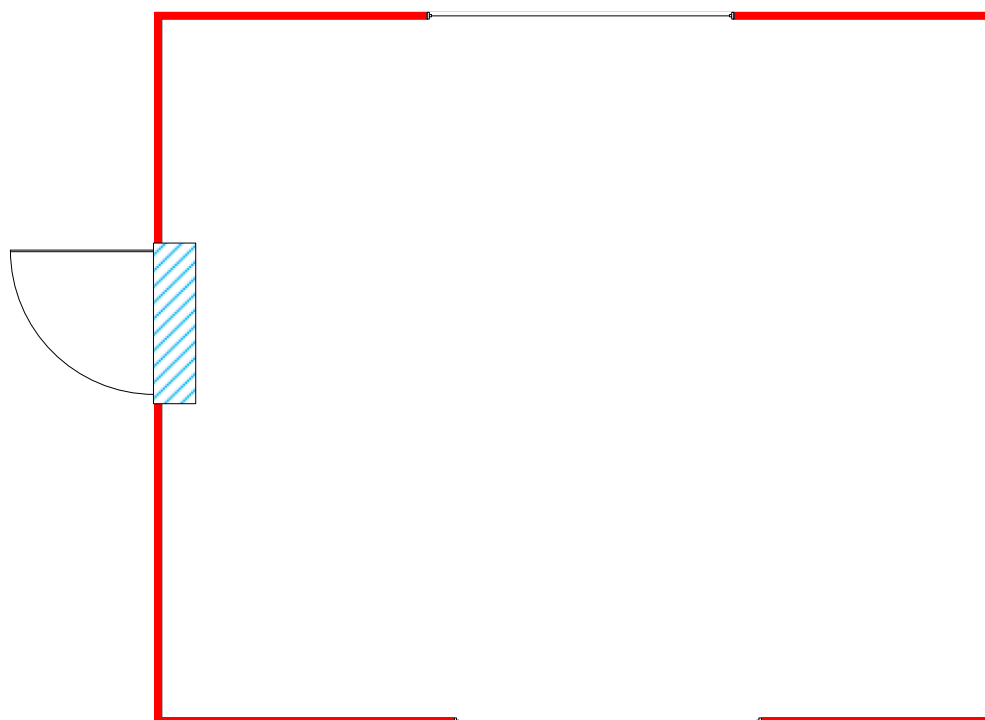


LC Dark Brown- Exterior  
 Wood Panels AND Light  
 Brown - Exterior Trim and  
 Window Frames

 AC White Linoleum Flooring

**Note:**

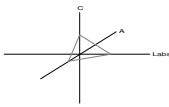
- Not To Scale
- LC: Lead Containing
- AC: Asbestos Containing



**APPENDIX IV**  
**LABORATORY REPORTS**

**CA Labs**  
Dedicated to  
Quality

**Crisp Analytical, L.L.C.**  
1929 Old Denton Road  
Carrollton, TX 75006  
Phone 972-242-2754  
Fax 972-242-2798



**CA Labs, L.L.C.**  
12232 Industriplex, Suite 32  
Baton Rouge, LA 70809  
Phone 225-751-5632  
Fax 225-751-5634

## **Materials Characterization - Bulk Asbestos Analysis**

### **Laboratory Analysis Report - Polarized Light**

#### **ASE Services**

2216 27th Ave. NE, Ste. 208  
Calgary, AB T2E 7A7

Customer Project: AS8674, Kicking Horse Campground  
Reference #: CAL1801170AF

Date: 1/16/2018

#### **Analysis and Method**

Summary of polarized light microscopy (PLM / Stereomicroscopy bulk asbestos analysis) using the methods described in 40CFR Part 763 Appendix E to Subpart E (Interim and EPA 600 / R-93 / 116 (Improved)). The sample is first viewed with the aid of a stereomicroscope. Numerous liquid slide preparations are created for analysis under the polarized microscope where identifications and quantifications are performed. Calibrated liquid refractive oils are used as liquid mounting medium. These oils are used for identification (dispersion staining). A calibrated visual estimation is reported, should any asbestiform mineral be present. Other techniques such as acid washing are used in conjunction with refractive oils for detection of smaller quantities of asbestos. All asbestos percentages are based on calibrated visual estimation traceable to NIST standards for regulated asbestos. Traceability to measurement and calibration is achieved by using known amounts and types of asbestos from standards where analyst and laboratory accuracy are measured. As little as 0.001% asbestos can be detected in favorable samples, while detection in unfavorable samples may approach the detection limit of 0.50% (well above the laboratory definition of trace).

#### **Discussion**

Vermiculite containing samples may contain trace amounts of actinolite/tremolite. When not detected by PLM, these samples should be analyzed using TEM methods and / or water separation techniques. Suspected actinolite/vermiculite presence will be indicated through the sample comment section of this report.

Fibrous talc containing samples may contain a regulated asbestos fiber known as anthophyllite. Under certain conditions the same fiber may actually contain both talc and anthophyllite (a phenomenon called intergrowth). Again, TEM detection methods are recommended. CA Labs PLM report comments will denote suspected amounts of asbestiform anthophyllite with talc, where further analysis is recommended.

Some samples (floor tiles, surfacings, etc.) may contain fibers too small to be detectable by PLM analysis and should be analyzed by TEM bulk protocols.

A "trace asbestos" will be reported if the analyst observes far less than 1% asbestos. CA Labs defines "trace asbestos" as a few fibers detected by the analyst in several preparations and will indicate as such under these circumstances.

Since allowable variation in quantification of samples close to 1% is high, <1% may be reported. Such results are ideal for point counting, and the technique is mandatory for friable samples (NESHAP, Nov. 1990 and clarification letter 8 May 1991) under 1% percent asbestos or "trace asbestos". **In order to make all initial PLM reports issued from CA Labs NESHAP compliant, all <1% asbestos results (except floor tiles) will be point counted at no additional charge.**

#### **Qualifications**

CA Labs is accredited by the National Voluntary Accreditation Program (NVLAP) for selected test methods for airborne fiber analysis (TEM), and for bulk asbestos fiber analysis (PLM). CA Labs is also accredited by AIHA LAP, LLC. in the PLM asbestos field of testing for Industrial Hygiene. All analysts have completed college courses or hold a degree in a natural science (geology, biology, or environmental science). Recognition by a state professional board in one these disciplines is preferred, but not required. Extensive in-house training programs are used to augment the educational background of the analyst. The Laboratory Director and Quality Manager have received supplemental McCrone Research training for asbestos identification. Analysis performed at Crisp Analytical Labs, LLC 1929 Old Denton Road Carrollton, TX 75006

*Dallas NVLAP Lab Code 200349-0 TEM/PLM TCEQ# T104704513-15-3 TDH 30-0235*  
**AIHA LAP, LLC Laboratory #102929**

## Overview of Project Sample Material Containing Asbestos

Customer Project:		AS8674, Kicking Horse Campground		CA Labs Project #:	CAL1801170AF
Sample #	Layer #	Analysts Physical Description of Subsample	Asbestos type / calibrated visual estimate percent	List of Affected Building Material Types	
A-3	3-1	<b>KH Shower NW Window in Womens Hard White Caulking/</b> white surfaced off-white caulking	<b>2% Chrysotile</b>	<b>white surfaced off-white caulking white patterned transite tile white linoleum</b>	
A-5	5-1	<b>KH Shower Mens Wall Black White Speckled Wall Panel/</b> white patterned transite tile	<b>27% Chrysotile</b>		
A-17	17-1	<b>KH Kiosk Floor White Lino/</b> white linoleum	<b>24% Chrysotile</b>		

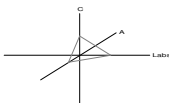
Dallas NVLAP Lab Code 200349-0 TEM/PLM TCEQ# T104704513-15-3 TDH 30-0235  
**AIHA LAP, LLC Laboratory #102929**

### **Glossary of abbreviations (non-asbestos fibers and non-fibrous minerals):**

ca - carbonate	pe - perlite	fg - fiberglass	pa - palygorskite (clay)
gypsum - gypsum	qu - quartz	mw - mineral wool	
bi - binder		wo - wollastonite	
or - organic		ta - talc	
ma - matrix		sy - synthetic	
mi - mica		ce - cellulose	
ve - vermiculite		br - brucite	
ot - other		ka - kaolin (clay)	

This report relates to the items tested. This report is not to be used by the customer to claim product certification, approval or endorsement by NVLAP, NIST, AIHA LAP, LLC, or any other agency of the federal government. This report may not be reproduced except in full without written permission from CA Labs. These results are submitted pursuant to CA Labs' current terms and sale, condition of sale, including the company's standard warranty and limitations of liability provisions and no responsibility or liability is assumed for the manner in which the results are used or interpreted. Unless notified in writing to return the samples covered by this report, CA Labs will store the samples for a period of ninety (90) days before discarding. A shipping or handling fee may be assessed for the return of any samples.





## Polarized Light Asbestiform Materials Characterization

Customer Info: Attn:

**ASE Services**

2216 27th Ave. NE, Ste. 208  
Calgary, AB T2E 7A7

Phone # 403-475-0963

Fax # 403-475-0971

Customer Project:

AS8674, Kicking Horse  
Campground

Turnaround Time:

5 Days

CA Labs Project #:

CAL1801170AF

Date: 1/16/2018

Samples Received: 1/10/18 10:30am

Date Of Sampling: 1/8/2018

Purchase Order #: AS8674

Sample #	Com ment	Layer #	Analysts Physical Description of Subsample	Homo- geneo us (Y/N)	Asbestos type / calibrated visual estimate percent	Non-asbestos fiber type / percent	Non-fibrous type / percent
----------	-------------	------------	---	-------------------------------	--	--------------------------------------	-------------------------------

A-1		1-1	<b>KH Shower House Exterior White Compound on Wood Panel/</b> brown surfaced white compound	n	<b>None Detected</b>		100% qu,mi,ca
A-2		2-1	<b>KH Shower Window Brown Window Caulking/</b> white surfaced brown caulking	n	<b>None Detected</b>	2% ce	98% qu,bi,ca
A-3		3-1	<b>KH Shower NW Window in Womens Hard White Caulking/</b> white surfaced off-white caulking	n	<b>2% Chrysotile</b>		98% qu,bi,ca
A-4		4-1	<b>KH Shower S Window of Handi Gray Caulking/</b> gray caulking	y	<b>None Detected</b>		100% qu,bi
A-5		5-1	<b>KH Shower Mens Wall Black White Speckled Wall Panel/</b> white patterned transite tile	n	<b>27% Chrysotile</b>		73% qu,ca,ma
A-6		6-1	<b>KH Shower Mens Toilet Concrete Scratch Coat/</b> gray surfaced gray plaster	n	<b>None Detected</b>		100% qu,bi,ca
A-7		7-1	<b>KH Shower Building Electrical Room DWJC Wall Ceiling/</b> white surfaced white compound	n	<b>None Detected</b>		100% qu,mi,ca

Dallas NVLAP Lab Code 200349-0 TEM/PLM TCEQ# T104704513-15-3 TDH 30-0235

### AIHA LAP, LLC Laboratory #102929

Analysis Method: Interim (40CFR Part 763 Appendix E to Subpart E) / Improved (EPA-600 / R-93/116). All samples received in good condition unless noted.

Preparation Method: HCL acid washing for carbonate based samples, chemical reduction for organically bound components, oil immersion for

identification of asbestos types by dispersion attaining / becke line method.

ca - carbonate	mi - mica	fg - fiberglass	ce - cellulose
gy - gypsum	ve - vermiculite	mw - mineral wool	br - brucite
bi - binder	ot - other	wo - wollastonite	ka - kaolin (clay)
or - organic	pe - perlite	ta - talc	pa - palygorskite (clay)
ma - matrix	qu - quartz	sy - synthetic	

Approved Signatories:

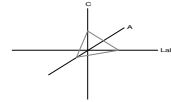
Tanner Rasmussen  
Analyst

Technical Manager  
Tanner Rasmussen

Senior Analyst  
Julio Robles

1. Fire Damage significant fiber damage - reported percentages reflect unaltered fibers
2. Fire Damage no significant fiber damages effecting fibrous percentages
3. Actinolite in association with Vermiculite
4. Layer not analyzed - attached to previous positive layer and contamination is suspected
5. Not enough sample to analyze

6. Anthophyllite in association with Fibrous Talc
7. Contamination suspected from other building materials
8. Favorable scenario for water separation on vermiculite for possible analysis by another method
9. < 1% Result point counted positive
10. TEM analysis suggested



## Polarized Light Asbestiform Materials Characterization

**Customer Info: Attn:**

**ASE Services**

2216 27th Ave. NE, Ste. 208  
Calgary, AB T2E 7A7

Phone # 403-475-0963

Fax # 403-475-0971

**Customer Project:**

AS8674, Kicking Horse  
Campground

**Turnaround Time:**

5 Days

**CA Labs Project #:**

CAL1801170AF

**Date:** 1/16/2018

**Samples Received:** 1/10/18 10:30am

**Date Of Sampling:** 1/8/2018

**Purchase Order #:** AS8674

Sample #	Com ment	Layer #	Analysts Physical Description of Subsample	Homo- geneo us (Y/N)	Asbestos type / calibrated visual estimate percent	Non-asbestos fiber type / percent	Non-fibrous type / percent
A-8		8-1	<b>KH Shower Handi Sink Blue Countertop/</b> gray countertop	y	<b>None Detected</b>	45% ce	55% qu,ma
A-9		9-1	<b>KH Shower Building Roof Shingle Tar/</b> black roofing shingle with brown gravel	y	<b>None Detected</b>	23% ce	77% qu,bi
		9-2	black felt	y	<b>None Detected</b>	36% ce	64% qu,bi
A-10		10-1	<b>KH Pumphouse Boiler Gasket/</b> tan surfaced black gasketing	n	<b>None Detected</b>	38% ce	62% qu,bi,ot
A-11		11-1	<b>KH Pumphouse Black Expansion Cloth/</b> black covering	y	<b>None Detected</b>	32% fg	68% qu,bi,ot
A-12		12-1	<b>KH Pumphouse Black Pipe Cushion Wrap/</b> black rubber gasketing	y	<b>None Detected</b>		100% qu,bi,ot
A-13		13-1	<b>KH Pumphouse Window Glazing White/</b> white surfaced tan caulking	n	<b>None Detected</b>		100% qu,bi,ca

Dallas NVLAP Lab Code 200349-0 TEM/PLM TCEQ# T104704513-15-3 TDH 30-0235

**AIHA LAP, LLC Laboratory #102929**

Analysis Method: Interim (40CFR Part 763 Appendix E to Subpart E) / Improved (EPA-600 / R-93/116). All samples received in good condition unless noted.

Preparation Method: HCL acid washing for carbonate based samples, chemical reduction for organically bound components, oil immersion for

identification of asbestos types by dispersion attaining / becke line method.

ca - carbonate	mi - mica	fg - fiberglass	ce - cellulose
gy - gypsum	ve - vermiculite	mw - mineral wool	br - brucite
bi - binder	ot - other	wo - wollastonite	ka - kaolin (clay)
or - organic	pe - perlite	ta - talc	pa - palygorskite (clay)
ma - matrix	qu - quartz	sy - synthetic	

Approved Signatories:

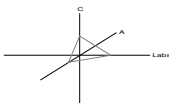
Tanner Rasmussen  
Analyst

Technical Manager  
Tanner Rasmussen

Senior Analyst  
Julio Robles

1. Fire Damage significant fiber damage - reported percentages reflect unaltered fibers
2. Fire Damage no significant fiber damages effecting fibrous percentages
3. Actinolite in association with Vermiculite
4. Layer not analyzed - attached to previous positive layer and contamination is suspected
5. Not enough sample to analyze

6. Anthophyllite in association with Fibrous Talc
7. Contamination suspected from other building materials
8. Favorable scenario for water separation on vermiculite for possible analysis by another method
9. < 1% Result point counted positive
10. TEM analysis suggested



## Polarized Light Asbestiform Materials Characterization

**Customer Info: Attn:**

**ASE Services**

2216 27th Ave. NE, Ste. 208  
Calgary, AB T2E 7A7

Phone # 403-475-0963

Fax # 403-475-0971

**Customer Project:**

AS8674, Kicking Horse  
Campground

**Turnaround Time:**

5 Days

**CA Labs Project #:**

CAL1801170AF

**Date:** 1/16/2018

**Samples Received:** 1/10/18 10:30am

**Date Of Sampling:** 1/8/2018

**Purchase Order #:** AS8674

Sample #	Com ment	Layer #	Analysts Physical Description of Subsample	Homo- geneo us (Y/N)	Asbestos type / calibrated visual estimate percent	Non-asbestos fiber type / percent	Non-fibrous type / percent
----------	-------------	------------	---	-------------------------------	--	--------------------------------------	-------------------------------

A-14		14-1	<b>KH Kiosk Window Soft White Puddy/</b> white surfaced white caulking	n	<b>None Detected</b>		100% qu,bi,ca
A-15		15-1	<b>KH Kiosk Window Hard White</b> <b>Caulking/</b> tan surfaced white caulking	n	<b>None Detected</b>		100% qu,gy,bi
A-16		16-1	<b>KH Kiosk Window Beige Soft White</b> <b>Caulking/</b> tan surfaced white caulking	n	<b>None Detected</b>		100% qu,gy,bi
A-17		17-1	<b>KH Kiosk Floor White Lino/</b> white linoleum	y	<b>24% Chrysotile</b>		76% gy,ma
A-18		18-1	<b>KH Kiosk Roof Shingle Tar/</b> black roofing shingle with black gravel	y	<b>None Detected</b>	16% fg	84% qu,bi

Dallas NVLAP Lab Code 200349-0 TEM/PLM TCEQ# T104704513-15-3 TDH 30-0235

**AIHA LAP, LLC Laboratory #102929**

Analysis Method: Interim (40CFR Part 763 Appendix E to Subpart E) / Improved (EPA-600 / R-93/116). All samples received in good condition unless noted.

Preparation Method: HCL acid washing for carbonate based samples, chemical reduction for organically bound components, oil immersion for

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gy - gypsum	ve - vermiculite	mw - mineral wool	br - brucite
bi - binder	ot - other	wo - wollastonite	ka - kaolin (clay)
or - organic	pe - perlite	ta - talc	pa - palygorskite (clay)
ma - matrix	qu - quartz	sy - synthetic	

Approved Signatories:

Tanner Rasmussen  
Analyst

Technical Manager  
Tanner Rasmussen

Senior Analyst  
Julio Robles

1. Fire Damage significant fiber damage - reported percentages reflect unaltered fibers
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6. Anthophyllite in association with Fibrous Talc
7. Contamination suspected from other building materials
8. Favorable scenario for water separation on vermiculite for possible analysis by another method
9. < 1% Result point counted positive
10. TEM analysis suggested

### CERTIFICATE OF ANALYSIS

Client: Alberta Safety & Environmental Services  
208, 2216 27th Ave NE  
Calgary AB T2E 7A7  
  
Client: ALB464

Report Date: 1/17/2018  
Report No.: 554990 - Lead Paint  
Project: Kicking Horse Campground  
Project No.: AS 8674

### LEAD PAINT SAMPLE ANALYSIS SUMMARY

<b>Lab No.:</b> 6420550	<b>Description:</b> Dark Brown w/Light Paint	<b>Result (% by Weight):</b> 1.2
<b>Client No.:</b> L-1	<b>Location:</b> KH Camp-Shower House (Exterior Walls), 1/8/18	<b>Result (ppm):</b> 12000
		<b>Comments:</b>

<b>Lab No.:</b> 6420551	<b>Description:</b> Light Brown w/White Wood Frame Paint	<b>Result (% by Weight):</b> 2.6
<b>Client No.:</b> L-2	<b>Location:</b> KH Camp-Shower Window Frame, 1/8/18	<b>Result (ppm):</b> 26000
		<b>Comments:</b>

<b>Lab No.:</b> 6420552	<b>Description:</b> Grey Metal Door Paint	<b>Result (% by Weight):</b> 0.0098
<b>Client No.:</b> L-3	<b>Location:</b> KH Camp-Shower-Handi-Door, 1/8/18	<b>Result (ppm):</b> 98
		<b>Comments:</b>

<b>Lab No.:</b> 6420553	<b>Description:</b> Dark Red Roof Trim Paint	<b>Result (% by Weight):</b> 3.3
<b>Client No.:</b> L-4	<b>Location:</b> KH Camp-Shower-House, 1/8/18	<b>Result (ppm):</b> 33000
		<b>Comments:</b>

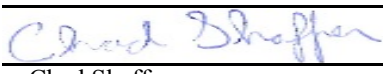
<b>Lab No.:</b> 6420554	<b>Description:</b> White w/Green On Metal Stall Paint	<b>Result (% by Weight):</b> 1.0
<b>Client No.:</b> L-5	<b>Location:</b> KH Camp-Shower-Stall, 1/8/18	<b>Result (ppm):</b> 10000
		<b>Comments:</b>


<b>Lab No.:</b> 6420555	<b>Description:</b> White Ceiling Wood Paint	<b>Result (% by Weight):</b> <0.0065
<b>Client No.:</b> L-6	<b>Location:</b> KH Shower-Men's Ceiling, 1/8/18	<b>Result (ppm):</b> <65
		<b>Comments:</b>

<b>Lab No.:</b> 6420556	<b>Description:</b> Yellow Pipe Metal Paint	<b>Result (% by Weight):</b> 8.9
<b>Client No.:</b> L-7	<b>Location:</b> KH Shower-Back SE Corner, 1/8/18	<b>Result (ppm):</b> 89000
		<b>Comments:</b>

<b>Lab No.:</b> 6420557	<b>Description:</b> White Interior Wall Wood Paint	<b>Result (% by Weight):</b> 0.034
<b>Client No.:</b> L-8	<b>Location:</b> KH-Storage Room, 1/8/18	<b>Result (ppm):</b> 340
		<b>Comments:</b>

Please refer to the Appendix of this report for further information regarding your analysis.

Date Received: 1/10/2018  
Date Analyzed: 01/17/2018  
Signature:   
Analyst: Chad Shaffer

Approved By:   
Frank E. Ehrenfeld, III  
Laboratory Director

### CERTIFICATE OF ANALYSIS

Client: Alberta Safety & Environmental Services  
208, 2216 27th Ave NE  
Calgary AB T2E 7A7  
  
Client: ALB464

Report Date: 1/17/2018  
Report No.: 554990 - Lead Paint  
Project: Kicking Horse Campground  
Project No.: AS 8674

### LEAD PAINT SAMPLE ANALYSIS SUMMARY

<b>Lab No.:</b> 6420558	<b>Description:</b> White Wood Trim Paint	<b>Result (% by Weight):</b> 0.098
<b>Client No.:</b> L-9	<b>Location:</b> KH Pumphouse, 1/8/18	<b>Result (ppm):</b> 980
		<b>Comments:</b>

<b>Lab No.:</b> 6420559	<b>Description:</b> Brown Wood Paint	<b>Result (% by Weight):</b> 0.66
<b>Client No.:</b> L-10	<b>Location:</b> KH Pumphouse, 1/8/18	<b>Result (ppm):</b> 6600
		<b>Comments:</b>

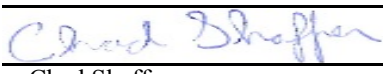
<b>Lab No.:</b> 6420560	<b>Description:</b> Dark Brown Exterior Paint	<b>Result (% by Weight):</b> 0.18
<b>Client No.:</b> L-11	<b>Location:</b> KH Kiosk-Wood Panel, 1/8/18	<b>Result (ppm):</b> 1800
		<b>Comments:</b> *


<b>Lab No.:</b> 6420561	<b>Description:</b> Chocolate Brown Exterior Paint	<b>Result (% by Weight):</b> <0.0066
<b>Client No.:</b> L-12	<b>Location:</b> KH Kiosk-Wood Panel, 1/8/18	<b>Result (ppm):</b> <66
		<b>Comments:</b>

<b>Lab No.:</b> 6420562	<b>Description:</b> Tan Wood Trim Exterior Paint	<b>Result (% by Weight):</b> 3.0
<b>Client No.:</b> L-13	<b>Location:</b> KH Kiosk-Door And Window, 1/8/18	<b>Result (ppm):</b> 30000
		<b>Comments:</b>

<b>Lab No.:</b> 6420563	<b>Description:</b> White Paint On Wood	<b>Result (% by Weight):</b> <0.0063
<b>Client No.:</b> L-14	<b>Location:</b> KH KioskCeiling, 1/8/18	<b>Result (ppm):</b> <63
		<b>Comments:</b>

Please refer to the Appendix of this report for further information regarding your analysis.

Date Received: 1/10/2018  
Date Analyzed: 01/17/2018  
Signature:   
Analyst: Chad Shaffer

Approved By:   
Frank E. Ehrenfeld, III  
Laboratory Director

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CERTIFICATE OF ANALYSIS

---

Client: Alberta Safety & Environmental Services  
208, 2216 27th Ave NE  
Calgary AB T2E 7A7  
  
Client: ALB464

Report Date: 1/17/2018  
Report No.: 554990 - Lead Paint  
Project: Kicking Horse Campground  
Project No.: AS 8674

## Appendix to Analytical Report:

**Customer Contact:**

**Analysis:** ASTM D3335-85a

This appendix seeks to promote greater understanding of any observations, exceptions, special instructions, or circumstances that the laboratory needs to communicate to the client concerning the above samples. The information below is used to help promote your ability to make the most informed decisions for you and your customers. Please note the following points of contact for any questions you may have.

**iATL Customer Service:** customerservice@iatl.com

**iATL Office Manager:** cdavis@iatl.com

**iATL Account Representative:** Cassie Doherty

**Sample Login Notes:** See Batch Sheet Attached

**Sample Matrix:** Paint

**Exceptions Noted:** See Following Pages

### General Terms, Warrants, Limits, Qualifiers:

General information about iATL capabilities and client/laboratory relationships and responsibilities are spelled out in iATL policies that are listed at [www.iATL.com](http://www.iATL.com) and in our Quality Assurance Manual per ISO 17025 standard requirements. The information therein is a representation of iATL definitions and policies for turnaround times, sample submittal, collection media, blank definitions, quantification issues and limit of detection, analytical methods and procedures, sub-contracting policies, results reporting options, fees, terms, and discounts, confidentiality, sample archival and disposal, and data interpretation.

iATL warrants the test results to be of a precision normal for the type and methodology employed for each sample submitted. iATL disclaims any other warrants, expressed or implied, including warranty of fitness for a particular purpose and warranty of merchantability. iATL accepts no legal responsibility for the purpose for which the client uses test results. Any analytical work performed must be governed by our Standard Terms and Conditions. Prices, methods and detection limits may be changed without notification. Please contact your Customer Service Representative for the most current information.

This confidential report relates only to those item(s) tested and does not represent an endorsement by NIST-NVLAP, AIHA LAP LLC, or any agency of local, state or province governments nor of any agency of the U.S. government.

This report shall not be reproduced except in full, without written approval of the laboratory.

### Information Pertinent to this Report:

Analysis by ASTM D3335-85a by AAS

Certification:

- National Lead Laboratory Program (NLLAP): AIHA-LAP, LLC No. 100188

- NYSDOH-ELAP No. 11021

Regulatory limit is 0.5% lead by weight (EPA/HUD guidelines). Recommend multiple sampling for all samples less than regulatory limit for confirmation.

All results are based on the samples as received at the lab. iATL assumes that appropriate sampling methods have been used and that the data upon which these results are based have been accurately supplied by the client.

Method Detection Limit (MDL) per EPA Method 40CFR Part 136 Appendix B.

Reporting Limit (RL) based upon Lowest Standard Determined (LSD) in accordance with AIHA-ELLAP policies.

LSD=0.2 ppm MDL=0.005% by weight. RL= 0.010% by weight (based upon 100 mg sampled).

### Disclaimers / Qualifiers:

There may be some samples in this project that have a "NOTE:" associated with a sample result. We use added disclaimers or qualifiers to inform the client about something that requires further explanation. Here is a complete list with highlighted disclaimers pertinent to this project. For a full explanation of these and other disclaimers, please inquire at [customerservice@iatl.com](mailto:customerservice@iatl.com).

- \* Insufficient sample provided to perform QC reanalysis (<200 mg)
- \*\* Not enough sample provided to analyze (<50 mg)
- \*\*\* Matrix / substrate interference possible.



**BIO-CHEM CONSULTING**

Services (1980) Ltd.

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### Analytical Test Report

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**Test Report #:** BC31664A

**Revision #:** 0

**Issue Date:** 11-Jan-18

**Client:** ASE Services

**Code:** ASE

**Contact:** Alisa Robertson

**Job #:** AS 8674

**P.O.#:**

**Address:** #208, 2216 – 27 Avenue NE  
Calgary AB  
T2E 7A7

**Internal Project #:** BC31664

**Sampled By:** AR/CT

**Sample Location:** Monarch and Kicking Horse Campground

**Sample Date:** 8-Jan-18

**Date Received:** 10-Jan-18

Analytical	# of Pages
Direct	1

Total (incl. Cover)	2
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**Comments:** None.

Approved By: \_\_\_\_\_

Michael Busse, B.Sc.  
Laboratory Supervisor

- 
- 1) THIS REPORT MAY NOT BE REPRODUCED IN PART WITHOUT THE EXPRESSED WRITTEN CONSENT OF THE LABORATORY.
  - 2) ANY REMAINING SAMPLES WILL BE DISPOSED OF 30 DAYS FOLLOWING ANALYSIS. CONTACT THE LABORATORY IF ADDITIONAL SAMPLE STORAGE TIME IS REQUIRED.
  - 3) ALL LABORATORY ANALYSES INCORPORATE STANDARD QC PROTOCOLS; HOWEVER, UNSIGNED TEST REPORTS ARE PRELIMINARY AND UNOFFICIAL. IF REQUIRED, PLEASE CONTACT LABORATORY SUPERVISOR FOR QC DATA REPORTS.
  - 4) REPORTED TEST RESULTS RELATE ONLY TO THE SAMPLES AS RECEIVED BY THE LABORATORY.
  - 5) BIO-CHEM CONSULTING SERVICES (1980) LTD. ASSUMES NO LIABILITY FOR THE USE OR INTERPRETATION OF THE TEST RESULTS
  - 6) WHERE APPLICABLE, ESTIMATION OF THE MEASUREMENT UNCERTAINTY IS AVAILABLE ON REQUEST.
  - 7) THIS LABORATORY OR SUB-CONTRACTED LABORATORY IS NOT ACCREDITED FOR THE TESTS MARKED <sup>§</sup>
- 

#### Laboratory Contact Information

#118, 339 - 50<sup>TH</sup> Avenue S.E.  
Calgary, Alberta T2G 2B3  
CANADA  
Telephone: (403) 253-7026  
Fax: (403) 253-7072  
E-mail: [reporting@bio-chemconsulting.com](mailto:reporting@bio-chemconsulting.com)  
[www.bio-chemconsulting.com](http://www.bio-chemconsulting.com)



Please note that laboratory privacy policy limits discussion of this report to the client listed above.  
For all others, please direct questions directly to client listed.

**CERTIFICATE OF ANALYSIS**  
**Direct Microscopic Fungal Analysis**

**B.C. Report No. :** BC31664A Rev. 0  
**Client Job No.:** AS 8674

**Date Analyzed:** 11-Jan-18  
**Page Issue Date:** 11-Jan-18

Sample #	Sample Description	Observation/Comments	Relative Abundance	Distribution
1	M-1: Monarch Pit Privy #1 - Men's Bathroom, by Door	No Spores/Fungal Structures Observed	N/A	N/A
2	M-2: KH Shower House - Women's Shower Room	<i>Penicillium/Aspergillus</i> - like	Low	MH
		Hyphal Fragments	Very High	UD
		Non-Specified Spore	High	SH
		<i>Cladosporium</i>	Moderate	MH

**Relative Abundance Descriptions (approximate magnification: X400; Field of View (FOV): 0.15mm<sup>2</sup>)**

Very Low: much less than 1 spore/structure observed per FOV

Low: <1 spore/structure observed per FOV

Moderate: 1 to 100 spores/structures observed per FOV

High: >100 spores/structures observed per FOV

Very High: much greater than 100 spores/structures observed per FOV

**Distribution (Heterogeneity) Descriptions**

HH: Highly Heterogeneous

MH: Moderately Heterogeneous

SH: Somewhat Heterogeneous

UD: Uniform (Homogeneous) Distribution

**Comments:**

None.





ALBERTA SAFETY & ENVIRONMENTAL SERVICES

February 14, 2018

Brent Rutten  
AECOM  
200 - 2100 8 Street East  
Saskatoon, Saskatchewan S7H 0V1

Dear Mr. Rutten,

**Re: Hazardous Materials Assessment - REVISED  
Monarch Campground – Two (2) Pit Privy Buildings  
Yoho Valley Road, near Field, British Columbia  
Project #: AS 8674**

## **1.0 INTRODUCTION**

Alberta Safety & Environmental Services Ltd. (ASE Services) was requested by Brent Rutten of AECOM to conduct a hazardous materials assessment of two (2) Pit Privy buildings on the Monarch Campground located along Yoho Valley Road, near Field, British Columbia. The assessment was performed on January 8 and 9, 2018 by Ailsa Robertson and Cameron Toth with ASE Services.

The purpose of the assessment was to conduct a room-by-room assessment to sample and/or identify building materials that may contain asbestos, paint which may contain lead, as well as to identify the presence of mould growth, water damage and other potential hazardous materials, such as polychlorinated biphenyls (PCBs), mercury, miscellaneous chemicals, radioactive material and ozone-depleting substances (ODS), in relation to the in relation to WorkSafe BC Occupational Health and Safety Regulations, and industry accepted guidelines. The results of the assessment have been used to complete a detailed inventory so that hazardous materials will be properly identified for appropriate management by the owners of the buildings prior to demolition or renovation activities.

## **2.0 SCOPE OF WORK**

The scope of work involved an assessment of the building environment for the presence of building materials that may contain the following:

- Asbestos;
- Lead paint;
- Mould growth and/or water damage;
- Polychlorinated biphenyls (PCB's);
- Mercury;
- Miscellaneous chemicals;
- Radioactive materials; and
- Ozone-depleting substances (ODS).

The reporting scope of work for the building environment includes:

- Photographs of identified materials;
- Site drawings outlining the location of all identified hazardous materials; and
- Preparation of this report detailing our findings, conclusions and recommendations.

### **3.0 OBSERVATIONS**

At the time of the assessment ASE Services made the following observations:

- There were two (2) Pit Privy Buildings slated for renovation or demolition;
- The buildings were unoccupied;
- They were one story structures;
- The exteriors consisted of stained wood paneling;
- The floors consisted of painted concrete;
- The doors and roof trim were painted a brown-green;
- There were four windows and two vents on each building;
- The walls consisted of white painted wood panels;
- The ceiling consisted of white painted wood panels; and
- The roof consisted of wooden shingles.

### **4.0 METHODOLOGY**

The assessment included a room-by-room inspection of all accessible locations as well as an inspection of the exterior of the building. Samples of suspected asbestos-containing materials and suspected lead-containing paints were collected from the interior and exterior of the building. Observations were made for PCBs, mercury, radioactive materials, miscellaneous chemicals, and ozone-depleting substances in the building. The methodology used for each parameter of the hazardous materials survey is outlined below.

#### **4.1 Asbestos-Containing Materials**

Small, representative pieces of those materials suspected to contain asbestos were collected and placed in clear, sealable plastic bags. All samples were forwarded to Crisp Analytical Laboratories, L.L.C. in Carrollton, Texas, for analysis. The samples were analyzed using the EPA 600/R-93/116 analysis method. This is a comprehensive method outlining various techniques for determining the asbestos concentration in bulk building materials.

#### **4.2 Lead-Based Paint**

Small, representative samples of paint suspected to contain lead were collected and forwarded to iATL International Asbestos Testing Laboratories for analysis. The samples are analyzed using the ASTM D3335-85A "Standard Method to Test for Low Concentrations of Lead in Paint by Atomic Absorption Spectrophotometry" analysis method.

#### **4.3 Mould Contaminated and Water Damaged Materials**

The survey included a room-by-room inspection of all accessible locations in the buildings. Tape lift samples were collected to confirm the presence of mould. Mould tape sampling is performed by taking small, representative samples of those materials suspected to contain mould, and then place them on glass slides. All samples were analyzed by certified Bio-Chem Consulting (1980) Ltd. analysts to determine the type or class of mould growth involved. Observations were made for visible mould and water damage.

#### **4.4 Polychlorinated Biphenyls in Fluorescent Light Fixtures**

Building materials were visually assessed for the presence, or potential presence, of PCBs. Common building materials that could contain PCBs are fluorescent light ballasts, electrical transformers, and heat transfer equipment. Ballasts are inaccessible if the light fixture is not de-energized and the power locked out in accordance with the WorkSafe BC Occupational Health and Safety Regulations. Ballasts that were inaccessible at the time of assessment are considered to be PCB-containing until proven otherwise.

#### 4.5 Mercury in Thermostats and Pressure-Sensing Devices

All thermostats and pressure-sensing devices were visually assessed for the presence of a mercury-containing bulb. All fluorescent light tubes are known to contain mercury dust unless otherwise stated by the manufacturer.

#### 4.6 Miscellaneous Chemicals

At the time of assessment each room was inspected for miscellaneous chemicals such as paints, lubricants, oils, gasoline, and household and/or commercial cleaning products that may be impacted by demolition and potentially pose an environmental hazard.

#### 4.7 Radioactive Materials

Ionization chambers in select smoke detectors contain a small amount of radioactive material to sense the presence of airborne particles or smoke. All smoke detectors that were inaccessible at the time of assessment are considered to contain radioactive material until proven otherwise.

#### 4.8 Ozone-Depleting Substances (ODS)

At the time of assessment each room was visually inspected for equipment such as refrigerators, freezers and air conditioning units that may contain Ozone-Depleting Substances (ODS). Ozone-Depleting Substances contain the following chemical compounds:

- Chlorofluorocarbons (CFCs);
- Halons;
- Hydrochlorofluorocarbons (HCFCs);
- Bromochloromethane;
- Carbon Tetrachloride;
- Methyl Bromide; and
- Methyl Chloroform.

Stamp codes on the equipment indicate the type of chemical used in each piece of equipment. If stamp codes are not visible at the time of assessment the equipment is considered to be ODS-containing until proven otherwise. Please note that even equipment that uses ozone friendly chemicals must be removed, handled and disposed of and/or recycled properly as they could emit greenhouse gases.

### 5.0 RESULTS AND DISCUSSION

#### 5.1 Samples Collected for Asbestos Content

Table 1 summarizes the laboratory sample results and provides an indication of the asbestos-containing materials present in the buildings. Results indicate that all samples were negative for asbestos. Please refer to **Appendix III** for sample locations and **Appendix IV** for the laboratory reports.

**Table 1: Summary of Asbestos Sample Analysis dated January 16, 2018**

Sample #	Sample Location	Sample Description	Type of Asbestos	Asbestos %	Photograph #
A-1	Pit Privy #1 – Windows and Doors	Brown Caulking	None Detected	Not Applicable	Not Applicable
A-2	Pit Privy #1 – Men's Wall	Grey Mastic	None Detected	Not Applicable	Not Applicable

Sample #	Sample Location	Sample Description	Type of Asbestos	Asbestos %	Photograph #
A-3	Pit Privy #2 – Windows and Doors	Grey Caulking	None Detected	Not Applicable	Not Applicable
A-4	Pit Privy #2 – Under Exterior Wood Panels	Paper Flashing	None Detected	Not Applicable	Not Applicable

**Notes:**

- **Bolded text indicates that asbestos is present in the sample.**

## 5.2 Paint Samples Collected to Determine Lead Content

Table 2 summarizes the laboratory sample results and provides an indication of the lead-containing paint present in the building. Results indicate that Six (6) samples exceeded the criterion limit of 90 parts per million (ppm), or 0.009 percent by weight<sup>1</sup> and are considered lead-containing. Please refer to **Appendix II** for Photographs, **Appendix III** for sample locations and **Appendix IV** for the laboratory report.

**Table 2: Summary of Lead Sample Results dated January 17, 2018**

Sample #	Location/Description	Paint Colour	Lead Content (ppm)	Condition	Photograph #
L-1	Pit Privy #1 – Wood Doors and Roof Trim	Green/Brown	430	Good (Women's) to Poor (Men's)	<a href="#">01</a>
L-2	Pit Privy #1 – Interior Wood Walls	White	470	Poor	<a href="#">02</a>
L-3	Pit Privy #1 – Interior Wood Walls	Beige (with White underneath)	180	Poor	<a href="#">02</a>
L-4	Pit Privy #1 – Interior Wood Walls	Grey (Under White, Above Beige)	440	Poor	<a href="#">02</a>
L-5	Pit Privy #2 – Wood Doors and Trim	Green/Brown	4000	Good (Men's) to Fair (Women's)	<a href="#">03</a>
L-6	Pit Privy #2 – Interior Wood Walls	White	490	Good to Poor	<a href="#">04</a>

<sup>1</sup> Government of BC. WorkSafe BC. *Lead-Containing Paints and Coatings: Preventing Exposure in the Construction Industry* (2011).

### 5.3 Mould Tape Lift Bulk Sampling & Visual Mould Growth & Water Damage Inspection

Table 3 summarizes the laboratory sample results and provides an indication of the mould present in the area sampled. Results indicate that mould was not found in the tape lift sample collected. Please refer to **Appendix III** for the sample location and **Appendix IV** for a detailed laboratory report.

**Table 3: Summary of Mould Tape Lift (Bulk) Sample Analysis dated January 11, 2018**

Sample #	Location/Description	Mould Growth Present	Relative Amount of Mould	Photograph #
M-1	Pit Privy #1 – Men's Bathroom, By Door	<i>No Spores/Fungal Structures Observed</i>	Not Applicable	Not Applicable

At the time of the assessment, no mould growth was confirmed to be present, and no visible water damage was observed.

### 5.4 Polychlorinated Biphenyls (PCB's) in Fluorescent Light Ballasts

Fluorescent light fixtures are identified by opening the casing of the light fixtures to visually identify a code stamp on the ballast. In order to safely open the light casing the lighting fixture must be fully de-energized and the power locked out in accordance with the WorkSafe BC Occupational Health and Safety Regulations. ASE Services did not observe any Fluorescent Light Ballasts in the Pit Privy Buildings at the time of assessment.

### 5.5 Mercury in Thermostats and Pressure-Sensing Devices

Mercury and other heavy metals pose a danger to human and environmental health when improperly managed. Common sources of mercury include thermometers, light bulbs and tubes, and thermostats. Mercury thermostats are commonly used in residential and commercial office spaces. ASE Services did not identify any Fluorescent Light Tubes, bulbs, or thermostats containing mercury dust in the Pit Privy Buildings at the time of assessment.

### 5.6 Miscellaneous Chemicals

A total of four (4) hand sanitizers were observed in Pit Privy Buildings at the time of the assessment and should be considered miscellaneous chemicals (see Photograph [05](#)).

### 5.7 Radioactive Materials

At the time of the assessment, no potential radioactive containing materials were observed.

### 5.8 Ozone-Depleting Substances

Ozone-depleting substances (ODS) are human-made chemicals that contain chlorine, fluorine, bromine, carbon and hydrogen that do not readily degrade after being released into the atmosphere. ASE Services did not observe any Ozone-Depleting Substances in the Pit Privy Buildings at the time of assessment.

## 6.0 CONCLUSIONS

Based on the observations and the sampling results, ASE Services makes the following conclusions:

1. Asbestos was determined not to be present in any of the building materials sampled at the time of the assessment.
2. Lead was determined to be present within the following building materials:

### **Pit Privy #1**

- Brown and green painted wood door and roof trim; and
- White (with beige and grey underneath) painted wood interior walls, bathroom stalls, and ceiling.

### **Pit Privy #2**

- Brown and green painted wood door and roof trim; and
- White painted wood interior walls, bathroom stalls, and ceiling.

3. Mould growth or water damage was determined not to be present in either of the Pit Privy Buildings at the time of assessment.
4. At the time of the assessment, ASE Services did not observe any PCB-containing light fixture ballasts.
5. At the time of the assessment, no fluorescent light tubes containing mercury dust were observed in the buildings.
6. Miscellaneous chemicals, including hand sanitizer, were observed in the storage building.
7. No Radioactive materials were observed at the time of assessment
8. At the time of assessment, no ODS-containing equipment was observed in the Pit Privy Buildings.

## 7.0 RECOMMENDATIONS

Based on the above conclusions ASE Services makes the following recommendations:

1. No further action is required at this time, with regards to asbestos-containing materials as the building materials sampled were negative for asbestos. *Please note: if any building materials not included in the assessment are uncovered throughout the renovation of the building, they should be assumed positive for asbestos unless proven otherwise.*
2. If the identified lead containing paint is to be impacted during the course of any renovation or hand demolition activities, it should be removed and disposed of properly by a contractor competent in lead abatement, prior to any such renovation and or hand demolition. Please note: If the buildings are scheduled for demolition by mechanical means, lead paint in good condition (adhering to surface), does not need to be removed prior to demolition; however, lead paint not in good condition (flaking) should be removed by a contractor competent in lead paint abatement.

3. No further action is required at this time with regards to mould-contaminated materials.  
*Please note: if any mould or water damaged materials are uncovered during the renovation of the building, they should be properly remediated following the appropriate high, moderate or low risk procedures as outlined in the WorkSafe BC Occupational Health and Safety Mould and Indoor Air Quality Guidelines.*
4. No further action is required in regards to PCB-containing light fixture ballasts as no light fixtures were identified at the time of assessment.
5. No further action is required at this time with regard to thermostats with mercury containing bulbs.
6. All miscellaneous chemicals must be properly packaged and labelled according to WHMIS regulations. Miscellaneous chemicals must be removed and properly disposed of prior to any demolition activities where these items will be impacted.
7. No further action is required at this time with regard to radioactive materials.
8. No further action is required at this time with regard to ODS-containing equipment.

**Please note: Materials that are visually similar to those identified as asbestos- or lead-containing which are observed in locations other than those outlined in this report should be considered to contain asbestos or lead until proven otherwise.**

Any additional materials identified which were not previously sampled or visually assessed should be assumed as hazardous unless proven otherwise.

## 8.0 WARRANTY

This report is intended for the exclusive use of the company, organization, or individual to whom it is addressed. It may not be used or relied upon in any manner whatsoever, or for any purpose whatsoever, by any other person. ASE Services makes no representation of fact or opinion of any nature whatsoever to any person other than the company, organization, or individual to whom this report is addressed. The warranty stated above may not be assigned.

If you have any questions or require any additional information, please feel free to contact our project management team at (403) 475-0963.

Sincerely,

Alberta Safety & Environmental Services Ltd.

Reviewed by:



Grace-Ann Palmer, B.Sc.  
Project Manager

Drafted by: Ailsa Robertson, B.Sc., EPt, Environmental Safety Consultant

### Attachments:

- Appendix I: Regulations and Guidelines
- Appendix II: Photographs
- Appendix III: Floor Plans
- Appendix IV: Laboratory Reports

**APPENDIX I**  
**REGULATIONS AND GUIDELINES**



## **Asbestos Containing Materials**

### Excerpt from WorkSafe BC Occupational Health and Safety Guidelines Part 6: Substance Specific Requirements – Asbestos

#### Definitions:

"asbestos-containing material" means the following:

(a) a manufactured article or other material, other than vermiculite insulation, that would be determined to contain at least 0.5% asbestos if tested in accordance with one of the following methods:

(i) Asbestos, Chrysotile by XRD, Method 9000 (Issue 2, dated August 15, 1994) in the NIOSH Manual of Analytical Methods, published by the United States National Institute for Occupational Safety and Health, Centers for Disease Control and Prevention;

(ii) Asbestos (bulk) by PLM, Method 9002 (Issue 2, dated August 15, 1994) in the NIOSH Manual of Analytical Methods, published by the United States National Institute for Occupational Safety and Health, Centers for Disease Control and Prevention;

(iii) Test Method for the Determination of Asbestos in Bulk Building Materials (EPA/600/R-93/116, dated July 1993) published by the United States Environmental Protection Agency;

(b) vermiculite insulation that would be determined to contain any asbestos if tested in accordance with the Research Method for Sampling and Analysis of Fibrous Amphibole in Vermiculite Attic Insulation (EPA/600/R-04/004, dated January 2004) published by the United States Environmental Protection Agency;

"low risk work activity" means a work activity that involves working with or in proximity to asbestos-containing material if, at the time the work activity is being carried out, both of the following apply:

(a) the asbestos-containing material is not being

(i) cut, sanded, drilled, broken, ground down or otherwise fragmented, or

(ii) disturbed such that the asbestos-containing material may release airborne asbestos fibre;

(b) it is not necessary to use personal protective equipment or engineering controls in respect of that activity to prevent exposure of a worker to airborne asbestos fibre;

#### Monitoring

6.12

(1) Repealed. [B.C. Reg. 312/2003, App. D, s. 4 (a).]

(2) During a high risk work activity, except where glove bags are used as the containment, the employer must sample for airborne asbestos fibre in

(a) areas outside of the containment but in its vicinity, at least daily if there are unprotected workers in the area,

(b) the clean room, at least daily during removal and cleanup operations, and

(c) contaminated areas inside the containment, as necessary during removal and cleanup to ensure that workers are adequately protected.

(3) The employer must make the results of all air samples taken during a high risk work activity available to the workers involved, within 24 hours of completing the collection of the samples.

(4) Except where glove bags are used as the containment, prior to dismantling a containment used in a high risk work activity and after all asbestos waste has been cleaned up, removed or otherwise controlled, the employer must ensure that

(a) clearance air sampling is conducted in previously contaminated areas inside the containment, and

(b) the airborne asbestos fibre levels in these areas do not exceed 0.02 f/cc.

[am. B.C. Regs. 312/2003, App. D, s. 4; 188/2011, App. B, s. 8.]

High risk work

6.16

(1) For high risk work activity the employer must provide and maintain a containment and a decontamination facility, except that a decontamination facility is not required if the containment is a glove bag.

(2) The employer must inspect a containment and a decontamination facility used for high risk work activity at least daily to ensure their effectiveness is maintained.

(3) The employer must ensure that the design of the decontamination facility includes

(a) a physical connection to the containment,

b) a shower facility, and

(c) provision for the safe entry and exit of workers.

(4) If the high risk work activity involves encapsulation of asbestos-containing material, the employer must ensure that the encapsulant penetrates the material and effectively binds the asbestos fibres together, and has not disturbed the bonding of the material to the supporting surface.

(5) At the completion of a high risk work activity and before dismantling the containment, the employer must

(a) visually inspect the area inside the containment to ensure that an effective cleanup has been completed, and

(b) treat all exposed surfaces inside the containment with a sealant to bind any remaining asbestos fibres and prevent them from becoming airborne.

[am. B.C. Reg. 188/2011, App. B, s. 8.]

#### From WorkSafeBC's "Asbestos Safe Work Procedures"

Occupational Exposure Limit – 0.1 fibres/mL.

Low Risk Work Activities:

Working with or in proximity to ACM, if the material is not being:

-cut, sanded, drilled, or otherwise fragmented

-disturbed such that fibers may be released

\*\*In other words, classified as low-risk if PPE and engineering controls are not needed to prevent worker exposure to airborne fibres.

#### Examples:

-Disturbing materials that contain less than 0.5% asbestos, provided that dust controls are in place.

-Repairs to drywall with asbestos-containing joint compound; provided that the mud itself is not disturbed

-Replacing a single asbestos-containing floor tile without breaking the tile

-Removing asbestos-containing waste material, contained within a clean, properly sealed bag

**Moderate Risk Work Activities:**

Work, other than that classified as high risk, that involve working with or in proximity to ACM that is being cut, sanded, or otherwise fragmented or disturbed. PPE and engineering controls are required to prevent worker exposure to airborne fibers.

**Examples:**

- Using hand tools to cut, shape, grind, remove etc. non-friable ACM's, such as cement pipe
- Impacting products as described above with a power tool, provided that the tool is equipped with a HEPA-filtered local exhaust ventilation (LEV) system.
- Removing asbestos tape or paper on ductwork
- Removing vinyl floor tile
- “Wrap and cut” removal
- Glove bagging
- See WorkSafeBC’s “Asbestos Safe Work Procedures” for more examples.

**Work Procedures**

- mark work area with barricades/fences, signage warning not to enter unless authorized
- poly drop sheets
- respirator with P100 filter
- Tyvek suit over street clothes, with head and foot coverings (laceless rubber boots or booties acceptable if site conditions permit)

#### Bulk material sample collection guide

Type of material	Area of homogeneous material*	Minimum number of bulk samples to be collected**
Surfacing materials, including textured coatings, drywall mud, plasters, and stucco	Less than 90 m <sup>2</sup> (approximately 1,000 ft <sup>2</sup> )	At least 3 samples of each type of surfacing material
	Between 90 and 450 m <sup>2</sup> (approximately 5,000 ft <sup>2</sup> )	At least 5 samples of each type of surfacing material
	Greater than 450 m <sup>2</sup>	At least 7 samples of each type of surfacing material
Sprayed insulation and blown-in insulation, including sprayed fireproofing and vermiculite insulation (including vermiculite insulation within concrete masonry units, or CMUs)	Less than 90 m <sup>2</sup> (approximately 1,000 ft <sup>2</sup> )	At least 3 samples
	Between 90 and 450 m <sup>2</sup> (approximately 5,000 ft <sup>2</sup> )	At least 5 samples
	Greater than 450 m <sup>2</sup>	At least 7 samples
Flooring, including vinyl sheet flooring (and backing) and floor tiles	Any size	At least 1 sample per flooring type in each room (and 1 from each layer of flooring)
Mechanical insulation, including duct taping, pipe insulation, elbows and boiler/tank insulation	Any size	At least 3 samples
Mastics and putties, including duct mastic (around penetrations) and window putty	Any size	At least 3 samples
Roofing materials, including felting and shingles	Less than 90 m <sup>2</sup> (approximately 1,000 ft <sup>2</sup> )	At least 1 sample (each layer of material must be sampled)
	Between 90 and 450 m <sup>2</sup> (approximately 5,000 ft <sup>2</sup> )	At least 2 samples (each layer of material must be sampled)
	Greater than 450 m <sup>2</sup>	At least 3 samples (each layer of material must be sampled)
Asbestos cement (transite) board and pipe	Any size	At least 1 sample
Other materials	Any size	At least 1 sample per type of material

\* Homogeneous material is considered uniform in texture and appearance, was installed at one time, and is likely to be of only one type of material or formulation.

\*\* If the material is assumed to contain asbestos, samples do not have to be collected. The professional judgment of a qualified person can be used to reduce the number of bulk samples of homogeneous materials. If fewer samples than the minimum recommended number are collected, surveyors should document the rationale for their position in the survey report.

#### High Risk Work Activities

Work with or in proximity to ACM that requires a high level of control (ex. containment and PAPR) to prevent worker exposure to airborne fibers.

##### Examples:

- Removing asbestos-containing textured materials from ceilings or walls
- Removal of vermiculite insulation
- Dismantling, repairing or altering a boiler, furnace or kiln on which asbestos-containing insulating materials have been applied.
- Using power tools to cut or drill ACM
- See WorkSafeBC's "Asbestos Safe Work Procedures" for more examples.

##### Work Procedures:

- Same as Alberta's high risk.

#### Air Monitoring

Moderate Risk – Occupationals, Outside Work Areas, Field Blanks.

\*Air clearances not required, but may be asked for depending on the work area, ex. a school or hospital.

High Risk – Occupationals, OWA, Clean Room, Field Blanks, Air Clearances. Following air clearance, workers must use moderate risk work procedures when taking down the containment.

\*Air Clearance Requirements – must be less than 0.02 fibers/mL. Must have at least 2,000 L, and 1 sample per 270m<sup>3</sup>, if the containment is smaller than 270m<sup>3</sup> then do at least two samples.

\*Inspections for High Risk – daily during work, final before glue out.

Asbestos Clearance Document: along with what we already put in our clearance documents, should also include

- Reference to hazardous materials survey (name of company or surveyor and date it was completed)
- NOP number
- Waste manifest documentation

### **Lead Based Paint**

Some paints used before 1950 contained as much as fifty percent lead by weight. Lead was often used as a pigment in white and pastel shades. Lead made paint dry faster, last longer and gave the colours a more vibrant look. In the 1950s the amount of lead used in paint decreased as other pigments were substituted. In 1976, federal regulations limited the level of lead in paint to 0.5 percent by weight. In 2009 they were limited the level of lead in paint again to 0.009 percent by weight. Exterior paints could still contain more lead. The yellow markings found on highways still use lead-based paint. By 1991, Canadian paint manufacturers had voluntarily stopped using lead altogether. Currently, paint considered to be lead containing are those with a content of 90 ppm (0.009%) or greater<sup>2</sup>.

Lead-based paint does not pose a danger if it is in good condition, and is not disturbed. However, if the paint is peeling or flaking, a potentially harmful situation exists. Even friction from opening and closing doors or windows with painted frames can produce paint dust. This dust can get onto children's hands and toys, and from there, into their mouths. Paint chips can easily be swallowed by young children. Ledges and trim that are accessible to teething toddlers should also be cause for concern.<sup>3</sup>

The requirements for lead can be found within the Occupational Health and Safety Regulation. Part 4 of the Occupational Health and Safety Code sets limits for exposure to Chemical Hazards, Biological Hazards and Harmful Substances. Part 4 of the Code (Sections 16 through 27) outlines the General Requirements for employers to ensure worker exposure to a harmful substance is kept as low as reasonably practicable. In summary, the general requirements portion addresses the following:

1. worker exposure to harmful substances;
2. worker exposure during shifts greater than 8-hours;
3. airborne concentration measurements;
4. potential worker exposure;

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<sup>2</sup> Government of BC. WorkSafe BC. *Lead-Containing Paints and Coatings: Preventing Exposure in the Construction Industry* (2011).

<sup>3</sup> Ibid.

5. worker overexposure;
6. worker decontamination;
7. emergency bath, showers, eye wash equipment;
8. prohibited activities;
9. codes of practice; and
10. storage of harmful substances.

Sections 41 through 43 outline the employer's requirements for lead at the work site. With respect to the Code it primarily applies to managing worker exposure to lead. Lead-based paint should be removed following very specific guidelines according to industry-accepted practices, as well as the Alberta Occupational Health and Safety Act, Regulations and adopted Code.

### **Polychlorinated Biphenyls**

PCBs are human-produced chemicals. They do not occur naturally. They are made by attaching chlorine molecules to a biphenyl molecule. There are 209 possible PCB compounds. All PCBs are heavy, colourless oils or resinous solids. They are very stable since they do not react with other chemicals. They have a high boiling point and do not conduct electricity. They are not soluble in water.

Polychlorinated biphenyls are no longer manufactured in North America. They are still found in older electrical transformers and capacitors, heat transfer equipment, and electro-magnets. However, when this equipment is serviced, other fluids replace the PCBs. PCBs or PCB-contaminated materials must be disposed of appropriately.

Storage sites are licensed and inspected regularly by provincial government inspectors. The owner or producer of the PCBs, or PCB-contaminated material, is responsible for their proper disposal or storage. The Waste Control Regulation under the Environmental Protection and Enhancement Act outlines the requirements for storage of PCB-containing materials not in use and their disposal. Once fluorescent light ballasts are not in service then they must be stored or disposed of in accordance with the Waste Control Regulation.

### **Mercury**

Mercury (Hg) is a very dense metal that expands and retracts evenly with changes in the temperature. Mercury exhibits super conductivity, which is the ability to conduct electrical currents with no resistance, and is the only metal that exists as a liquid at room temperature.

Mercury is released into the air, water and land, and it cycles between them due to its ability to change form with temperature. Mercury gets into the soil through natural breakdown of rocks, the disposal of mercury in landfills, and atmospheric deposition. It enters the water through runoff, atmospheric deposition, and when products containing mercury are poured down the drain. Mercury is released to the atmosphere through coal-fired utility, chlor-alkali plants, and incinerator emissions, as well as evaporation from water and land. Once mercury enters this cycle, it can remain in the environment for years as it accumulates. Mercury cannot be removed, but it can be prevented from ever entering the environment.

### **Miscellaneous Chemicals**

Miscellaneous chemicals may require special handling procedures as outlined under the Occupational Health and Safety Act and Environmental Protection and Enhancement Act. For the purpose of this survey miscellaneous chemicals included materials that had labeling or

packaging that falls under the Hazardous Product Act (Workplace Hazardous Materials Information System (WHMIS)) or Transportation of Dangerous Goods Act.

### **Ozone-depleting Substances**

In September of 1993, Alberta enacted the *Ozone-Depleting Substances and Halocarbons Regulation* (AR 181/2000), which governs the use, handling and release of CFCs, HCFCs and halons and other ozone-depleting substances. Provincial regulations require all persons servicing air conditioning or refrigeration equipment to be certified in accordance with the Apprenticeship and Industries Training Act and the associated regulations.

Canada banned chlorinated fluorocarbons as a propellant in aerosol cans in the 1980s, reducing their direct release into the atmosphere. As of January 1, 1996, no CFCs may be produced or imported into Canada.

Hydrochlorofluorocarbons (HCFCs) are chemical compounds related to CFCs and about 95 percent less damaging to the ozone layer. They are mainly used as a refrigerant in domestic air conditioning systems and in manufacturing plastic, insulation and packaging. Because HCFCs do contribute to ozone depletion, Canada is phasing out the production and use of HCFCs between the years 2010-2020. Therefore, HCFCs should only be used as a short-term alternative for replacing CFCs.

Most household refrigerators contain a chlorofluorocarbon refrigerant, sometimes called CFC-12 or R-12. While units manufactured prior to 1993 can contain CFCs or HCFCs, new refrigerators manufactured after 1993 can contain an alternate refrigerant with lower or nonexistent ozone-depleting potential. Alternate refrigerants are continuously being developed. Labels attached to all household units should list the refrigerant being used.

**APPENDIX II**  
**PHOTOGRAPHS**





**Photograph 01:** Sample L-1 – Lead Containing Brown/Green Painted Wood Door and Roof Trim from the Pit Privy #1.



**Photograph 02:** Sample L-2, L-3, and L-4 – Lead Containing White (with Beige and Grey Underneath) Painted Interior Wood Walls and Ceiling in Pit Privy #1.



**Photograph 03:** Sample L-5 – Lead Containing Brown Paint from the Wooden Doors and Trim of Pit Privy #2.

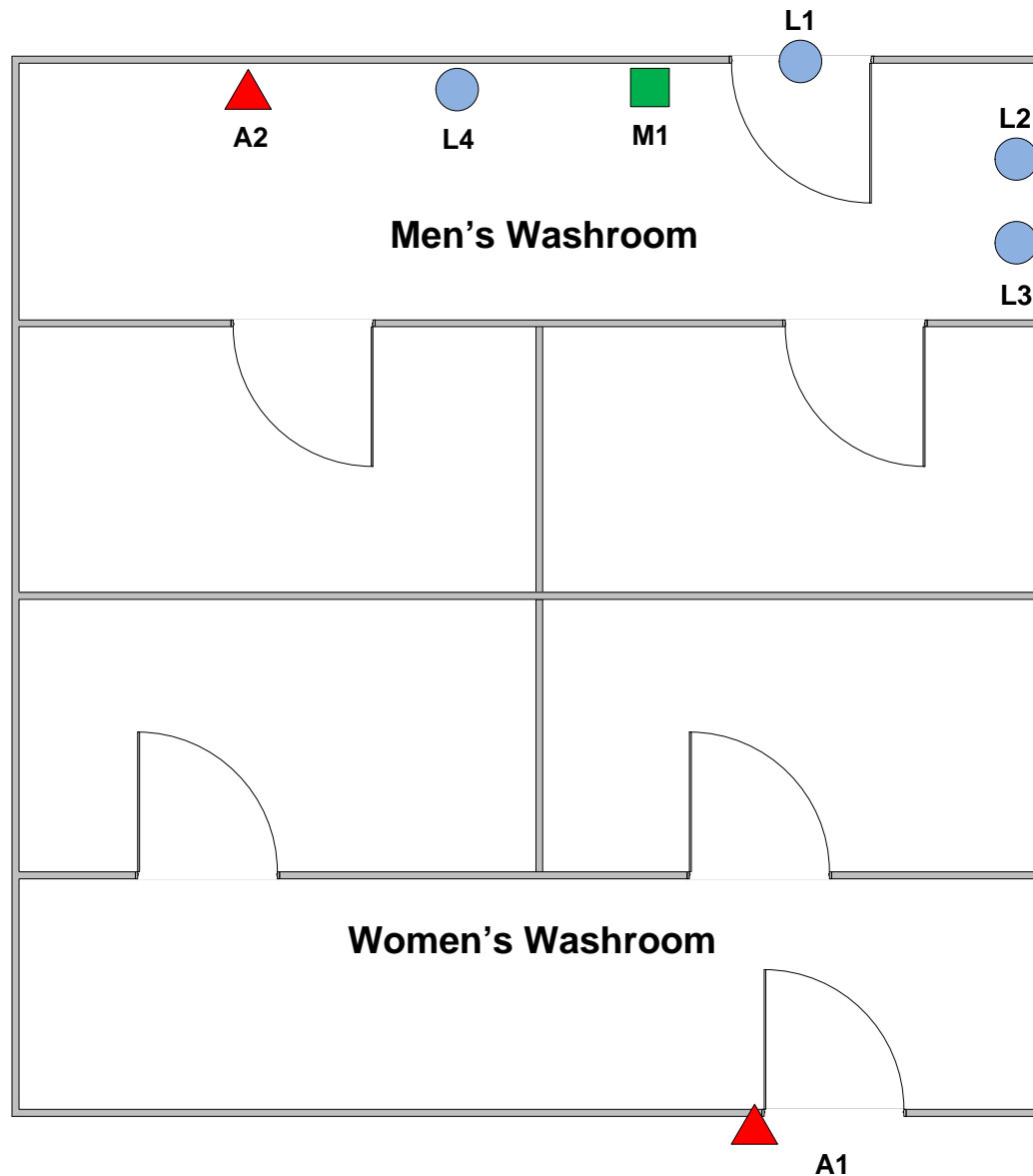


**Photograph 04:** Sample L-6 – Lead Containing White Paint on the Interior Wood Walls and Ceiling of Pit Privy #2.



**Photograph 05:** Hand Sanitizer (classified as a miscellaneous chemical) in Pit Privy #1 and #2.

**APPENDIX III**  
**FLOOR PLANS**



**Hazardous Materials  
Assessment**  
Sample Locations and  
Observations  
*Pit Privy #1 (North)*




**Project #:** AS 8674

**Client:**  
AECOM

**Project Location:**  
Yoho National Park of Canada –  
Monarch Campground, Yoho  
Valley Road, near Field, British  
Columbia

**Legend:**



-  Asbestos Sample
-  Lead Paint Sample
-  Mould Bulk Sample

**Notes:**  
- Not to Scale

**Hazardous Materials  
 Assessment**  
 Sample Locations and  
 Observations

*Pit Privy #1 (North)*

**Project #:** AS 8674

**Client:**  
 AECOM

**Project Location:**

Yoho National Park of Canada –  
 Monarch Campground, Yoho  
 Valley Road, near Field, British  
 Columbia

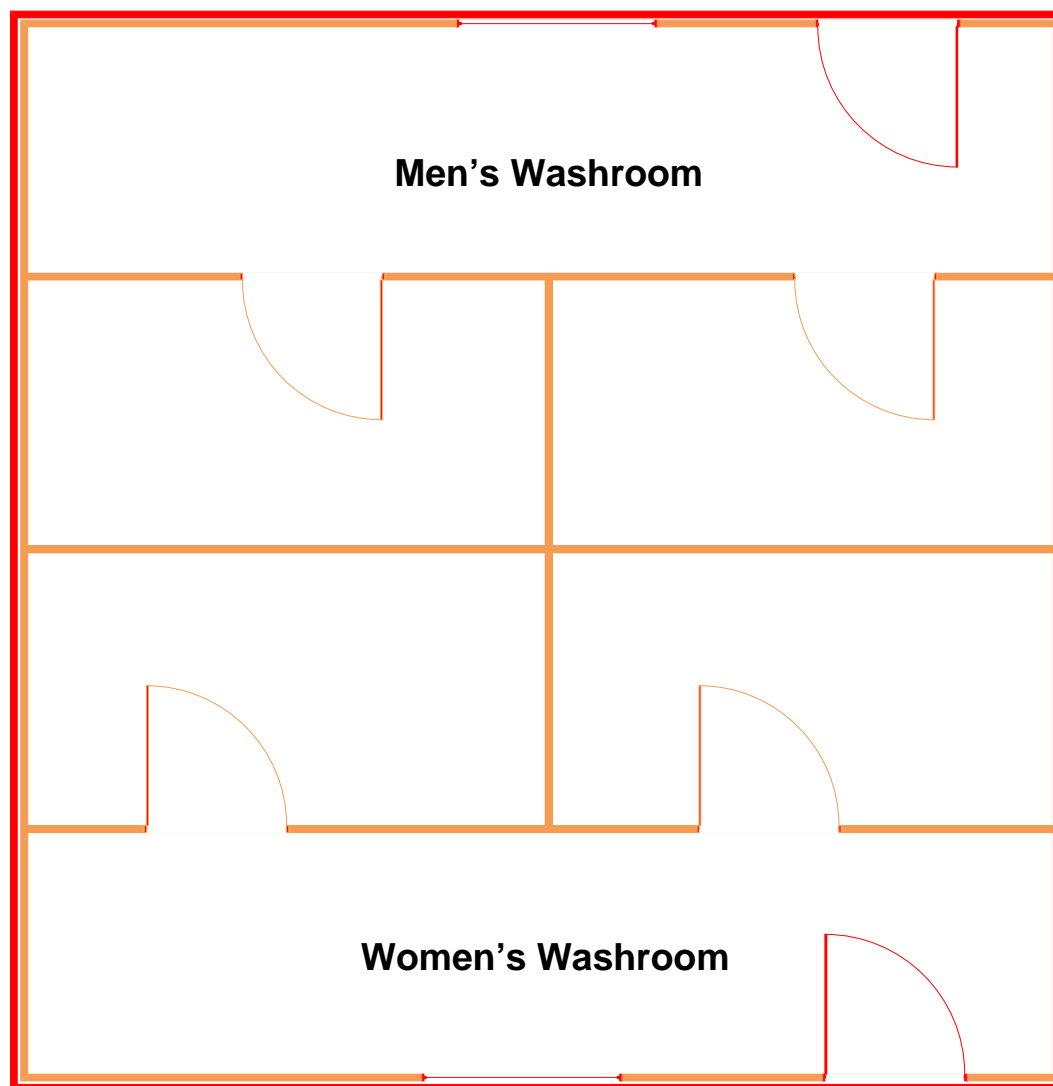
**Legend:**

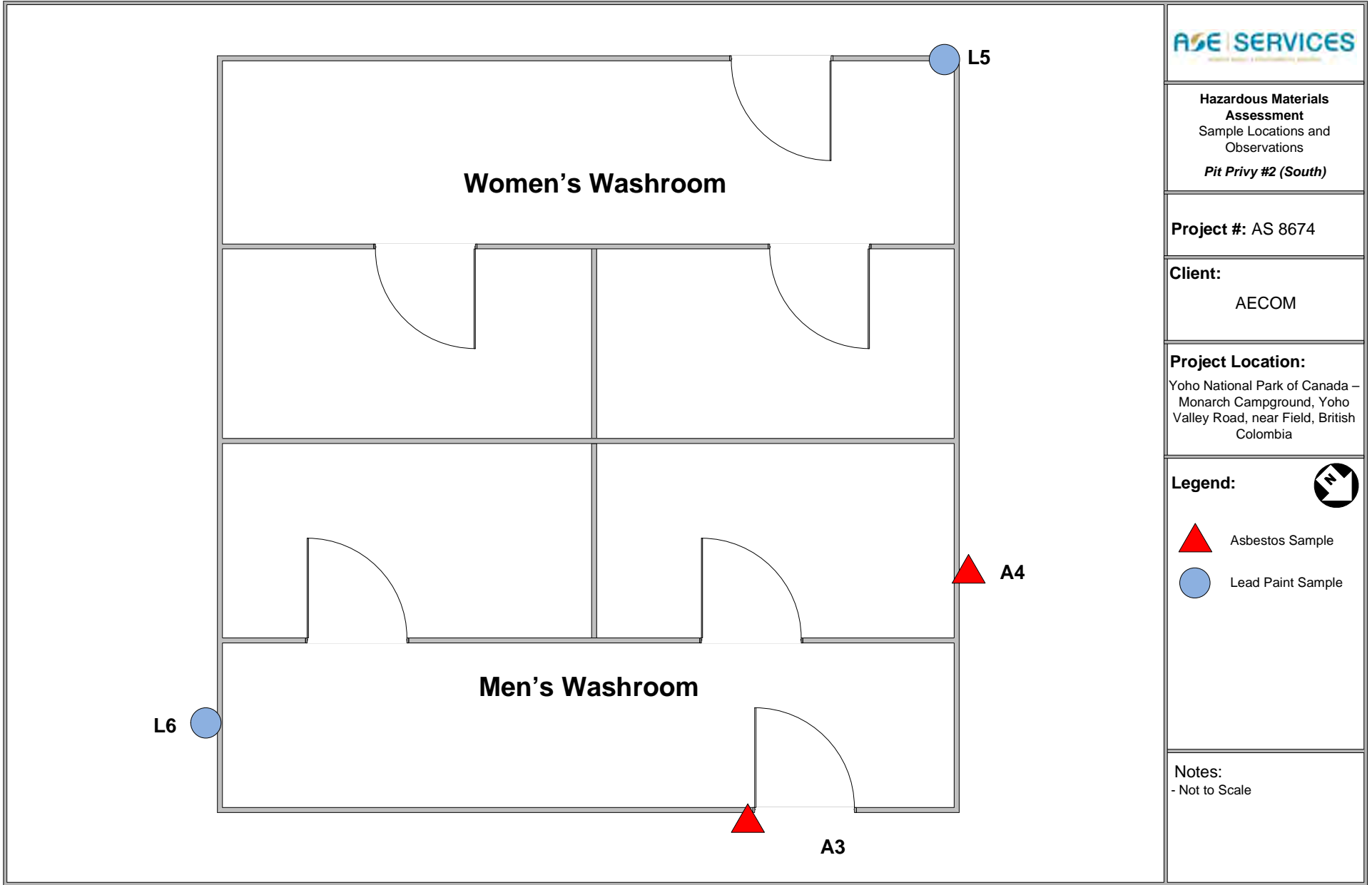


Lead Containing Brown/  
 Green Paint on Doors,  
 Vents and Roof Trim

Lead Containing White,  
 Beige and Grey Paint on  
 Walls, Ceiling and Stalls

**Notes:**  
 - Not to Scale





**Hazardous Materials  
Assessment**  
Sample Locations and  
Observations  
*Pit Privy #2 (South)*



**Project #:** AS 8674

**Client:**  
AECOM

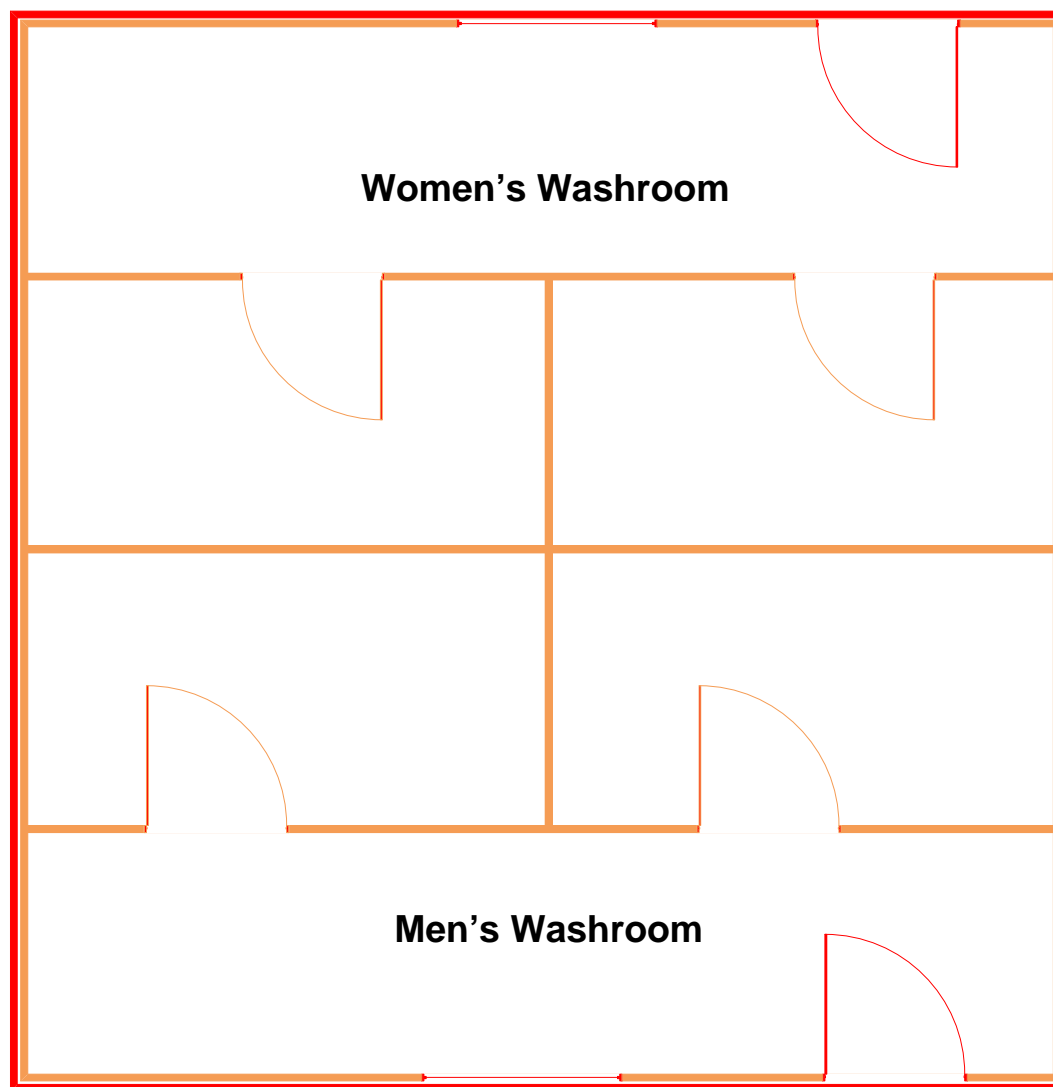
**Project Location:**  
Yoho National Park of Canada –  
Monarch Campground, Yoho  
Valley Road, near Field, British  
Columbia

**Legend:**



-  Asbestos Sample
-  Lead Paint Sample

**Notes:**  
- Not to Scale



**Hazardous Materials Assessment**

Sample Locations and Observations

*Pit Privy #2 (South)*

**Project #:** AS 8674

**Client:**

AECOM

**Project Location:**

Yoho National Park of Canada –  
Monarch Campground, Yoho  
Valley Road, near Field, British  
Columbia

**Legend:**



Lead Containing Brown/  
Green Paint on Doors,  
Vents and Roof Trim

Lead Containing White  
Paint on Walls, Ceiling  
and Stalls

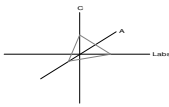
**Notes:**

- Not to Scale

**APPENDIX IV**  
**LABORATORY REPORTS**

**CA Labs**  
Dedicated to  
Quality

**Crisp Analytical, L.L.C.**  
1929 Old Denton Road  
Carrollton, TX 75006  
Phone 972-242-2754  
Fax 972-242-2798



**CA Labs, L.L.C.**  
12232 Industriplex, Suite 32  
Baton Rouge, LA 70809  
Phone 225-751-5632  
Fax 225-751-5634

## **Materials Characterization - Bulk Asbestos Analysis**

### **Laboratory Analysis Report - Polarized Light**

#### **ASE Services**

2216 27th Ave. NE, Ste. 208  
Calgary, AB T2E 7A7

Customer Project: AS8674, Monarch Campground  
Reference #: CAL1801171AF Date: 1/16/2018

#### **Analysis and Method**

Summary of polarized light microscopy (PLM / Stereomicroscopy bulk asbestos analysis) using the methods described in 40CFR Part 763 Appendix E to Subpart E (Interim and EPA 600 / R-93 / 116 (Improved)). The sample is first viewed with the aid of a stereomicroscope. Numerous liquid slide preparations are created for analysis under the polarized microscope where identifications and quantifications are performed. Calibrated liquid refractive oils are used as liquid mounting medium. These oils are used for identification (dispersion staining). A calibrated visual estimation is reported, should any asbestiform mineral be present. Other techniques such as acid washing are used in conjunction with refractive oils for detection of smaller quantities of asbestos. All asbestos percentages are based on calibrated visual estimation traceable to NIST standards for regulated asbestos. Traceability to measurement and calibration is achieved by using known amounts and types of asbestos from standards where analyst and laboratory accuracy are measured. As little as 0.001% asbestos can be detected in favorable samples, while detection in unfavorable samples may approach the detection limit of 0.50% (well above the laboratory definition of trace).

#### **Discussion**

Vermiculite containing samples may contain trace amounts of actinolite/tremolite. When not detected by PLM, these samples should be analyzed using TEM methods and / or water separation techniques. Suspected actinolite/vermiculite presence will be indicated through the sample comment section of this report.

Fibrous talc containing samples may contain a regulated asbestos fiber known as anthophyllite. Under certain conditions the same fiber may actually contain both talc and anthophyllite (a phenomenon called intergrowth). Again, TEM detection methods are recommended. CA Labs PLM report comments will denote suspected amounts of asbestiform anthophyllite with talc, where further analysis is recommended.

Some samples (floor tiles, surfacings, etc.) may contain fibers too small to be detectable by PLM analysis and should be analyzed by TEM bulk protocols.

A "trace asbestos" will be reported if the analyst observes far less than 1% asbestos. CA Labs defines "trace asbestos" as a few fibers detected by the analyst in several preparations and will indicate as such under these circumstances.

Since allowable variation in quantification of samples close to 1% is high, <1% may be reported. Such results are ideal for point counting, and the technique is mandatory for friable samples (NESHAP, Nov. 1990 and clarification letter 8 May 1991) under 1% percent asbestos or "trace asbestos". **In order to make all initial PLM reports issued from CA Labs NESHAP compliant, all <1% asbestos results (except floor tiles) will be point counted at no additional charge.**

#### **Qualifications**

CA Labs is accredited by the National Voluntary Accreditation Program (NVLAP) for selected test methods for airborne fiber analysis (TEM), and for bulk asbestos fiber analysis (PLM). CA Labs is also accredited by AIHA LAP, LLC. in the PLM asbestos field of testing for Industrial Hygiene. All analysts have completed college courses or hold a degree in a natural science (geology, biology, or environmental science). Recognition by a state professional board in one these disciplines is preferred, but not required. Extensive in-house training programs are used to augment the educational background of the analyst. The Laboratory Director and Quality Manager have received supplemental McCrone Research training for asbestos identification. Analysis performed at Crisp Analytical Labs, LLC 1929 Old Denton Road Carrollton, TX 75006

*Dallas NVLAP Lab Code 200349-0 TEM/PLM TCEQ# T104704513-15-3 TDH 30-0235*  
**AIHA LAP, LLC Laboratory #102929**



## Overview of Project Sample Material Containing Asbestos

<b>Customer Project:</b>		AS8674, Monarch Campground		<b>CA Labs Project #:</b>	CAL1801171AF
Sample #	Layer #	Analysts	Physical Description of Subsample	Asbestos type / calibrated visual estimate percent	List of Affected Building Material Types

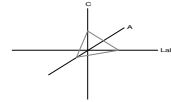
**No Asbestos Detected.**

Dallas NVLAP Lab Code 200349-0 TEM/PLM TCEQ# T104704513-15-3 TDH 30-0235  
**AIHA LAP, LLC Laboratory #102929**

### **Glossary of abbreviations (non-asbestos fibers and non-fibrous minerals):**

ca - carbonate	pe - perlite	fg - fiberglass	pa - palygorskite (clay)
gypsum - gypsum	qu - quartz	mw - mineral wool	
bi - binder		wo - wollastonite	
or - organic		ta - talc	
ma - matrix		sy - synthetic	
mi - mica		ce - cellulose	
ve - vermiculite		br - brucite	
ot - other		ka - kaolin (clay)	

This report relates to the items tested. This report is not to be used by the customer to claim product certification, approval or endorsement by NVLAP, NIST, AIHA LAP, LLC, or any other agency of the federal government. This report may not be reproduced except in full without written permission from CA Labs. These results are submitted pursuant to CA Labs' current terms and sale, condition of sale, including the company's standard warranty and limitations of liability provisions and no responsibility or liability is assumed for the manner in which the results are used or interpreted. Unless notified in writing to return the samples covered by this report, CA Labs will store the samples for a period of ninety (90) days before discarding. A shipping or handling fee may be assessed for the return of any samples.



## Polarized Light Asbestiform Materials Characterization

<b>Customer Info:</b>		<b>Attn:</b>		<b>Customer Project:</b>		<b>CA Labs Project #:</b>	
<b>ASE Services</b>				AS8674, Monarch Campground		CAL1801171AF	
2216 27th Ave. NE, Ste. 208 Calgary, AB T2E 7A7				<b>Turnaround Time:</b> 5 Days		<b>Date:</b> 1/16/2018	
Phone # 403-475-0963						<b>Samples Received:</b> 1/10/18 10:30am	
Fax # 403-475-0971						<b>Date Of Sampling:</b> 1/8/2018	
						<b>Purchase Order #:</b> AS8674	
Sample #	Com ment	Layer #	Analysts Physical Description of Subsample	Homo- geneo us (Y/N)	Asbestos type / calibrated visual estimate percent	Non-asbestos fiber type / percent	Non-fibrous type / percent
A-1		1-1	Monarch Pit Privy 1 Windows and Doors Brown Caulking/ brown caulking	y	None Detected	2% sy	98% qu,gy,bi
A-2		2-1	Monarch Pit Privy 1 Mens Wall Gray Mastic/ gray caulking	y	None Detected		100% qu,gy,bi
A-3		3-1	Monarch Pit Privy 2 Windows and Doors Brown Caulking/ brown caulking	y	None Detected	3% sy	97% qu,gy,bi
A-4		4-1	Monarch Pit Privy 2 Paper Flashing Under Wood Siding Gray Caulking/ black tar paper	y	None Detected	75% ce	25% qu,bi

Dallas NVLAP Lab Code 200349-0 TEM/PLM TCEQ# T104704513-15-3 TDH 30-0235

### AIHA LAP, LLC Laboratory #102929

Analysis Method: Interim (40CFR Part 763 Appendix E to Subpart E) / Improved (EPA-600 / R-93/116). All samples received in good condition unless noted.

Preparation Method: HCL acid washing for carbonate based samples, chemical reduction for organically bound components, oil immersion for identification of asbestos types by dispersion attaining / becke line method.

ca - carbonate	mi - mica	fg - fiberglass	ce - cellulose
gy - gypsum	ve - vermiculite	mw - mineral wool	br - brucite
bi - binder	ot - other	wo - wollastonite	ka - kaolin (clay)
or - organic	pe - perlite	ta - talc	pa - palygorskite (clay)
ma - matrix	qu - quartz	sy - synthetic	

Approved Signatories:

Tanner Rasmussen  
Analyst

Technical Manager  
Tanner Rasmussen

Senior Analyst  
Julio Robles

1. Fire Damage significant fiber damage - reported percentages reflect unaltered fibers
2. Fire Damage no significant fiber damages effecting fibrous percentages
3. Actinolite in association with Vermiculite
4. Layer not analyzed - attached to previous positive layer and contamination is suspected
5. Not enough sample to analyze

6. Anthophyllite in association with Fibrous Talc
7. Contamination suspected from other building materials
8. Favorable scenario for water separation on vermiculite for possible analysis by another method
9. < 1% Result point counted positive
10. TEM analysis suggested

CERTIFICATE OF ANALYSIS


Client: Alberta Safety & Environmental Services  
208, 2216 27th Ave NE  
Calgary AB T2E 7A7  
  
Client: ALB464

Report Date: 1/17/2018  
Report No.: 554989 - Lead Paint  
Project: Monarch Campground  
Project No.: AS 8674

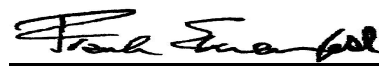
LEAD PAINT SAMPLE ANALYSIS SUMMARY

<b>Lab No.:</b> 6420544 <b>Client No.:</b> L-1	<b>Description:</b> Brown/Green Wood Door Paint <b>Location:</b> Monarch Pit Privy #1, 1/8-1/9/18	<b>Result (% by Weight):</b> 0.043 <b>Result (ppm):</b> 430 <b>Comments:</b>
<b>Lab No.:</b> 6420545 <b>Client No.:</b> L-2	<b>Description:</b> White Paint Wood Paint <b>Location:</b> Monarch Pit Privy #1, 1/8-1/9/18	<b>Result (% by Weight):</b> 0.047 <b>Result (ppm):</b> 470 <b>Comments:</b>
<b>Lab No.:</b> 6420546 <b>Client No.:</b> L-3	<b>Description:</b> Beige (Under White) Paint Wood Walls <b>Location:</b> Monarch Pit Privy #1, 1/8-1/9/18	<b>Result (% by Weight):</b> 0.018 <b>Result (ppm):</b> 180 <b>Comments:</b>
<b>Lab No.:</b> 6420547 <b>Client No.:</b> L-4	<b>Description:</b> Grey (Under White, Above Beige) Paint Wood Walls <b>Location:</b> Monarch Pit Privy #1, 1/8-1/9/18	<b>Result (% by Weight):</b> 0.044 <b>Result (ppm):</b> 440 <b>Comments:</b>
<b>Lab No.:</b> 6420548 <b>Client No.:</b> L-5	<b>Description:</b> Brown Paint Wood Trim/Doors <b>Location:</b> Monarch Pit Privy #2, 1/8-1/9/18	<b>Result (% by Weight):</b> 0.40 <b>Result (ppm):</b> 4000 <b>Comments:</b>
<b>Lab No.:</b> 6420549 <b>Client No.:</b> L-6	<b>Description:</b> White Paint Wood Interior Walls <b>Location:</b> Monarch Pit Privy #2, 1/8-1/9/18	<b>Result (% by Weight):</b> 0.049 <b>Result (ppm):</b> 490 <b>Comments:</b>

Please refer to the Appendix of this report for further information regarding your analysis.

Date Received: 1/10/2018  
Date Analyzed: 01/17/2018  
Signature:   
Analyst: Chad Shaffer

Approved By:

  
Frank E. Ehrenfeld, III  
Laboratory Director

## CERTIFICATE OF ANALYSIS

Client: Alberta Safety & Environmental Services  
208, 2216 27th Ave NE  
Calgary AB T2E 7A7  
Client: ALB464

Report Date: 1/17/2018  
Report No.: 554989 - Lead Paint  
Project: Monarch Campground  
Project No.: AS 8674

## Appendix to Analytical Report:

### Customer Contact:

Analysis: ASTM D3335-85a

This appendix seeks to promote greater understanding of any observations, exceptions, special instructions, or circumstances that the laboratory needs to communicate to the client concerning the above samples. The information below is used to help promote your ability to make the most informed decisions for you and your customers. Please note the following points of contact for any questions you may have.

**iATL Customer Service:** customerservice@iatl.com

**iATL Office Manager:** cdavis@iatl.com

**iATL Account Representative:** Cassie Doherty

**Sample Login Notes:** See Batch Sheet Attached

**Sample Matrix:** Paint

**Exceptions Noted:** See Following Pages

### General Terms, Warrants, Limits, Qualifiers:

General information about iATL capabilities and client/laboratory relationships and responsibilities are spelled out in iATL policies that are listed at [www.iATL.com](http://www.iATL.com) and in our Quality Assurance Manual per ISO 17025 standard requirements. The information therein is a representation of iATL definitions and policies for turnaround times, sample submittal, collection media, blank definitions, quantification issues and limit of detection, analytical methods and procedures, sub-contracting policies, results reporting options, fees, terms, and discounts, confidentiality, sample archival and disposal, and data interpretation.

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### Information Pertinent to this Report:

Analysis by ASTM D3335-85a by AAS

#### Certification:

- National Lead Laboratory Program (NLLAP): AIHA-LAP, LLC No. 100188

- NYSDOH-ELAP No. 11021

Regulatory limit is 0.5% lead by weight (EPA/HUD guidelines). Recommend multiple sampling for all samples less than regulatory limit for confirmation.

All results are based on the samples as received at the lab. iATL assumes that appropriate sampling methods have been used and that the data upon which these results are based have been accurately supplied by the client.

Method Detection Limit (MDL) per EPA Method 40CFR Part 136 Appendix B.

Reporting Limit (RL) based upon Lowest Standard Determined (LSD) in accordance with AIHA-ELLAP policies.

LSD=0.2 ppm MDL=0.005% by weight. RL= 0.010% by weight (based upon 100 mg sampled).

### Disclaimers / Qualifiers:

There may be some samples in this project that have a "NOTE:" associated with a sample result. We use added disclaimers or qualifiers to inform the client about something that requires further explanation. Here is a complete list with highlighted disclaimers pertinent to this project. For a full explanation of these and other disclaimers, please inquire at [customerservice@iatl.com](mailto:customerservice@iatl.com).

- \* Insufficient sample provided to perform QC reanalysis (<200 mg)
- \*\* Not enough sample provided to analyze (<50 mg)
- \*\*\* Matrix / substrate interference possible.



**BIO-CHEM CONSULTING**

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### Analytical Test Report

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**Test Report #:** BC31664A

**Revision #:** 0

**Issue Date:** 11-Jan-18

**Client:** ASE Services

**Code:** ASE

**Contact:** Alisa Robertson

**Job #:** AS 8674

**P.O.#:**

**Address:** #208, 2216 – 27 Avenue NE  
Calgary AB  
T2E 7A7

**Internal Project #:** BC31664

**Sampled By:** AR/CT

**Sample Location:** Monarch and Kicking Horse Campground

**Sample Date:** 8-Jan-18

**Date Received:** 10-Jan-18

Analytical	# of Pages
Direct	1

Total (incl. Cover)	2
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**Comments:** None.

Approved By: \_\_\_\_\_

Michael Busse, B.Sc.

Laboratory Supervisor

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- 1) THIS REPORT MAY NOT BE REPRODUCED IN PART WITHOUT THE EXPRESSED WRITTEN CONSENT OF THE LABORATORY.
  - 2) ANY REMAINING SAMPLES WILL BE DISPOSED OF 30 DAYS FOLLOWING ANALYSIS. CONTACT THE LABORATORY IF ADDITIONAL SAMPLE STORAGE TIME IS REQUIRED.
  - 3) ALL LABORATORY ANALYSES INCORPORATE STANDARD QC PROTOCOLS; HOWEVER, UNSIGNED TEST REPORTS ARE PRELIMINARY AND UNOFFICIAL. IF REQUIRED, PLEASE CONTACT LABORATORY SUPERVISOR FOR QC DATA REPORTS.
  - 4) REPORTED TEST RESULTS RELATE ONLY TO THE SAMPLES AS RECEIVED BY THE LABORATORY.
  - 5) BIO-CHEM CONSULTING SERVICES (1980) LTD. ASSUMES NO LIABILITY FOR THE USE OR INTERPRETATION OF THE TEST RESULTS
  - 6) WHERE APPLICABLE, ESTIMATION OF THE MEASUREMENT UNCERTAINTY IS AVAILABLE ON REQUEST.
  - 7) THIS LABORATORY OR SUB-CONTRACTED LABORATORY IS NOT ACCREDITED FOR THE TESTS MARKED <sup>§</sup>
- 

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Please note that laboratory privacy policy limits discussion of this report to the client listed above.  
For all others, please direct questions directly to client listed.

**CERTIFICATE OF ANALYSIS**  
**Direct Microscopic Fungal Analysis**

**B.C. Report No. :** BC31664A Rev. 0  
**Client Job No.:** AS 8674

**Date Analyzed:** 11-Jan-18  
**Page Issue Date:** 11-Jan-18

Sample #	Sample Description	Observation/Comments	Relative Abundance	Distribution
1	M-1: Monarch Pit Privy #1 - Men's Bathroom, by Door	No Spores/Fungal Structures Observed	N/A	N/A
2	M-2: KH Shower House - Women's Shower Room	<i>Penicillium/Aspergillus</i> - like	Low	MH
		Hyphal Fragments	Very High	UD
		Non-Specified Spore	High	SH
		<i>Cladosporium</i>	Moderate	MH

**Relative Abundance Descriptions (approximate magnification: X400; Field of View (FOV): 0.15mm<sup>2</sup>)**

Very Low: much less than 1 spore/structure observed per FOV

Low: <1 spore/structure observed per FOV

Moderate: 1 to 100 spores/structures observed per FOV

High: >100 spores/structures observed per FOV

Very High: much greater than 100 spores/structures observed per FOV

**Distribution (Heterogeneity) Descriptions**

HH: Highly Heterogeneous

MH: Moderately Heterogeneous

SH: Somewhat Heterogeneous

UD: Uniform (Homogeneous) Distribution

**Comments:**

None.