Public Works and Government Services Canada

Requisition No. _____

DRAWINGS & SPECIFICATIONS
for

Fire Sprinkler Rehabilitation
Gulf of Georgia Cannery, Steveston, BC

Project No.: R.089515.001

APPROVED BY:

A/DERM — JUNE 28/2018
Regional Manager, AES — Date

2018.03.28
Construction Safety Coordinator — Date

TENDER:

18/07/03
Project Manager — Date

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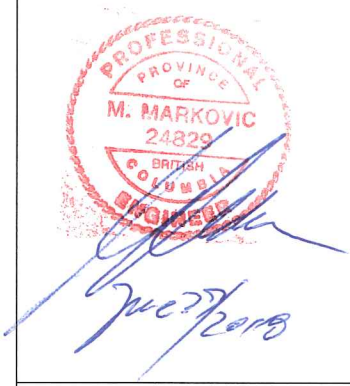
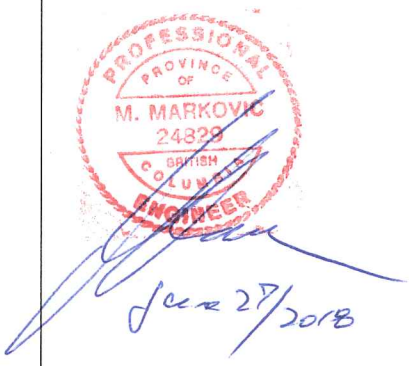
Mechanical 	**Plumbing** 	**Fire Protection** 
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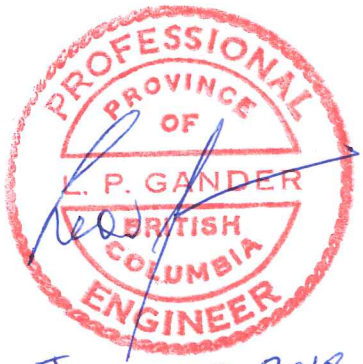
Electrical  June 27, 2018.		

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PART 1 GENERAL

1.1 Definitions – Agreement, Participants and Continuity

.1 Work of this project will be executed under a “Fixed Price” Agreement between the Government of Canada, the Owner, hereinafter called the “Departmental Representative” and the Contractor.

.2 Architectural, Engineering and other Consultants will also be referred to as the “Departmental Representative”.

1.2 Authorities

.1 Perform Work in accordance with the National Building Code of Canada (NBCC), 2015, the BC Building Code (BCBC), 2012, Worksafe BC regulations, and any other code of provincial or local application. In any case of conflict or discrepancy, the more stringent requirements shall apply.

.2 Meet or exceed requirements of specified standards, codes and referenced documents.

1.3 Description of Work

.1 This Contract covers the following work at the multiple buildings and supporting wood pier substructure of the Gulf of Georgia Cannery National Historic Site (the “Cannery”), located at 12138 Fourth Avenue, Richmond, BC. The building complex is a classified FHBRO Heritage resource, and Heritage Character Defining Elements must be protected, as outlined in the Heritage Character Statement and Commemorative Integrity Statement (ref. Appendix). The heritage value of the Gulf of Georgia Cannery is embodied in the integrity of the material fabric of the building, the historic artifacts it contains, and its compatible context including the site. It is a requirement that all staff employed by the Contractor and Subcontractors review the Heritage Character Statement and Commemorative Integrity Statement as guidance in the performance of all aspects of the Work.

.2 Existing Conditions: The Cannery complex is a historic amalgamation of medium and large wood-framed industrial buildings located on a wood pier over Fraser River estuarine tidewater. It has unique physical features and other limitations affecting the performance of the Work, such as but not limited to:

.1 Pier substructure: water level fluctuations including tides;

.2 Buildings Ground Floor: numerous exhibits and large fixed industrial artifacts throughout;

.3 Buildings Mezzanines: storage of medium- and small-sized artifacts on free-standing metal rack shelves arranged in aisles, on the floor, and suspended in the rafters above. Observe posted structural load limitations on mezzanines & provide temporary structural reinforcement where loads are exceeded, per Section 01 35 33 part 1.19;

.4 and as further detailed below.

Refer to photographs of existing conditions on drawing sheet A6.10.

.3 The Work includes, but is not limited to, the following general scope:

.1 Fire Protection:

.1 Remove existing (but not original) dry fire protection systems, and supply and install new dry fire protection system for the pier substructure and building(s) of the Gulf of Georgia Cannery.

.2 Civil:

.1 New Drain Sump

.2 New Discharge Standpipe

.3 Electrical:

.1 Replace and upgrade the existing emergency battery lighting installation with new wiring and emergency lighting powered by mini - inverters

.2 Replace the existing fire alarm system and wiring to provide renewal of the fire alarm installation.

.3 Provide wiring of the new sprinkler installation to accommodate connection to the fire alarm system.

.4 Replace and upgrade the installation of exit signage in the building.

.5 Update Fire Safety Plan at each building exit.

.4 Structural:

.1 Remote Valve Room

.5 Architectural

.1 Repairs to the Sprinkler Room (Ground Floor)

.2 New Remote Valve Room (Mezzanine)

.3 New Electrical Closet in Maintenance Workshop

.4 Minor Work in support of Fire Protection, Electrical, and other measures

.5 Upgrade of Door Hardware at 2 existing Exit Doors

.6 Demolition of the existing base of the “skiff” artifact in Zone 5

.7 Provision of a temporary platform “Main Scaffolding” in Zone 5, as indicated in the drawings, for the protection of the public, Cannery staff and exhibits below. To be non-climbable from Ground level to 3000mm a.f.f. and be equipped with temporary lighting for the scaffolded ground floor area (min. 200 lux average, refer to Lighting Spec, at 900mm a.f.f.) Provide Shop Drawings and sealed Letters of Assurance from a specialty engineer for the Main Scaffolding installation.

.4 The Departmental Representative shall undertake the temporary removal and storage offsite of a limited number of larger artifacts or exhibits that will impede the installation of the Main Scaffolding, or of the performance of the Work in general, as shown N.I.C. on the architectural plans. The final determination of the items to be so removed shall be in coordination with the Contractor's input regarding constructability and safe access to all locations of the Work. It is the Departmental Representative's intent to minimize, for conservation purposes, the number of items to be temporarily removed while reasonably supporting the efficient performance of the Work. The Contractor shall make provision in the schedule for this coordination and allow for the artifact packing & removal by the Departmental Representative's specialist moving and storage provider.

.5 The Contractor shall undertake the Work with temporary provisions for the protection of remaining artifacts and exhibits, per Section 01 51 00 – Temporary Facilities, part 1.2.

.6 The Contractor shall exercise caution when working in the proximity to protected interior, exterior, or structural elements, and finishes, artifacts and exhibits. Refer to Section 01 14 00 – Temporary Facilities, parts 1.5 & 1.6 for the minimum standards of care to be provided, and for the repair of damaged elements or materials.

.7 The Contractor to coordinate with the Departmental Representative for timely Heritage review and approval of locations and methods of installations of seismic restraints, typical for all installations. All work of this contract shall be subject to seismic sign off by structural engineer(s) whose expertise is the fixings of equipment and who are registered in BC. Sign off shall consist of letters of assurance B-1, B-2 and C-B as they pertain to the particular items of equipment. Except as otherwise indicated the seismic sign off shall be to the importance factor "normal" in table 4.1.2.1 of the 2015 National Building Code.

.8 Fire Protection and Fire Watch: the Contractor shall endeavour to maintain the continuous operability of the Fire Alarm & Sprinkler systems. When either system is impaired by the work, the Contractor shall provide a Fire Protection System Impairment Plan to the satisfaction of the Departmental Representative, and Fire Watch per Section 01 51 00, part 1.14.

.9 Hazardous Materials: Refer to Appendix B for the presence of Hazardous Materials, and undertake the relevant provisions of Sections 01 35 00, 01 74 19, 02 81 01, and 02 82 00.01.

.10 Archaeological Monitoring: The Contractor shall make provisions for the continuous monitoring of excavation work and excavated materials by a designated Archaeological Consultant engaged by Parks Canada. Follow instructions from the Departmental Representative for the handling of any uncovered identified items of interest. Refer to General Conditions GC6 for Changes to the Contract in the case of any discovered items of interest.

.11 Soils Contamination Monitoring: The Contractor shall make provisions for the continuous monitoring and selective contamination testing of all excavated materials by a designated Contaminated Soils Consultant engaged by Parks Canada. Follow instructions from the Departmental Representative for the handling, storage and disposal of excavated materials.

.12 Environmental Provisions: The Contractor shall undertake the Work with the special provisions outlined in Section 01 35 43 – Environmental Procedures.

.13 Environmental Monitoring: The Contractor is to allow the designated Environmental Monitor to observe and inspect the work and work site as required.

.14 All contractor personnel must attend and environmental briefing and contractor personnel involved in excavations must attend and archaeological briefing.

.15 Contractor Staging Area and Access to the Site:

.1 Due to the tight physical limitations of the Cannery property (ref. Site Plan) a Contractor Staging Area has been designated on adjacent Steveston Harbour Authority (the "Harbour Authority") property at the south end of the Cannery buildings. The cost for the lease of this Harbour Authority property will be borne by Parks Canada for the designated period of the contract (ref. part 1.7 below) and by the Contractor thereafter until completion.

.2 Provisions for access to:

.1 the pier substructure (to tidewater below), and

.2 the west exterior face of the Cannery (Zone 8)

shall be via Harbour Authority property. The Contractor shall make arrangements directly with the Harbour Authority for any such access.

.3 Do not otherwise impede Harbour Authority property in the performance of the Work.

.16 Load Limitations – Mezzanines: observed posted structural load limitations. Provide temporary structural reinforcement of mezzanines as needed for the performance of the work.

1.4 Green Requirements:

.1 Use only environmentally responsible green materials/products with no VOC emissions or minimum VOC emissions of indoor off-gassing contaminants for improved indoor air quality – subject to Departmental Representative's approval of submitted MSDS Product Data.

.2 Use materials/products containing highest percentage of recycled and recovered materials practicable – consistent with maintaining cost effective satisfactory levels of competition.

.3 Adhere to waste reduction requirement for reuse or recycling of waste materials, thus diverting materials from landfill.

1.5 Contract Documents

.1 The Contract documents are intended to complement each other.

.2 Drawings are, in general, diagrammatic and are intended to indicate the scope and general arrangement of the work.

.3 Cooperate with pre-purchased and Departmental Representative-supplied equipment and component suppliers in carrying out their respective works and carry out instructions from Departmental Representative.

.4 Coordinate work with that of pre-purchased and Departmental Representative-supplied equipment and component suppliers. If any part of work under this Contract depends on its proper execution or result upon work of said suppliers, report promptly to Departmental Representative, in writing, any defects which may interfere with proper execution of this Work.

1.6 Division of Specifications

.1 The specifications are subdivided in accordance with the current 6-digit National Master Specifications System.

.2 A Division may consist of the work of more than one subcontractor. Responsibility for determining which subcontractor provides the labour, material, equipment and services required to complete the work rests solely with the Contractor.

.3 In the event of discrepancies or conflicts when interpreting the drawings and specifications, the specifications shall govern.

1.7 Time of Completion

.1 Complete the project within 15 months of contract award.

.2 Work can commence on site immediately after contract award.

1.8 Work Schedule

.1 Carry out the Work according to date, time and other limitations as outlined in the Phasing Plan (ref. drawing A5.10 Zoning Plans and Phasing) and as follows:

.1 Provide a “phasing bar chart” and a schedule, for approval by the Departmental Representative, showing anticipated progress stages and final completion of the Work within the time period required by the Contract documents. Indicate the following:

.1 Submission of shop drawings, product data, MSDS sheets and samples.

.2 Commencement and completion of work of each section of the specifications or trades for each phase as outlined.

.3 Final completion date within the time period required by the Contract documents.

.2 Do not change approved Schedule without notifying Departmental Representative.

.2 Interim reviews of work progress based on work schedule will be conducted as decided by Departmental Representative, and schedule updated by Contractor in conjunction with and approval of Departmental Representative.

.3 Maintain a project diary and submit daily reports to the Departmental Representative on a "per shift" basis.

.4 Maintain weekly progress photographs for submission to Departmental Representative when requested.

1.9 Hours of Work and Cannery Operations

.1 Carry out the Work according to date, time and other limitations as outlined in the Phasing Plan (ref. drawing A5.10 Proposed Zoning Plans and Proposed Phasing)

.1 Normal Cannery opening hours of operation are 9:00am to 6:00pm;

.2 The Cannery shall remain accessible to Cannery staff and visitors during hours of operation for the entire duration of the Work, except for certain areas of temporary closure as outlined in the Proposed Phasing Plan, as suits the Contractor's proposed schedule.

.3 Contractor to ensure that building washrooms are continuously operational and Accessible during hours of operation. Temporary public washrooms for staff and visitors shall be provided by the Contractor if the existing washrooms are disabled;

.4 Emergency Exit paths and doors shall not be impeded by the Work during Cannery hours of operation and kept clear at all times after hours.

1.10 Codes, Bylaws, Standards

.1 Perform work in accordance with the National Building Code of Canada (NBC) 2015, the BC Building Code (BCBC), 2012, and other indicated Codes, Construction Standards and/or any other Code or Bylaw of local application.

.2 Comply with applicable local bylaws, rules and regulations enforced at the location of the Work.

.3 Meet or exceed requirements of Contract documents, specified standards, codes and referenced documents. In any case of conflict or discrepancy, the most stringent requirements shall apply.

.4 Standards and Guidelines for the Conservation of Historic Places in Canada.

1.11 Documents Required

.1 Maintain one copy each of the following at the job site:

Contract drawings.

Contract specifications.

Addenda to Contract documents.

Copy of work schedule.

Reviewed/approved shop drawings.

Change orders.

Other modifications to Contract.

Field test reports.

Reviewed/approved samples.

Manufacturer's installation and application instructions.

One set of record drawings and specifications for "as-built" purposes.

National Building Code of Canada 2015, and BC Building Code 2012.

Building Safety Plan.

Former Gulf of Georgia Heritage Character Statement.

1.12 Regulatory Requirements

.1 Contractor to obtain and pay for Building Permit, Occupancy Permit, Certificates, Licenses and other permits required by regulatory municipal, provincial or federal authorities to complete the work.

.2 Provide inspection authorities with plans and information required for issue of acceptance certificates.

.3 Furnish inspection certificates in evidence that the work installed conforms with the requirements of the authority having jurisdiction. See also item 1.20

.4 Permit applications will be submitted only for exterior civil work.

1.13 Contractor's Use of Site

.1 Use of site:

1. Work on site will be under the control of Parks Canada.
2. As the Gulf of Georgia Cannery is an active museum, all Cannery activities must remain operational during work on site.
3. Coordinated access and egress for delivery will be required to mitigate traffic disruptions. Refer to Section 01 14 00.
4. Strict security protocol shall be followed at all times on site. Refer to Section 01 14 00.
5. Assume responsibility for assigned premises for performance of this work.
6. Be responsible for coordination of all work activities on site, including any work of other contractors engaged by the Departmental Representative.

.2 Do not unreasonably encumber site with material or equipment.

.3 Execute Work with least possible interference or disturbance to normal use of premises. Make arrangements with Departmental Representative to facilitate work as stated.

.4 Maintain existing services to in-use facilities.

.5 Where security is reduced by work, provide temporary means to maintain security as per Departmental Representative's direction and as specified.

.6 Closures: protect work temporarily until project is completed.

.7 Parks Canada will allow the rental of twelve (12) parking stalls for rental in the North parking lot (ref. Site Plan on drawing sheet A1.10). All parking costs will be paid for by the Contractor, to be included in the contract price.

1.14 Examination

.1 Examine site and be familiar and conversant with existing conditions likely to affect work. Refer also to Section 01 51 00.

1.15 Work Restrictions and Security

.1 Refer to Section 01 14 00.

1.16 Location of Equipment and Fixtures

.1 Location of equipment, fixtures and outlets indicated or specified are to be considered as approximate.

.2 Locate equipment, fixtures and distribution systems to provide minimum interference and maximum usable space, and in accordance with manufacturer's recommendations for safety, access and maintenance.

.3 Inform Departmental Representative of impending installation and obtain his approval for actual location.

.4 Submit field drawings or shop drawings to indicate the relative position of various services and equipment when required by the Departmental Representative and/or as specified.

1.17 Cutting and Patching

.1 Cutting of building elements may be as required to accommodate new work only upon approval of the Departmental Representative.

.2 Remove items so shown or specified.

.3 Do not cut, bore, or sleeve load-bearing members.

.4 Make cuts with clean, true, smooth edges.

.5 Fit work airtight to pipes, sleeves, ducts and conduits.

.6 Patch and make good elements and finishes cut, damaged or disturbed using accepted heritage conservation methods, to Departmental Representatives approval. Patches are to be compatible, matching existing material, colour, finish and texture. Refer to Section 06 20 00 Finish Carpentry and Millwork, Part 2.

.7 Making good is defined as matching construction and finishing materials and the adjacent surfaces such that there is no visible difference between existing and new surfaces when viewed from 1.5 metres in ambient light, and includes painting the whole surface to the next change in plane.

.8 Submit typical details of the proposed methods for patching historic fabric including mock up of each type of patching method for review and approval by Departmental Representative.

1.18 Acceptance of Substrates

.1 Each trade shall examine surfaces prepared by others and job conditions which may affect his work, and shall report defects to the Contractor. Commencement of work shall imply acceptance of prepared work or substrate surfaces.

1.19 Quality of Work

.1 Ensure that quality workmanship is performed through use of skilled tradesmen, under supervision of qualified journeyman.

.2 The workmanship, erection methods and procedures to meet minimum standards set out in the National Building Code of Canada 2015, and BC Building Code 2012.

1.20 Works Coordination

.1 Coordinate work of sub-trades:

Designate one person to be responsible for review of contract documents and shop drawings and managing coordination of Work.

.2 Convene meetings between subcontractors whose work interfaces and ensure awareness of areas and extent of interface required.

Provide each subcontractor with complete plans and specifications for project, to assist them in planning and carrying out their respective work.

Develop coordination drawings when required, illustrating potential interference between work of various trades and distribute to affected parties. And provide a copy of the coordination drawings to Departmental Representative for record.

.1 Pay particularly close attention to overhead work above ceilings and within or near to building structural elements.

.2 Identify on coordination drawings, building elements, service lines, rough-in points and indicate location services entrance to site.

Facilitate meeting and review coordination drawings.

Record and Publish meeting minutes of each meeting within 3 days after the meeting.

Plan and coordinate work in such a way to minimize quantity of service line offsets.

Submit copy of coordination drawings and meeting minutes to Departmental Representative for information purposes.

.3 Submit shop drawings and order of prefabricated equipment or rebuilt components only after coordination meeting for such items has taken place.

.4 Work cooperation:

Ensure cooperation between trades in order to facilitate general progress of Work and avoid situations of spatial interference.

Ensure that each trade provides all other trades reasonable opportunity for completion of Work and in such a way as to prevent unnecessary delays, cutting, patching and removal or replacement of completed work.

Ensure that disputes between subcontractors are resolved.

.5 Departmental Representative is not responsible for, nor accountable for extra costs incurred as a result of Contractor's failure to coordinate Work.

.6 Maintain efficient and continuous supervision.

.7 Coordinate and cooperate with Parks Canada staff where new work interfaces with active museum equipment and operation.

1.21 Project Meetings

.1 Contractor shall arrange project meetings and assume responsibility for setting times and the Consultant shall record and distribute the Minutes.

.2 Project Construction meetings shall be bi-weekly for the duration of the Work, or as agreed by the Departmental Representative.

1.22 Testing and Inspections

.1 Particular requirements for inspection and testing to be carried out by testing service or laboratory approved by the Departmental Representative are specified in individual Sections. Refer also to Section 01 45 00 – Quality Control.

.2 The Contractor will appoint and pay for the services of testing agency or testing laboratory as specified and where required for the following:

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

Inspection and testing performed exclusively for Contractor's convenience.

Testing, adjustment and balancing of mechanical, sprinkler and electrical equipment and systems.

.1 Mill tests and certificates of compliance.

.2 Tests specified to be carried out by Contractor under the Departmental Representative's supervision.

.3 Where tests or inspections reveal work is not in accordance with the Contract requirements, Contractor shall pay costs for additional tests or inspections as the Departmental Representative may require verifying acceptability of corrected work.

.4 Contractor shall furnish labour and facilities to:

Notify Departmental Representative in advance of planned testing.

.5 Where materials are specified to be tested, deliver representative samples in required quantity to testing laboratory.

.6 Pay costs for uncovering and making good work that is covered before required inspection or testing is completed and approved by Departmental Representative.

.7 The Departmental Representative may require, and pay for, additional inspection and testing services not included in Paragraph 1.22.2 above.

.8 Provide Departmental Representative with two copies of testing laboratory reports as soon as they are available.

1.23 Approval of Shop Drawings, Product Data and Sample

.1 In accordance with Section 01 33 00 Submittals, submit the requested shop drawings, product data, MSDS sheets and samples indicated in each of the technical Sections.

.2 All new sprinkler runs, openings through historic fabric or enlargement of existing openings shall be approved by Departmental Representative.

.3 Shop drawings to clearly indicate the location and description of all the changes and additions to the existing layout (piping, risers, sprinkler heads), additional and enlarged penetrations through historic building fabric and the locations of seismic bracing.

.4 Contractor to submit details for all seismic bracing methods, including indication of where each type of bracing is to be installed. Provide mock-up for each method of seismic bracing proposed for review by Departmental Representative.

.5 Submit typical details of the proposed methods for patching historic fabric including mock-up of each type of patching method for review and approval by Departmental Representative.

.6 Allow sufficient time, minimum of four (4) weeks for the following including mock-ups:

Review of product data.

Approval of shop drawings.

Review of re-submission.

1.24 As-Built Documents

.1 The Contractor shall provide two sets of drawings, two sets of specifications, and two copies of the original AutoCAD files for “as-built” purposes.

.2 As work progresses, maintain accurate records to show all deviations from the Contract documents.

.3 Refer to Section 01 78 30.

1.25 Cleaning

.1 Refer to Section 01 74 00.

1.26 Dust Control

.1 Limit the production and spread of dust and other particles produced by the performance of the Work by the close use of vacuum equipment or other means.

1.27 Environmental Protection

.1 Refer to Sections 01 35 43 and 01 74 21.

1.28 Security Clearances

.1 Refer to Section 01 14 00 – Work Restrictions.

1.29 Maintenance Materials, Special Tools and Spare Parts

.1 Specific requirements for maintenance materials, tools and spare parts are specified in individual technical sections of specifications. Refer to Section 01 78 30 – Closeout Submittals.

1.30 Speciality Engineers

.1 Various specifications sections require BC Registered Professional Engineers (“Specialty Engineers”) to prepare, sign and seal shop drawings, submit Letters of Assurance and perform Field Services as required. Payment of Specialty Engineer services shall be included in the cost of the appropriate work.

1.31 Additional Drawings

.1 The Departmental Representative may furnish additional drawings for clarification. These additional drawings have the same meaning and intent as if they were included with drawings referenced in the Contract documents.

.2 Upon request, Departmental Representative may furnish up to a maximum of 10 sets of Contract documents for use by the Contractor at no additional cost. Should more than 10 sets of documents be required the Departmental Representative will provide them at additional cost.

1.32 Building Smoking Environment

.1 Smoking within the building and property is not permitted.

1.33 System of Measurement

.1 The metric system of measurement (SI) will be employed on this Contract except where existing installations are in Imperial units of measurement.

1.34 Familiarization with Site

.1 Before submitting tender, visit site – as indicated in tender documents and become familiar with all conditions likely to affect the cost of the work.

1.35 Submission of Tender

.1 Submission of a tender is deemed to be confirmation of the fact that the Tenderer has analyzed the Contract documents and inspected the site, and is fully conversant with all conditions.

1.36 Construction Review

.1 Departmental Representative will provide construction review once (1) a week during construction. Contractor to allow for time on site for coordination with Departmental Representative during reviews.

END OF SECTION

PART 1 GENERAL

1.1 CONTROL AND AUTHORITY OVER SITE

.1 All work on site will be under the control of Parks Canada during hours of operation, except the areas designated to the Contractor as the Prime Contractor controlled area.

.2 As the Gulf of Georgia Cannery is an active museum, all museum activities and security controls must remain operational at all times.

.3 Strict security and construction personnel behaviour protocols shall be observed at all times including, but not limited to the following:

.1 All construction personnel must wear Government issued picture identification at all times while working on Parks Canada property.

.2 With the exception of the Contractor controlled designated areas, a Contractor pass will be signed out by each construction crew member at the start of the project. This pass must be worn and be visible at all times while on Parks Canada Property. This pass shall be surrendered to the Parks Canada personnel at the end of the project. If a pass is lost during the course of the project, a $100.00 replacement fee shall be paid by the Contractor.

.3 While on Parks Canada property, all construction personnel shall remain within the designated work areas.

.4 Construction personnel must remain aware of their surroundings and be accountable for their tools/equipment at all times. At no point should tools be left unattended that are within reach of the public.

.5 As construction personnel are within the Parks Canada areas, their actions and language content of conversation will be a direct reflection on Parks Canada. Be mindful that the public will be aware of your presence and act professionally at all times.

.6 Construction personnel shall not have any interactions with the public.

1.2 ACCESS AND EGRESS

.1 All construction, staff and delivery vehicles accessing contractor's lay-down area and parking zones shall follow routes as designated on the Site Plan.

.2 Emergency Exit paths and doors shall not be impeded by the Work during Cannery hours of operation.

1.3 HOURS OF WORK

.1 As the museum is operational from 9:00am to 6:00pm, the Contractor may set their own schedule of work on site, with certain restrictions as follows: Submit proposed hours-of-work to Departmental Representative for review and approval along with schedule outlined in Section 01 11 55, Clause 1.8 and the Phasing Plan (ref. A5.10).

.2 Carry out the Work according to date, time and other limitations as outlined in the Phasing Plan (ref. drawing A5.10 Zoning Plans and Phasing)

.1 The Cannery shall remain accessible to Cannery staff and visitors during hours of operation and after-hours events (ref. drawing A5.10 Zoning Plans and Phasing) for the entire duration of the Work, except for certain permitted areas of temporary closure as outlined. The Departmental Representative and Cannery staff will have access to the Cannery after hours.

.2 Contractor to ensure that building washrooms are continuously operational and Accessible during hours of operation. Temporary public washrooms for staff and visitors shall be provided by the Contractor if the existing washrooms are disabled;

.3 Disruptive construction noise and operations may require work to be executed during low museum volume periods.

1.4 USE OF SITE AND FACILITIES

.1 Execute work with least possible interference or disturbance to normal use and operation of premises. Make arrangements with Departmental Representative to facilitate work as stated.

.2 Maintain existing services and abide by regulations for personnel and vehicle access.

.3 Where security is reduced by work, provide temporary means to maintain security as per Departmental Representative's direction and as specified.

.4 Closures: protect work temporarily until project is completed.

.5 Areas under construction must be separated by temporary fencing or hoarding (refer to Section 01 51 00) and should not utilize any more space in the Contractor's lay-down area than what is absolutely necessary.

.6 Construction crews are not allowed to use washrooms in the buildings. Refer to Section 01 51 00.

1.5 HERITAGE CONSIDERATIONS

Do not remove, replace or substantially alter any character defining elements.

Conserve heritage value by adopting an approach calling for a Heritage Conservation Minimal Intervention Approach for all work, as defined in the Standards and Guidelines for the Conservation of Historic Places in Canada, typical, and generally as follows:

.1 Conserve the heritage value and character defining elements when creating any new additions to a historic place or any related new construction. Make the new work physically and visually compatible with, subordinate to and distinguishable from the historic place.

.2 Create any new additions or related new construction so that the essential form and integrity of a historic place will not be impaired if the new work is removed in the future.

.3 Repair character-defining elements by reinforcing their materials using recognized conservation methods. Replace in-kind any extensively deteriorated or missing parts of character-defining elements.

.4 Repair rather than replace character-defining elements. Where character defining elements are too severely deteriorated to repair, and where physical evidence exists, replace them with new elements that match the forms, materials and detailing of sound versions of the same elements.

1.6 REPAIR OF DAMAGED HERITAGE ELEMENTS

.1 The Contractor shall exercise caution when working in the proximity to protected interior, exterior, or structural elements, and finishes, artifacts and exhibits.

.2 Accidental damage requiring repair or replacement will require specialist advice by the Parks Canada's own forces, and prior approval from the appropriate heritage authorities for repair methods and materials.

.3 If the performance of the Work creates debris on or damage to an artifact or exhibit it shall be removed, cleaned and reinstalled to its original condition under the direction of the Departmental Representative, and if damaged it shall be repaired or replaced to the satisfaction of the Departmental Representative by the Contractor at no cost to the Owner or the facility operator.

1.7 NOISE GENERATION

.1 Construction noise levels which disrupt museum events shall be conducted during unoccupied hours (per A5.10) as determined by the Departmental Respresentative.

.2 Means and procedures of controlling and isolating other excessive or disturbing noise and vibration affecting occupied areas shall be the responsibility of the Contractor and approved by the Departmental Representative and Parks Canada.

1.8 EXISTING SERVICES

.1 Where work involves interrupting, breaking into or connecting to existing sprinkler or electrical services: give Departmental Representative (1) one week's notice for permission. All shut-downs shall occur during low occupancy volume periods.

.2 Optimize and plan shut-downs so that services are restored in time for daily Cannery operation hours. Coordinate all shut-downs with utility providers and Parks Canada.

.3 Contractor will be held responsible for damages to facility equipment as the result of service shut-downs.

.4 Contractor will be held responsible for any and all unscheduled shut-downs of building utilities and services.

.5 Contractor will not be allowed to connect to User's existing data and communication services for his own use.

1.9 BUILDING SMOKING ENVIRONMENT

.1 Comply with Facility's smoking restrictions. Smoking is NOT permitted on Cannery property

END OF SECTION

PART 1 GENERAL

1.1 Approvals

.1 Approval of shop drawings and samples: refer to Section 01 11 55.

1.2 General

.1 This Section specifies general requirements and procedures for the Contractor's submissions of shop drawings, product data, samples and other requested submittals to Departmental Representative for review. Additional specific requirements for submissions are specified in individual technical sections.

.2 Present shop drawings, product data and samples in Metric dimensions.

.3 Where items or information is not produced in Metric dimensions, converted values are acceptable.

.4 Contractor's responsibility for errors and omissions in submission is not relieved by Departmental Representative's review of submissions.

.5 Notify Departmental Representative in writing at time of submission, identifying deviations from requirements of Contract documents and stating reasons for deviations.

.6 Contractor's responsibility for deviations in submission from requirements of Contract documents is not relieved by Departmental Representative's review of submission unless Departmental Representative gives written acceptance of specific deviations.

.7 Make any changes in submissions which Departmental Representative may require consistent with Contract documents and resubmit as directed by Departmental Representative.

.8 Notify Departmental Representative in writing, when resubmitting, of any revisions other than those requested by Departmental Representative.

.9 Do not proceed with work until relevant submissions are reviewed and approved by the Departmental Representative.

1.3 Submission Requirements

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

.2 Allow (10) ten working days for Departmental Representative's review of each submission, unless noted otherwise.

.3 Accompany submissions with transmittal letter, in duplicate, containing:

- .1 Date.
- .2 Project title and number.
- .3 Contractor's name and address.
- .4 Identification and quantity of each shop drawing, product data and sample.
- .5 Other pertinent data.

.4 Submissions shall 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 Seal of Professional Engineer, registered in British Columbia, for all items so required in the various sections of the specifications.

.6 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.

.5 After Departmental Representative's review, distribute copies.

1.4 Shop Drawings

.1 Shop drawings: original drawings or modified standard drawings provided by Contractor to illustrate details of portions of work which are specific to project requirements.

.2 Maximum sheet size: 850 x 1050 mm. (for hard copy submission).

.3 Submit electronic versions of shop drawings for each requirement requested in the specification sections and/or as requested by the Departmental Representative.

.4 Cross-reference shop drawing information to applicable portions of the Contract documents.

1.5 Shop Drawings Review

.1 Review of shop drawings by the Departmental Representative is for the sole purpose of ascertaining conformance with the general concept.

.2 This review shall not mean that the Departmental Representative approves the detail design inherent in the shop drawings, responsibility for which shall remain with Contractor submitting same.

.3 This review shall not relieve the Contractor of responsibility for errors or omissions in the shop drawings or of responsibility for meeting all requirements of the construction and Contract documents.

.4 Without restricting the generality of the foregoing, the Contractor is responsible for:

.1 Dimensions to be confirmed and correlated at the job site.

.2 Information that pertains solely to fabrication processes or to techniques of construction and installation.

.3 Coordination of the work of all sub-trades.

1.6 Product Data

.1 Product data: manufacturers' catalogue sheets, MSDS sheets, brochures, literature, performance charts and diagrams, used to illustrate standard manufactured products or any other specified information.

.2 Delete information not applicable to project.

.3 Supplement standard information to provide details applicable to project.

.4 Cross-reference product data information to applicable portions of Contract documents.

.5 Submit 6 copies of product data.

1.7 Samples

.1 Samples: examples of materials, equipment, quality, finishes and workmanship.

.2 Where colour, pattern or texture is a criterion, submit a full range of samples.

.3 Reviewed and accepted samples will become the standard of workmanship and material against which installed work will be verified.

1.8 Progress Schedule

.1 Submit work schedule and cost breakdown as required in Section 01 11 55 – General Instructions.

1.9 Test Results and Inspection Reports

.1 Submit in duplicate test results and inspection reports required by specification sections where noted.

.2 Section 21 13 13 Sprinkler System

END OF SECTION

PART 1 GENERAL

1.1 References

.1 Government of Canada.
- .1 Canada Labour Code – Part II
- .2 Canada Occupational Health and Safety Regulations

.2 National Building Code of Canada (NBC):
- .1 Part 8, Safety Measures at Construction and Demolition Sites.

.3 Canadian Standards Association (CSA as amended):
- .1 CSA Z797-2009 Code of Practice for Access Scaffold.
- .2 CSA S269.1-1975 (R2003), Falsework for Construction Purpose.
- .3 CSA-S350-M1980 (R2003) Code of Practice for Safety in Demolition of Structures.

.4 Fire Protection Engineering Services (HRSDC):
- .1 FCC No. 301, Standard for Construction Operations.
- .2 FCC No. 302, Standard for Welding and Cutting.

.5 American National Standards Institute (ANSI):
- .1 ANSI A10.3, Operations – Safety Requirements for Powder-Actuated Fastening Systems.

.6 Province of British Columbia:
- .1 Workers Compensation Act Part 3 Occupational Health & Safety.
- .2 Occupational Health and Safety Regulation

1.2 Related Sections

.1 Refer to the following current NMS sections as required:
- .1 General Instructions: Section 01 11 55
- .2 Work Restrictions: Section 01 14 00
- .3 Submittal Procedures: Section 01 33 00
- .4 Temporary Facilities: Section 01 51 00
- .5 Waste Management and Disposal: Section 01 74 21
- .6 Demolition: Section 02 41 00
- .7 Sealants: Section 07 90 00
- .8 Painting and Coating: Section 09 90 00
- .9 Asbestos Remediation: Section 02 82 00
- .10 Lead Remediation: Section 02 83 00

1.3 Workers' Compensation Board Coverage

.1 Comply fully with the Workers' Compensation Act, regulations and orders made pursuant thereto, and any amendments up to the completion of the work.

.2 Maintain Workers' Compensation Board coverage during the term of the Contract, until and including the date that the Certificate of Final Completion is issued.

1.4 Compliance with Regulations

.1 The Owner may terminate the Contract without liability to the Owner where the Contractor, in the opinion of the Departmental Representative, refuses to comply with a requirement of the Workers' Compensation Act or the Occupational Health and Safety Regulations.

.2 It is the Contractor's responsibility to ensure that all workers are qualified, competent and certified to perform the work as required by the Workers' Compensation Act or the Occupational Health and Safety Regulations.

1.5 Submittals

.1 Submit to Departmental Representative submittals listed for review

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

.3 Submit the following:

.1 Health and Safety Plan.

.2 Copies of reports or directions issued by federal and provincial health and safety inspectors.

.3 Copies of incident and accident reports.

.4 Complete set of Material Safety Data Sheets (MSDS), and all other documentation required by Workplace Hazardous Materials Information System (WHMIS) requirements.

.5 Emergency Procedures.

.4 The Departmental Representative will review the Contractor's site-specific project Health and Safety Plan and emergency procedures, and provide comments to the Contractor within 2 days after receipt of the plan. Revise the plan as appropriate and resubmit to Departmental Representative for review.

.5 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.

.6 Submission of the Health and Safety Plan, and any revised version, to the Departmental Representative is for information and reference purposes only. It shall not:

.1 Be construed to imply approval by the Departmental Representative.

.2 Be interpreted as a warranty of being complete, accurate and legislatively compliant.

.3 Relieve the Contractor of his legal obligations for the provision of health and safety on the project.

1.6 Responsibility

.1 Assume responsibility as the Prime Contractor for work under this project

.2 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.

.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.

1.7 Health and Safety Coordinator

.1 The Health and Safety Coordinator must:

.1 Be responsible for completing all health and safety training, and ensuring that personnel that do not successfully complete the required training are not permitted to enter the site to perform work.

.2 Be responsible for implementing, daily enforcing, and monitoring the site-specific Health and Safety Plan.

.3 Be on site during execution of work.

1.8 General Conditions

.1 Provide safety barricades and lights around work site as required to provide a safe working environment for workers and protection for pedestrian and vehicular traffic.

.2 Ensure that non-authorized persons are not allowed to circulate in designated construction areas of the work site.

.1 Provide appropriate means by use of barricades, fences, warning signs, traffic control personnel, and temporary lighting as required.

.2 Secure site at night, or provide security guard, as deemed necessary to protect site against entry.

.3 Comply with the Hazardous Materials Report, Appendix ‘B’.

1.9 Regulatory Requirements

.1 Comply with specified codes, acts, bylaws, standards and regulations to ensure safe operations at site.

.2 In event of a conflict between any provision of the above authorities, the most stringent provision will apply. Should a dispute arise in determining the most stringent requirement, the Departmental Representative will advise on the course of action.

1.10 Work Permits

.1 Obtain building, sprinkler, plumbing and specialty trade permits related to project before start of work.

1.11 Filing Notice

.1 The Contractor is to complete and submit a Notice of Project as required by provincial authorities.

.2 Provide copies of all notices to the Departmental Representative.

1.12 Health and Safety Plan

.1 Conduct a site-specific hazard assessment based on review of Contract documents, required work, and project site. Identify any known and potential health risks and safety hazards.

.2 Prepare and comply with a site-specific project Health and Safety Plan based on hazard assessment, including, but not limited to, the following:

.1 Primary requirements:

.1 Contractor's safety policy.

.2 Identification of applicable compliance obligations.

.3 Definition of responsibilities for project safety/organization chart for project.

.4 General safety rules for project.

.5 Job-specific safe work, procedures.

.6 Inspection policy and procedures.

.7 Incident reporting and investigation policy and procedures.

.8 Occupational Health and Safety Committee/Representative procedures.

.9 Occupational Health and Safety meetings.

.10 Occupational Health and Safety communications and record keeping procedures.

.2 Summary of health risks and safety hazards resulting from analysis of hazard assessment, with respect to site tasks and operations which must be performed as part of the work.

.3 List hazardous materials to be brought on site as required by work.

.4 Indicate engineering and administrative control measures to be implemented at the site for managing identified risks and hazards.

.5 Identify personal protective equipment (PPE) to be used by workers.

.6 Identify personnel and alternates responsible for site safety and health.

.7 Identify personnel training requirements and training plan, including site orientation for new workers.

.3 Develop the plan in collaboration with all subcontractors. Ensure that work/activities of subcontractors are included in the hazard assessment and are reflected in the plan.

.4 Revise and update Health and Safety Plan as required, and re-submit to the Departmental Representative prior to commencement of work on site.

.5 Departmental Representative's review: the review of Health and Safety Plan by Public Works and Government Services Canada (PWGSC) shall not relieve the Contractor of responsibility for errors or omissions in final Health and Safety Plan or of responsibility for meeting all requirements of construction and Contract documents.

1.13 Emergency Procedures

.1 List standard operating procedures and measures to be taken in emergency situations. Include an evacuation plan and emergency contacts (i.e. names/telephone numbers) of:

.1 Designated personnel from own company.

.2 Regulatory agencies applicable to work and as per legislated regulations.

.3 Local emergency resources.

.4 Departmental Representative and site staff.

.2 Include the following provisions in the emergency procedures:

.1 Notify workers and the first-aid attendant, of the nature and location of the emergency.

.2 Evacuate all workers safely.

.3 Check and confirm the safe evacuation of all workers.

.4 Notify the fire department or other emergency responders.

.5 Notify adjacent workplaces or residences that may be affected if the risk extends beyond the workplace.

.6 Notify Departmental Representative and site staff.

.3 Provide written rescue/evacuation procedures as required for, but not limited to:

.1 Work at high angles.

.2 Work in confined spaces or where there is risk of entrapment.

.3 Work with hazardous substances.

.4 Underground work.

.5 Work on, over, under and adjacent to water.

.6 Workplaces where there are persons who require physical assistance to be moved.

.4 Design and mark emergency exit routes to provide quick and unimpeded exit.

.5 Revise and update emergency procedures as required, and re-submit to the Departmental Representative.

1.14 Hazardous Products

.1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage and disposal of hazardous materials, and regarding labeling and provision of Material Safety Data Sheets (MSDS) acceptable to the Departmental Representative and in accordance with the Canada Labour Code.

.2 Comply with the Hazardous Materials Report, Appendix ‘B’.

.3 Where use of hazardous and toxic products cannot be avoided:

.1 Advise Departmental Representative beforehand of the product(s) intended for use. Submit applicable MSDS and WHMIS documents as per Section 01 33 00.

.2 In conjunction with Departmental Representative, schedule to carry out work during "off hours" when tenants have left the building.

.4 Provide adequate means of ventilation in accordance with Section 01 51 00.

1.15 Electrical Safety Requirements

.1 Comply with authorities and ensure that, when installing new facilities or modifying existing facilities, all electrical personnel are completely familiar with existing and new electrical circuits and equipment and their operation.

.1 Before undertaking any work, coordinate required energizing and de-energizing of new and existing circuits with Departmental Representative.

.2 Maintain electrical safety procedures and take necessary precautions to ensure safety of all personnel working under this Contract, as well as safety of other personnel on site.

1.16 Electrical Lockout

.1 Develop, implement and enforce use of established procedures to provide electrical, mechanical, pneumatic, hydraulic, chemical, thermal, or potential energy isolation and lockout and to ensure the health and safety of workers for every event where work must be done on any electrical circuit or facility.

.2 Prepare the lockout procedures in writing, listing step-by-step processes to be followed by workers, including how to prepare and issue the request/ authorization form. Have procedures available for review upon request by the Departmental Representative.

.3 Keep the documents and lockout tags at the site and list in a log book for the full duration of the Contract. Upon request, make such data available for viewing by Departmental Representative or by any authorized safety representative.

1.17 Overloading

.1 Ensure no part of work is subjected to a load which will endanger its safety or will cause permanent deformation.

1.18 Falsework

.1 Design and construct falsework in accordance with CSA S269.1-1975 (R2003).

1.19 Scaffolding

.1 Design, construct and maintain scaffolding in a rigid, secure and safe manner, in accordance with CSA-Z797-2009 and B.C. Occupational Health and Safety Regulations.

1.20 Confined Spaces

.1 Carry out work in confined spaces in compliance with Provincial Occupational Health and Safety regulations.

1.21 Powder-Actuated Devices

.1 Use powder-actuated devices in accordance with ANSI A10.3 only after receipt of written permission from the Departmental Representative.

1.22 Fire Safety and Hot Work

.1 Obtain Departmental Representative's authorization before any welding, cutting or any other hot work operations can be carried out on site.

.2 Hot work includes cutting/melting with use of torch, flame heating roofing kettles, or other open flame devices and grinding with equipment which produces sparks.

1.23 Fire Safety Requirements

.1 Store oily/paint-soaked rags, waste products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed containers and remove from site on a daily basis.

.2 Handle, store, use and dispose of flammable and combustible materials in accordance with the National Fire Code of Canada.

1.24 Fire Protection and Alarm System

.1 Fire Alarm and Fire Watch: the Contractor shall endeavour to maintain the continuous operability of the Fire Alarm system. In the case that the Fire Alarm system is impaired by the work, the Contractor shall provide continuous Fire Watch for the entire Cannery building. Refer to Section 01 51 00.

.2 Do not use fire hydrants, stand pipes and hose systems for any purposes other than fire fighting.

.3 Be responsible/liable for costs incurred from the fire department, the building owner and the tenants, resulting from false alarms.

1.25 Unforeseen Hazards

.1 Should any unforeseen or peculiar safety-related factor, hazard or condition become evident during performance of the work, immediately stop work and advise the Departmental Representative verbally and in writing.

1.26 Posted Documents

.1 Post legible versions of the following documents on site:

.1 Health and Safety Plan.

.2 Sequence of work.

.3 Emergency procedures.

.4 Site drawing showing project layout, locations of the first-aid station, evacuation route and marshalling station, and the emergency transportation provisions.

.5 Notice of Project.

.6 Floor plans or site plans.

.7 Notice as to where a copy of the Workers' Compensation Act and Regulations are available on the work site for review by employees and workers.

.8 Workplace Hazardous Materials Information System (WHMIS) documents.

.9 Material Safety Data Sheets (MSDS).

.10 List of names of Joint Health and Safety Committee members, or Health and Safety Representative, as applicable.

.2 Post all Material Safety Data Sheets (MSDS) on site, in a common area, visible to all workers and in locations accessible to tenants when work of this Contract includes construction activities adjacent to occupied areas.

.3 Postings should be protected from the weather and visible from the street or the exterior of the principal construction site shelter provided for workers and equipment, or as approved by the Departmental Representative.

1.27 Meetings

.1 Attend health and safety pre-construction meeting and all subsequent meetings called by the Departmental Representative.

1.28 Correction of Non-Compliance

.1 Immediately address health and safety non-compliance issues identified by the Departmental Representative.

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

.3 The Departmental Representative may issue a “stop work order” if non-compliance of health and safety regulations is not corrected immediately or within posted time. The General Contractor/subcontractors will be responsible for any costs arising from such a “stop work order”.

END OF SECTION

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 Section 01 33 00 Submittal Procedures

.2 Section 01 35 33 Health and Safety Requirements

.3 Section 01 51 00 Temporary Facilities

.4 Section 01 74 21 Waste Management and Disposal

.5 Section 31 23 33.01 Excavating, Trenching and Backfilling

1.2 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 humankind; unfavourably alter ecosystem components or processes that could result in the impairment or adverse effects to ecological integrity; or degrade environment aesthetically, culturally and/or historically.

.2 Environmental Protection: prevention/control of pollution and habitat or environment disruption during construction. Control of environmental pollution and damage requires consideration of land, water, and air; biological and cultural resources; and includes management of visual aesthetics; noise; solid, chemical, gaseous, and liquid waste; radiant energy and radioactive material as well as other pollutants.

1.3 SUBMITTALS

.1 Submittals: in accordance with Section 01 33 00 – Submittal Procedures.

.2 Prior to commencing construction activities or delivery of materials to site, submit Environmental Protection Plan for review and approval by Departmental Representative. Environmental Protection Plan is to present comprehensive overview of known or potential environmental issues which must be addressed during construction and provide details on how they will be addressed.

.3 Address topics at level of detail commensurate with environmental issue and required construction tasks.

.4 Submit an Environmental Protection Plan for approval by the Departmental Representative, including:

.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 which identifies type and location of erosion and sediment controls, and stormwater management plan 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 showing locations of proposed temporary excavations or embankments for haul roads, stream crossings, material storage areas, structures, sanitary facilities, and stockpiles of excess or spoil materials including methods to control runoff and to contain materials on site.

.7 Traffic control plans including measures to reduce erosion of temporary roadbeds by construction traffic, especially during wet weather. Plans include measures to minimize amount of mud transported onto paved roads by vehicles or runoff. Clean up mud and debris from paved areas.

.8 Work area plan showing proposed activity in each portion of area and identifying areas of limited use or non-use. Plan to include measures for marking limits of use areas including methods for protection of features to be preserved within authorized work areas.

.9 Spill Prevention and Response Plan: Document measures to be put in place to prevent and control spills and releases including procedures, instructions and reporting in compliance with Federal, Provincial, Municipal laws and regulations. Refer to Section 01 35 43 Part 1.10.

.10 Non-Hazardous solid waste disposal plan identifying methods and locations for solid waste disposal including clearing debris.

.11 Air pollution control plan detailing provisions to assure that dust, debris, materials, and trash, do not become air borne and travel off project site and/or into the marine environment" after "project site.

.12 Contaminant prevention plan that: identifies potentially hazardous substances to be used on job site; identifies intended actions to prevent introduction of such materials into air, water, or ground; and details provisions for compliance with Federal, Provincial, and Municipal laws and regulations for storage and handling of these materials.

.13 Waste water management plan that identifies methods and procedures for management and/or discharge of waste waters which are directly derived from construction activities, such as concrete curing water, clean-up water, dewatering of ground water, disinfection water, hydrostatic test water, and water used in flushing of lines.

.14 Comply with the Hazmat Assessment Report (Appendix B). Refer to Section 01 11 55 and undertake the provisions of sections 02 81 00 and 02 82 00.01

.5 Departmental Representative is to be notified immediately of any impact to the foreshore and its inhabitants as well as any wildlife as a result of project related activities.

.6 Invasive Species Management Plan: Plan that identifies methods and procedures for invasive species management.

1.4 FIRES

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

1.5 DISPOSAL OF WASTES

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

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

.3 All wildlife attractants must be secured in wildlife-proof containers, a secure building or vehicle. When possible, keep food waste separate from construction waste and remove daily.

.4 Contain and stabilise all waste material at a minimum of 30m from a waterbody.

.5 Contain wastes and transport to an approved waste landfill site outside the Parks Canada protected heritage place, unless otherwise directed; cover waste loads during transportation. All construction materials must be removed from the site on project completion.

1.6 DRAINAGE

.1 Provide erosion and sediment control plan that identifies type and location of erosion and sediment controls to be provided. Plan: 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 Stormwater Management Plan (SMP) to be substituted for erosion and sedimentations control plan.

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

.4 Do not pump water containing suspended materials into waterways, sewer or drainage systems.

.5 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with local authority requirements.

.6 If water collects in excavation areas and/or requires discharge from the site, water is to be tested for turbidity and/or Total Suspended Solids (TSS) prior to off-site discharge according to applicable legislation.

1.7 WORK ADJACENT TO WATERWAYS

.1 Project is adjacent to Fraser River floodplain and waterway and is sited in part directly over the Fraser River floodplain. Reduced risk works windows for the protection of fish and fish habitat are August 1 to September 15 and November 01 to February 15. Where feasible schedule higher risk works within these windows.

.2 Do not operate construction equipment directly in waterways.

.3 Do not use waterway beds for borrow material without Departmental Representative's approval.

.4 Do not dump excavated fill, waste material or debris in waterways.

.5 Design and construct temporary crossings to minimize erosion to waterways.

.6 Do not skid construction materials across waterways.

.7 Storage of any fuels, oils or hazardous materials must not be situated within 30m from waterbodies, as measured from the High Water Mark. No re-fueling must occur within 30m from waterbodies as measured from the High Water Mark.

.8 No temporary or permanent increase in existing project footprint below the High Water Mark.

.9 No new temporary or permanent fill placed below the High Water Mark.

.10 For all in-water activities, or associated in-water structures, do not interfere with fish passage, constrict the channel width, or reduce flows, or result in the stranding or death of fish.

.11 Screen any water intakes or outlet pipes to prevent entrainment or impingement of fish. Entrainment occurs when a fish is drawn into a water intake and cannot escape. Impingement occurs when an entrapped fish is held in contact with the intake screen and is unable to free itself.

1.8 PIER SUBSTRUCTURE WORK

Undertake all Work under the pier with the following special environmental provisions:

.1 Ground Protection for Southern Portion of Pier: for all Work activity south of gridline 9 on the Fire Protection design plans, use a skiff or barge or other floating platform at higher tides to avoid trampling the ground substrate or increasing the turbidity of adjacent waters.

.2 Avian Protection: Disturbance to nesting bird contravenes the Wildlife Act and the Migratory Birds Convention Act. Adhere to the Parks Canada National Best Management Practices Migratory Birds. To avoid undue impact to birds nesting on or around the pier substructure, for any work in the calendar period 1 March to 31 August undertake:

.1 A breeding activity survey which must be conducted a maximum of 7 days prior to work commencing. Surveys must be completed by a qualified environmental professional as defined by the Best Management Practices. Results must be documented and provided to the Departmental Representative prior to work commencing.

.2 Provide temporary nest deterrents in areas where nests may be constructed, in consultation with and to the satisfaction of the Departmental Representative, or

.3 Foreshore Habitat Protection: For all work under the pier avoid trampling ground surface or increasing turbidity of adjacent waters.

.4 Fish and Fish Habitat Protection: Reduced risk work windows for the protection of fish and fish habitat are August 1 to September 15 and November 01 to February 15. Where feasible sub-structure works must be conducted within these windows. Proposed works outside the windows must be done in consultation with the Departmental Representative and the Owners Environmental Monitor.

1.9 POLLUTION CONTROL

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

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

.3 Prevent sandblasting and other extraneous materials from contaminating air and waterways beyond application area, by providing temporary enclosures.

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

.5 Equipment must be properly tuned, clean and free of contaminants, in good operating order, free of leaks (e.g., fuel, oil or grease), and fitted with standard air emission control devices and spark arrestors prior to arrival on site.

.6 Machinery must be stored, maintained and refuelled on a flat surface, outside the dripline of trees and a minimum of 30m from waterbodies, as measured from the High Water Mark.

.7 Tools and equipment used for excavation and backfilling should be cleaned off site. Skiffs, floating platforms and scaffolding for substructure are to be cleaned before arriving on site.

1.10 SPILL PREVENTION, RESPONSE AND REPORTING

.1 Provide a project specific Spill Prevention and Response Plan to the satisfaction of the Departmental Representative. The plan will address spills and releases of materials including but not limited to sediment plumes from any causes including disturbance to river bed, fuels, concrete, hazardous and other deleterious materials. Include in Spill Prevention and Response Plan:

- .1 List of products and materials considered or defined as hazardous or toxic to the environment.
- .2 Size, type and location of spill kits.
- .3 Fuelling procedures, fuel storage
- .4 Spill prevention procedures (i.e., containment and storage of materials, security, handling, use and disposal of empty containers, surplus product or waste generated in the application of these products in accordance with all applicable federal and provincial legislation.
- .5 Spill response: emergency measures in case of a spill or release on the ground or on the water (i.e., containment, clean-up, disposal of contaminated materials, etc.).
- .6 Spill reporting procedure including incident reporting form.
- .7 Up-to-date emergency response contact list including contact information for reporting spills.

.2 Report spills/releases of any volume to the Departmental Representative. Spills/releases over 0.5L must be immediately reported to the Departmental Representative and Gulf of Georgia Cannery staff lead. Spills/Releases must also be reported as required by municipal, provincial and federal legislation.

.3 All additional costs and delays resulting from spill releases shall be the Contractor's.

.4 Ensure that all on-site workers receive a briefing about the Spill Prevention and Response Plan and are aware of the location and use of spill kits and containment devices.

.5 Refueling must take place on an impermeable fuel mat with a berm or within a container. Leaks and spills during refueling must be cleaned up and contaminated materials must be disposed of appropriately. Fuel must never be dispelled or deposited into the environment or any water body.

.6 Gas generators must be secured to prevent movement during operation and set up on an impermeable fuel mat with a berm or within a container that can contain 110% of the volume of fuel in the generator.

.7 Spill containment equipment must be present on-site. A spill contingency response kit including sorbent material and berms to contain 110% of the largest possible spill related to the work must be available on site at each location of potential spills (sites where equipment is working and at re-fuelling, lubrication, and repair locations).

.8 All spills must be contained and cleaned-up as soon as it is possible to safely do so. In the event of a major spill, work must stop until the spill has been adequately contained and cleaned up.

.9 Contaminants must be recovered at source and disposed of according to applicable laws, policies and regulations.

.10 Petrochemical products, paints and chemicals must be stored a minimum of 30 meters away from waterbodies and, if left overnight, they must be secured.

.11 All construction sites must be equipped with containers suitable for the secure, temporary storage of hazardous wastes, separated by type.

1.11 INVASIVE SPECIES MANAGEMENT

.1 Tools and equipment used for excavation and backfilling should be cleaned off site. Skiffs, floating platforms and scaffolding for substructure are to be cleaned before arriving on site. Proof that this mitigation was applied may be requested before equipment is permitted into the protected heritage place.

.2 All soil, gravel, lumber, erosion and sediment control products (e.g., hay, straw, mulch), or other applicable materials from outside the protected heritage place must be from an approved weed-free source.

.3 Minimise bare soil exposure (e.g., cover stockpiled material with tarps.

.4 Stabilize and re-vegetate disturbed areas as soon as possible, ideally with native plants, soil and seed mix or otherwise approved.

1.12 NOTIFICATION

.1 Departmental Representative will notify Contractor in writing of observed noncompliance with the Contract, 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 the Departmental Representative of proposed corrective action and take such action to the satisfaction of the Departmental Representative.

.3 Departmental Representative will issue stop order of work until satisfactory corrective action has been taken.

.4 No time extensions will be granted or equitable adjustments allowed to the Contract for such suspensions.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

.1 Inspection and testing, administrative and enforcement requirements.

.2 Quality control program.

.3 Tests and mix designs.

.4 Mock-ups.

.5 Mill tests.

.6 Equipment and system adjust and balance.

1.2 RELATED SECTIONS

.1 Section 01 33 00 Submittal Procedures

.2 Section 01 61 00 Product Requirements

.3 Section 01 78 00 Closeout Submittals

1.3 GENERAL

.1 At Project commencement, establish quality assurance benchmarks and quality expectations for all workers and Subcontractors to follow.

.2 The Specification identifies a minimum level of quality, exceed this minimum level.

.3 Identify a person in the employ of the Contractor to monitor Work quality and to report quality assurance steps being taken, identified or discovered disparities, and corrective action taken.

.4 Submit written reports monthly to the Departmental Representative, to accompany progress claims.

.5 Monitor quality control over Suppliers, manufacturer's, Products, services, site conditions, and workmanship, to produce Work of specified quality.

.6 Comply with manufacturer's instructions, including each step in sequence. Should manufacturer's instructions conflict with Contract Documents, request clarification from Departmental Representative before proceeding.

.7 Comply with specified standards as minimum quality for the work except where more stringent tolerance, codes, or specified requirements indicate higher standards or more precise workmanship.

.8 Perform work with persons qualified to produce required and specified quality.

.9 Ensure that building envelope is weathertight and that building interior has been allowed to dry before installation of interior components and finishes as well as HVAC systems.

1.4 QUALITY CONTROL PROGRAM

.1 Develop a quality control program. Program requires approval of the Departmental Representative and prior to commencement of Work.

.2 Within fourteen (14) days of award of Contract, submit five (5) copies of the quality control program and list of independent inspection agencies for review.

.3 Prepare all test results in triplicate and provide copies of all tests concurrently to the Departmental Representative and Contractor.

.4 All test results shall specify at least the following data:

.1 Type of test.

.2 Dates of sampling, testing and reporting.

.3 Personnel involved.

.4 Location of test (with sketch if required).

.5 Specified requirements.

.6 Test results.

.7 Remarks regarding conformance with Contract Documents.

.5 Provide written test results to the Departmental Representative within 12 hours of tests. If the tests are completed on Site, provide the Departmental Representative with field memo summarizing results immediately following testing.

.6 Minimum testing requirements shall be in accordance with all applicable bylaws, regulations, standards, building codes and requirements of authorities having jurisdiction.

1.5 QUALITY CONTROL PLAN

.1 Include the following in the quality control plan:

.1 An organization chart for the project group including identification of the quality control group and the quality control manager.

.2 Resumes of the quality control manager and key quality control personnel.

.3 A statement from the Contractor's management that the quality control manager has authority to reject or require correction of work.

.4 A process for initiating, tracking and resolving rejected work.

.5 A procedure for the quality control of Subcontractors complying with the requirements of the Contract.

.6 An outline of the required communication with the Departmental Representative including:

.1 reporting procedures, both daily and summary reports;

.2 arrangements for pre-work reviews to be organized by the Contractor;

.3 arrangements for weekly quality control review meetings; and

.4 coordination of quality control activities with quality assurance.

.7 A list of test procedures, identification of protocols for sampling and designation of the frequency for each test.

.8 Procedures for pre-qualification of materials.

.9 Provide copies of proposed inspection and testing reporting forms.

.10 Identification of certifications held by the Contractor and relevant to the Work.

.11 A definition of Contractor's management procedure for auditing the quality control plan.

1.6 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 timely notice 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 may order any 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.

1.7 INDEPENDENT INSPECTION AGENCIES

.1 Independent Inspection/Testing Agencies shall be engaged by the Contractor for purpose of inspecting and/or testing portions of Work. Cost of such services will be borne by Contractor. Said inspections, testing and quality assurance shall include, but not be limited to the following:

- .1 Geotechnical continual inspection and monitoring including backfilling and compaction.
- .2 Hazardous material survey, report and continual inspection and monitoring.
- .3 Asphalt paving testing and inspecting.
- .4 Concrete mix design and testing.
- .5 Mill tests for steel.
- .6 Sprinkler system inspection and testing.
- .7 Architectural woodwork inspection.
- .8 Painting and coating inspection.
- .9 Mechanical systems inspection, testing and balancing.
- .10 Electrical systems inspection and testing.
- .11 Inspection and testing of all materials, components and systems as called for specifically in each specification section and as required.

.2 Submit for approval by Departmental Representative names of proposed Independent Inspection/Testing Agencies

.3 Provide equipment required for executing inspection and testing by appointed agencies.

.4 Employment of inspection/testing agencies does not relax responsibility to perform Work in accordance with Contract Documents.

.5 If defects are revealed during inspection and/or testing, appointed agency will request additional inspection and/or testing to ascertain full degree of defect. Correct defect and irregularities as advised by Departmental Representative at no cost to Departmental Representative. Pay costs for retesting and re-inspection.

1.8 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.

1.9 PROCEDURES

.1 Notify appropriate agency and 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 an orderly sequence so as not to cause delay 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.

1.10 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, Departmental Representative may deduct from Contract Price difference in value between Work performed and that called for by Contract Documents, amount of which shall be determined by Departmental Representative.

1.11 REPORTS

.1 Submit electronic copies of inspection and test reports to Departmental Representative.

.2 Provide copies to Subcontractor of work being inspected or tested manufacturer or fabricator of material being inspected or tested.

1.12 TESTS AND MIX DESIGNS

.1 Contractor shall furnish test results and mix designs as may be requested.

.2 The cost of tests and mix designs beyond those called for in Contract Documents or beyond those required by law of Place of Work shall be appraised by Departmental Representative and may be authorized as recoverable.

1.13 SAMPLE INSTALLATIONS / MOCK-UPS

.1 Prepare sample installations and/or mock-ups for Work specifically requested in specifications. Include for Work of all Sections required to provide mock-ups.

.2 Construct in all locations acceptable to Departmental Representative.

.3 Prepare mock-ups for Departmental Representative's review with reasonable promptness and in an orderly sequence, so as not to cause any delay in Work.

.4 Failure to prepare mock-ups in ample time is not considered sufficient reason for an extension of Contract Time and no claim for extension by reason of such default will be allowed.

.5 If requested, Departmental Representative will assist in preparing a schedule fixing dates for preparation.

.6 Remove mock-up at conclusion of Work or when acceptable to Departmental Representative.

.7 Except where otherwise specified, mock-ups may remain as part of Work.

.8 Specification section identifies whether mock-up may remain as part of Work or if it is to be removed and when.

.9 Mockups shall be constructed of actual materials to be used in the work unless otherwise approved by the Departmental Representative.

1.14 MILL TESTS

.1 Submit mill test certificates as required of specification Sections.

1.15 EQUIPMENT AND SYSTEMS

.1 Submit adjustment and balancing reports for mechanical, sprinkler, electrical and building equipment systems.

.2 Refer to Divisions 22, 23, and 26 for definitive requirements.

PART 2 PRODUCTS

2.1 NOT USED

PART 3 EXECUTION

3.1 STAINLESS STEEL PIPE

.1 All stainless steel piping to be used within the fire protection system is to be reviewed and documented as part of the overall quality assurance program.

.2 Stainless steel piping for use in the project shall be individually documented and the following recorded on a per pipe basis.

.1 Supplier and all pertinent information on the pipe origin.

.2 Delivery date and location.

.3 Grade of SS material and its alloy composition.

.4 Outside diameter.

.5 Inside diameter.

.6 Wall thickness.

.7 Ovality.

.8 Pipe end flare.

.9 End square cut.

.3 Pipe, fittings, valves and devices to be joined with grooved couplings shall contain cut, rolled, or cast grooves that are dimensionally compatible with the couplings.

.4 Fabricated stainless steel pipe for installation within the fire protection system shall be individually document and the following recorded on a per pipe basis.

.1 Gasket seating area.

.2 Groove/cut width.

.3 Groove/cut base diameter.

.4 Groove/cot depth.

.5 Pipe end flare.

.6 Wall thickness.

.7 Groove/cut radius, where required.

.5 Stainless steel pipe which exceeds the tolerances associated with pipe end characteristics or roll/cut grove tolerance is not permitted to be used within the fire protection system.

.6 Substructure material product as delivered and fabrication reports shall be provided for review and acceptance prior to installation.

END OF SECTION

PART 1 GENERAL

1.1 Temporary Facilities & Phasing Plan

.1 In concert with, and approval of the Departmental Representative and Parks Canada, the Contractor shall prepare a Temporary Facilities & Phasing Plan (sufficient for the timely performance of the Work, and coordinated with the project phasing schedule) indicating locations and extents of the following:

- .1 Project Phase areas, indicating extents of the Work during sequential Phases of the Contract, so as to ensure the Owner's operational requirements during the course of the Work;
- .2 Temporary continuous emergency vehicle access routing.
- .3 Contractor's access, lay-down and marshalling areas;
- .4 Job trailers, toilets, first aid station, debris bins, storage sheds and site offices;
- .5 Contractors' and staff parking;
- .6 Temporary hoarding and barriers;
- .7 Temporary public traffic routing, controls and diversion;
- .8 Project construction & safety signage;
- .9 Special provisions for the protection of Artifacts and Heritage Value.

.2 No work on site shall proceed until the Temporary Facilities & Phasing Plan is approved by the Departmental Representative and Parks Canada.

1.2 Temporary Protection of Artifacts & Exhibits

The Contractor shall undertake the Work with the following provisions for the protection of remaining artifacts and exhibits:

- .1 Artifacts and exhibits remaining in place during the performance of the Work shall be provided with temporary protection (min. 12mm plywood casing typical) in the Zone(s) of work actively underway, by the Contractor against damage due to the Work, to the satisfaction of the Departmental Representative.
- .2 Artifacts in open storage in the Mezzanines, that are vulnerable to damage, shall be temporarily relocated on site by the Contractor under the direction of the Departmental Representative. The Contractor shall make provisions for this temporary artifact on-site relocation and return to original positions, to the satisfaction of the Departmental Representative.
- .3 Artifacts are only to be moved under Departmental Representative supervision and approval.

1.3 Access & Delivery

.1 Refer to Section 01 14 00 – Work Restrictions.

.2 Comply with the Temporary Facilities & Phasing Plan.

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

.4 Make good damage to local roadways and paved areas used for construction access to work site.

1.4 Public Traffic Flow

.1 Provide and maintain and signage as required to perform the Work and protect the public.

1.5 Fire and Emergency Vehicle Routes

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

1.6 Contractor Staging Area

.1 Due to the tight physical limitations of the Cannery property (ref. Site Plan) a Contractor Staging Area has been designated on adjacent Steveston Harbour Authority (the "Harbour Authority") property at the south end of the Cannery buildings. The cost for the lease of this Harbour Authority property will be borne by the Owner for the designated period of the contract (ref. part 1.7 below) and by the Contractor thereafter until completion.

.2 Confine activities to the area of the site, except where space restrictions require the use of off-site storage, or other project needs. Do not endanger or interfere with operations, existing facilities nor utilities on site. Refer also to Section 01 14 00.

.3 Contractors' storage and lay-down facilities shall be confined to that area indicated on the Temporary Facilities Plan, and confined by the following Contractor provided means:

.1 The areas shall be contained by temporary construction type fencing screwed or bolted to the pavement or wood decks.

.2 Provide access gates, of type as approved by Departmental Representative, where indicated on Temporary Facilities Plan.

.4 At completion of project, remove barriers, fencing, gates and make good to pavement or wood decks and other affected elements.

.5 Storage space is limited to lay-down area. Should more storage be required, Contractor shall provide off site.

.6 Do not load or permit to load any part of Work with weight or force that will endanger Work or existing structure or elements.

.7 Contractor(s) shall provide construction trailers for use as site office and storage located in the Contractor Staging Area.

.8 Locate and maintain in clean, orderly and safe condition. Remove and make good site at Project completion. Provide first aid facilities in strict accordance with WorkSafeBC requirements. Locate temporary facilities in compliance with Temporary Facilities Plan and as directed by Departmental Representative.

1.7 Temporary Construction Power

.1 Provide and pay for temporary power during construction. Contractor shall also be responsible for connections to power source and for continued maintenance of same for the duration of the project, all in accordance with the Facility's Policy and BC Hydro.

.2 Electrical power and lighting installed under this contract may be used for temporary construction purposes, provided that guarantees are not affected thereby and electrical components used for temporary power are replaced when damaged. Charges for said power shall be paid for by the Contractor.

.3 Replace lighting bulbs/tubes used for more than three months or provide replacement bulbs/tubes and hand over to Departmental Representative.

1.8 Water Supply

.1 Contractor shall make arrangements for water supply and be responsible for making all connections and making good at project completion.

1.9 Sanitary Facilities

.1 Contractor shall provide temporary portable toilets for construction workers on site. Locate in the Contractor Staging Area and maintain in a sanitary, safe and secure manner. Remove from site and make good at completion of Project.

1.10 Temporary Heating and Ventilation

.1 Maintain working temperatures and ventilation rates as required in writing by the manufacturers of the various materials, coatings and systems being employed on the Project.

.2 Construction heaters used inside any buildings must be vented to outside or be flameless type. Solid fuel salamanders are not permitted.

.3 Provide temporary heat and ventilation for construction as required:

.1 To facilitate progress of Work.

.2 To protect Work and products against dampness and cold.

.3 To cure concrete.

.4 To prevent moisture condensation on surfaces.

.5 To provide ambient temperatures and humidity levels for storage, installation and curing of materials.

.4 Provide adequate ventilation to meet health regulations for safe working environment.

1.11 Contractor's Parking

.1 Parks Canada will allow the rental of twelve (12) parking stalls for Contractor parking in the North parking lot (ref. Site Plan on drawing sheet A1.10). All parking costs will be paid for by the Contractor, to be included in the contract price.

.2 Any other parking required for the performance of the Work shall be provide off-site by the Contractor.

1.12 Dewatering

.1 Provide temporary drainage and pumping facilities to keep excavations and site free from standing water.

1.13 Temporary Communications Facilities

.1 Provide and pay for temporary telephone and fax hook up, line[s] necessary for own use.

1.14 Fire Protection Systems Impairment and Fire Watch

.1 The Contractor shall endeavour to maintain the continuous operability of the Fire Protection systems (Fire Alarm and Sprinkler systems). When either or both systems is/are impaired by the work, the Contractor shall provide Fire Watch and other measures for the duration of the impairment, according to a Fire Protection System Impairment Plan prepared by the Contractor to the satisfaction of the Departmental Representative.

.2 The Fire Protection System Impairment Plan shall include the following mandatory provisions:

.1 Fire Watch, which may be achieved either by contractor personnel, or by the designated alternate Fire Watch provider (see below). Fire Watch rounds shall be performed on an hourly basis, minimum. Where fuel-fired appliances are used and maintained in operation during contractor off-work hours, the frequency shall be increased to every 30 minutes.

.2 Information and mitigation measures listed in the National Fire Code parts A-6.1.1.3. (1) and A-6.1.1.4.(1);

.3 Provisions required under Chapter 15 of NFPA 25 “Standard for the Inspection, Testing, and Maintenance of Water-based Fire Protection Systems (2014 edition);

.4 A final comprehensive inspection of the work area and adjacent exposed areas shall be conducted 60 minutes after completion of each contractor work day. The comprehensive inspection shall include visual inspection of concealed spaces, building equipment, storage arrangements, and combustible refuse within the work area and exposed areas adjacent to the work area. Equipment such as thermal scanners or infrared thermometers can be used to take temperature readings in areas where visual inspection is impeded by obstructions;

.5 At the end of each contractor work day, all equipment introduced into the space shall be de-energized and completely disconnected from its power source. This includes power tools, equipment and lighting;

.6 All combustible refuse shall be removed from the affected work area and discarded appropriately per Section 01 74 19.

.3 Fire Watch Provisions: Fire Watch to be provided for different system impairment scenarios as follows:

.1 Cannery Buildings (superstructure)- Fire Alarm System and Sprinkler System Impairment:

.1 A Fire Watch shall be conducted throughout the building area(s) affected by the impairment.

.2 Cannery Buildings (superstructure)- Sprinkler System Impairment (only):

.1 Option #1- A fire watch shall be conducted throughout the building area(s) affected by the impairment, OR

.2 Option #2- Temporary fire detection shall be installed in the building area(s) affected by the impairment. These detectors shall be interconnected with the base building fire alarm system. Where fire detection is not currently installed, this can be achieved by temporarily installing conventional heat detectors in the affected work area with flexible metal conduit cable (BX / SecureX) and non-combustible ties. In areas where the project is calling for the deletion of heat detectors (refer to Electrical contract documents), this requirement is satisfied if these device are reconnected to the fire alarm system and that the circuits and detectors are verified as per Chapter 7 "System Modification" of CAN/ULC S537-13.

.3 Cannery Buildings (superstructure)- Fire Alarm System Impairment (Only)

.1 A fire watch shall be conducted throughout the area affected by the impairment.

.4 Pier Substructure:

.1 Option #1 – in addition to the mandatory requirements for inspections / shutdown (per the Impairment Plan), provide temporary fencing or material (non-combustible) around the exterior perimeter of the pier to prevent combustible material from entering the underside of the substructure.

.2 Option #2 - A fire watch shall be conducted throughout the area affected by the impairment.

.4 Fire Watch may be provided by the designated alternate provider, the Canadian Corps of Commissionaires (“Commissionaires BC”) under the terms of the Owner’s standing service agreement at $25.48 per hour.

.5 The Contractor shall carry in the Contract a budget cost for the designated alternate Fire Watch provider required for the performance of the work, including any management & scheduling of Fire Watch to suit the course of construction.

.6 The Owner shall pay the actual designated alternate Fire Watch provider costs incurred during the performance of the work, and shall recoup the whole incurred such Fire Watch costs from the Contract value by means of a credit Change Order, notwithstanding any Contractor budget limitations.

.7 Ensure all Fire Watch personnel have the training and means to adequately sound the alarm to notify building occupants in case of fire, and can appropriately communicate directly with the Fire Department. Include a system to regularly record the provision of Fire Watch in all parts of the building, and make such reports available to the Departmental Representative.

1.15 Scaffolding

.1 Construct and maintain scaffolding in rigid, secure and safe manner in accordance with WorkSafeBC regulations.

.2 Erect scaffolding independent of walls. Remove promptly when no longer required. The Main Scaffolding is to remain in place for the entire duration of the Work.

1.16 Hoisting

.1 Provide, operate and maintain hoists required for moving of workers, materials and equipment. Make financial arrangements with Sub-contractors for their use of hoists.

.2 Hoists shall be operated by qualified operator.

1.17 Protection, Temporary Barriers and Enclosures

.1 Provide temporary dust screens where dust generating work occurs.

.2 Guardrails and Excavations:

.1 Provide secure, rigid guard rails and barricades around deep excavations, open edges of floors and roofs in accordance with WorkSafeBC requirements.

.3 Hoarding

.1 Erect Temporary Hoarding, as approved by Department Representative, for site enclosure security and control of pedestrian and vehicular traffic.

.4 Access to Site:

.1 Maintain existing access roads and designated parking area in broom clean condition. Refer also to Section 01 14 00.

.5 Protection of Building Heritage Elements and Finishes, Artifacts and Exhibits:

.1 Provide protection for equipment during performance of Work. Refer to Section 01 11 55, Parts 1.3.4 to 8.

.2 Provide necessary screens, covers, and hoardings.

.3 Confirm with Departmental Representative locations and installation schedule three (3) days prior to installation.

.4 Be responsible for damage incurred due to lack of or improper protection.

.6 Mold Control and Materials Protection

.1 Protect all building materials from mold growth and propagation during transit, storage and assembly in accordance with CCA82-2004 – Mold Guidelines for the Canadian Construction Industry.

1.18 Site Signs and Notices

.1 Only Project identification signboards and notices for safety or instructions are permitted on site.

.2 Format, location and quantity of site signs and notices shall be approved by Departmental Representative.

.3 Signs and notices for safety or instructions shall be in English language, or commonly understood graphic symbols.

.4 Maintain signboards, signs and notices for duration of project. Remove and dispose of signs off site on completion of project.

.5 No other signs will be permitted on site unless approved by the Departmental Representative.

1.19 Contractor's Site Office

.1 Provide office (trailer) of size to accommodate site meetings and Contractor's operations

.2 Provide a clearly marked and fully stocked first-aid facility in a readily available location. Adhere to WorkSafeBC directions for first aid facilities.

.3 Locate trailer in the designated Contractor Staging Area, as indicated on the Temporary Facility Plan and as directed by Departmental Representative

1.20 Equipment, Tools and Storage

.1 All construction personnel must remain accountable for their tools and equipment at all times. At no time should tools and equipment be left unattended when within reach of the travelling public.

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

.3 Locate materials not required to be stored in weatherproof sheds on site in a safe and secure manner to cause least interference with work activities and facility operations and security.

1.21 Removal of Temporary Facilities

.1 Remove temporary facilities from site when directed by the Departmental Representative.

1.22 Clean-up

.1 Remove construction debris, waste materials, packaging material from work site daily. (Refer to Section 01 74 00 and 01 74 19).

.2 Clean dirt and mud tracked onto paved or surfaced roadways.

.3 Store materials resulting from demolition activities that are salvageable. (Refer to Section 01 74 21)

.4 At completion of Project: Remove and dispose of all debris, thoroughly clean and restore site to condition found at commencement of Work. Repair and make good to all damage caused by construction activities.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

.1 Section 01 45 00 Quality Control

1.2 Reference Standards

.1 All design and construction work shall be executed in conformance with the latest editions of the following Codes, Laws, regulations and trade/manufacturing quality standards associations:

- .1 National Building Code of Canada (NBCC).
- .2 British Columbia Building Code (BCBC)
- .3 Model National Energy Code of Canada for Buildings.
- .4 CAN/CSA-B651 – Barrier-Free Design.
- .5 National Fire Code, Latest Edition.
- .6 NFPA – National Fire Protection Association.
- .7 Canada Labour Code – Part 2.
- .8 Local Bylaws/Authorities having Jurisdiction.
- .9 WorkSafe BC – Workers Compensation Board of BC.
- .10 CSA – Canadian Standards Association.
- .11 CGSB – Canadian General Standards Board.
- .12 ULC – Underwriters Laboratories of Canada.
- .13 ASTM – American Society for Testing Materials.
- .14 ANSI – American National Standards Institute.
- .15 AASHTO – American Association of State Highways & Transportation Officials.
- .16 ASHRAE – American Society of Heating, Refrigeration and Air Conditioning Engineers.
- .17 AWMAC – Architectural Woodwork Manufacturers Association of Canada.
- .18 CSDFMA – Canadian Steel Door and Frame Manufacturer's Association.
- .19 CRCA – Canadian Roofing Contractors Association.
- .20 RCABC – Roofing Contractors Association of BC.
- .21 AWCCBC – Association of Wall and Ceiling Contractors of BC.
- .22 CISC – Canadian Institute of Steel Construction.
- .23 CSSBI – Canadian Sheet Steel Building Institute.
- .24 CUFCA – Canadian Urethane Foam Contractor's Association.
- .25 MPI – the Master Painters Institute.
- .26 NAAMM – National Association of Architectural Metal Manufacturers.
- .27 SMACNA – Sheetmetal and Air Conditioning Contractor's National Association, Inc.
- .28 NHLA – National Hardwood Lumber Association.
- .29 NLGA – National Lumber Grades Authority.
- .30 NFCA – National Floor Covering Association

1.3 Products/Material and Equipment

.1 Use NEW products/material and equipment unless otherwise specified. The term "products" is referred to throughout the specifications.

.2 Use products of one manufacturer for material and equipment of the same type or classification unless otherwise specified.

.3 Unless otherwise specified, comply with manufacturer's latest printed instructions for materials and installation methods.

.4 Notify Departmental Representative in writing of any conflict between these specifications and manufacturer's instructions. Departmental Representative will designate which document is to be followed.

.5 Provide metal fastenings and accessories in the same texture, colour and finish as base metal in which they occur.

.1 Prevent electrolytic action between dissimilar metals.

.2 Use non-corrosive fasteners, anchors and spacers for securing exterior work.

.6 Fastenings which cause spalling or cracking are not acceptable.

.7 Use fastenings of standard commercial sizes and patterns with material and finish suitable for service.

.8 Use heavy hexagon heads, semi-finished unless otherwise specified.

.9 Bolts may not project more than 1 diameter beyond nuts.

.10 Types of washers as follows:

.1 Plain type washers: use on equipment and sheet metal.

.2 Soft gasket lock type washers: use where vibrations occur.

.3 Resilient washers: use with stainless steel.

.11 Deliver, store and maintain packaged material and equipment with manufacturer's seals and labels intact.

.12 Prevent damage, moisture absorption, contact with organic matter, adulteration and soiling of products during delivery, handling and storage. Immediately remove rejected products from site.

.13 Store products in accordance with suppliers' instructions.

.14 Touch up damaged factory finished surfaces to Departmental Representative's satisfaction.

.1 Use primer or enamel to match original.

.2 Do not paint over nameplates.

1.4 Quality of Products

.1 Products, materials and equipment (referred to as products) incorporated into work shall be new, not damaged or defective, and of the best quality (compatible with the specifications) for the purpose intended. If requested, furnish evidence as to type, source and quality of the products provided.

.2 Defective products will be rejected regardless of previous inspections.

.1 Inspection does not relieve responsibility, but is precaution against oversight or error.

.2 Remove and replace defective products at own expense and be responsible for delays and expenses caused by rejection.

.3 Retain purchase orders, invoices and other documents to prove that all products utilized in this Contract meet the requirements of the specifications. Produce documents when requested by the Departmental Representative.

.4 Should any dispute arise as to quality or fitness of products, the decision rests strictly with the Departmental Representative based upon the requirements of the Contract documents.

.5 Unless otherwise indicated in the specifications, maintain uniformity of manufacture for any particular or like item throughout the 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.

1.5 Availability of Products

.1 Immediately upon project commencement, review product delivery requirements and anticipate foreseeable supply delays for any items.

.2 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 the work.

.3 In event of failure to notify Departmental Representative at the start of work and should it subsequently appear that the work may be delayed for such reason, the Departmental Representative reserves the right to substitute more readily available products of similar character, at no increase in either the Contract price or the Contract time.

1.6 Manufacturer’s Instructions

.1 Unless otherwise indicated in the specifications, install or erect products in accordance with the manufacturer's instructions.

.1 Do not rely on labels or enclosures provided with products.

.2 Obtain written instructions directly from the manufacturer.

.2 Notify Departmental Representative in writing of conflicts between the specifications and the manufacturer's instructions so that the Departmental Representative may establish the course of action.

.3 Improper installation or erection of products, due to failure in complying with these requirements, authorizes the Departmental Representative to require removal and re-installation at no increase in either the Contract price or the Contract time.

1.7 Contractor’s Options for Selection of Products for Tendering

.1 Products are specified by "Prescriptive" specifications: select any product meeting or exceeding specifications.

.2 Products specified under "Acceptable Products": select any one of the indicated manufacturers, or any other manufacturer meeting or exceeding the Prescriptive specifications and indicated Products.

.3 Products specified by performance and referenced standard: select any product meeting or exceeding the referenced standard.

.4 Products specified to meet particular design requirements or to match existing materials: use only material specified Approved Product. Alternative products may be considered provided full technical data is received in writing by Departmental Representative in accordance with "Special Instructions to Tenderers".

.5 When products are specified by a referenced standard or by or Performance specifications, upon request of Departmental Representative obtain from manufacturer an independent laboratory report showing that the product meets or exceeds the specified requirements.

1.8 Substitution After Contract Award

.1 No substitutions are permitted without prior written approval of the Departmental Representative.

.2 Proposals for substitution may only be submitted after Contract award. Such request must include statements of respective costs of items originally specified and the proposed substitution.

.3 Proposals will be considered by the Departmental Representative if:

.1 products selected by tenderer from those specified are not available;

.2 delivery date of products selected from those specified would unduly delay completion of Contract, or

.3 alternative product to that specified, which is brought to the attention of and considered by Departmental Representative as equivalent to the product specified, and will result in a credit to the Contract amount.

.4 Should the proposed substitution be accepted either in part or in whole, assume full responsibility and costs when substitution affects other work on the project. Pay for design or drawing changes required as result of substitution.

.5 Amounts of all credits arising from approval of the substitutions will be determined by the Departmental Representative, and the Contract price will be reduced accordingly.

END OF SECTION

PART 1 GENERAL

1.1 Qualifications of Surveyor

.1 Qualified registered land surveyor, licensed to practice in British Columbia acceptable to Departmental Representative.

1.2 Survey Reference Points

.1 Existing base horizontal and vertical control points are designated on drawings.

.2 Locate, confirm and protect control points prior to starting site work. Preserve permanent reference points during construction.

.3 Make no changes or relocations without prior written notice to Departmental Representative.

.4 Report to Departmental Representative when reference point is lost or destroyed, or requires relocation because of necessary changes in grades or locations.

.5 Require surveyor to replace control points in accordance with original survey control.

1.3 Survey Requirements

.1 Establish two permanent bench marks on site, referenced to establish bench marks by survey control points. Record locations, with horizontal and vertical data in Project Record Documents.

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

.3 Stake for grading, fill placement.

.4 Stake slopes.

.5 Establish pipe invert elevations.

.6 Stake batter boards for foundations.

.7 Establish foundation, column locations and floor elevations.

.8 Establish lines and levels for mechanical and electrical work.

1.4 Existing Services

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

.2 Remove abandoned service lines within 2 m of structures. Cap or otherwise seal lines at cut-off points as directed by Departmental Representative.

1.5 Location of Equipment and Fixtures

.1 Location of equipment, fixtures and outlets indicated or specified are to be considered as approximate.

.2 Locate equipment, fixtures and distribution systems to provide minimum interference and maximum usable space and in accordance with manufacturer’s recommendations for safety, access and maintenance.

.3 Inform Departmental Representative of impending installation and obtain approval for actual location.

.4 Submit field drawings to indicate relative position of various services and equipment when required by Departmental Representative.

1.6 Records

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

.2 On completion of foundations and major site improvements, prepare a certified survey showing dimensions, locations angles and elevations of Work.

.3 Record locations of maintained, re-routed and abandoned service lines.

1.7 Submittals

.1 Submit name and address of surveyor to Departmental Representative.

.2 On request of Departmental Representative, submit documentation to verify accuracy of field engineering work.

.3 Submit certificate signed by surveyor certifying and noting those elevations and locations of completed Work that conform and do not conform with Contract Documents.

1.8 Subsurface Conditions

.1 Promptly notify Departmental Representative in writing if subsurface conditions at Place of Work differ materially from those indicated in Contract Documents, or a reasonable assumption of probable conditions based thereon.

.2 After prompt investigation, should Departmental Representative determine that conditions do differ materially, instructions will be issued for changes in Work as provided in Changes and Change orders.

PART 2 PRODUCTS

2.1 Not Used

.1 Not Used.

2.2 Not Used

.1 Not Used.

END OF SECTION

PART 1 GENERAL

1.1 RELATED SECTION

.1 Section 01 74 21
Waste Management and Disposal

.2 Section 01 78 30
Closeout Submittals

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 regularly scheduled times or dispose of as directed by Departmental Representative. Do not burn waste materials on site.

.3 Clear snow and ice from access to building, bank/pile snow in designated areas only.

.4 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.

.5 Provide on-site containers for collection of waste materials and debris.

.6 Provide and use clearly marked separate bins for recycling. Refer to Section 01 74 21 - Waste Management and Disposal.

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

.8 Dispose of waste materials and debris off site.

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

.10 Store volatile waste in covered metal containers, and remove from premises at end of each working day.

.11 Provide adequate ventilation during use of volatile or noxious substances. Use of building ventilation systems is not permitted for this purpose. Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer. 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 DEMOLISHED MATERIALS AND CONSTRUCTION WASTE

.1 The Contractor is responsible for ensuring that all materials are properly disposed of and that under no circumstances are demolished materials, construction waste, screws, fasteners, connectors and other similar items to be left in walls, ceilings, cavities, pockets, and voids.

1.4 FINAL CLEANING

.1 When Work is Substantially Performed, remove surplus products, tools, construction machinery and equipment not required for performance of remaining Work.

.2 Remove waste products and debris other than that caused by others, and leave Work clean and suitable for occupancy.

.3 Prior to final review, remove surplus products, tools, construction machinery and equipment.

.4 Remove waste products and debris including that caused by other Contractors.

.5 Remove waste materials from site at regularly scheduled times or dispose of as directed by Departmental Representative. Do not burn waste materials on site, unless approved by Departmental Representative.

.6 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.

.7 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.

.8 Remove stains, spots, marks and dirt from decorative work, electrical and mechanical fixtures, furniture fitments, walls, and floors.

.9 Clean lighting reflectors, lenses, and other lighting surfaces.

.10 Vacuum clean and dust building interiors, behind grilles, louvres and screens.

.11 Wax, seal, shampoo or prepare floor finishes, as recommended by manufacturer.

.12 Inspect finishes, fitments and equipment and ensure specified workmanship and operation.

.13 Broom clean and wash exterior walks, steps and surfaces; rake clean other surfaces of grounds.

.14 Remove dirt and other disfiguration from exterior surfaces.

.15 Clean and sweep roofs, gutters, areaways, and sunken wells.

.16 Sweep and wash clean paved areas.

.17 Clean equipment and fixtures to a sanitary condition; clean or replace filters of mechanical equipment.

.18 Clean roofs, downspouts, and drainage systems.

.19 Remove debris and surplus materials from crawl areas and other accessible concealed spaces.

.20 Remove snow and ice from access to building.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

.1 Section 01 11 55 General Instructions

.2 Section 01 14 00 Work Restrictions

.3 Section 01 35 33 Health & Safety Requirements

.4 Section 01 51 00 Temporary Facilities

1.2 Definitions

.1 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.

.2 Recycle: Process by which waste and recyclable materials are transformed or collected for purpose of being transferred into new products.

.3 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.

.4 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.

.5 Salvage: Removal of structural and non structural materials from deconstruction/disassembly projects for purpose of reuse or recycling.

.6 Waste Reduction Workplan (WRW): a written report which addresses opportunities for reduction, re-use or recycling of materials.

1.3 Materials Source Separation Program (MSSP)

.1 Implement MSSP for waste generated on project in compliance with approved methods and as reviewed by Departmental Representative.

.2 Provide on site facilities for collection, handling, and storage of anticipated quantities of reusable and recyclable materials.

.3 Provide containers to deposit reusable and recyclable materials.

.4 Locate containers in locations, to facilitate deposit of materials without hindering daily operations.

.5 Locate separated materials in areas which minimize material damage.

.6 Collect, handle, store on site, and transport off site, salvaged materials in separate condition.

.7 .Transport to authorized recycling facility.

1.4 Storage, Handling and Protection

.1 Unless specified otherwise, materials for removal become Contractor's property.

.2 Protect, stockpile, store and catalogue salvaged items.

.3 Separate non salvageable materials from salvaged items. Transport and deliver non salvageable items to licensed disposal facility.

.4 Protect structural components not removed for demolition from movement or damage.

.5 Separate and store materials produced during dismantling of structures in designated areas.

.6 Prevent contamination of materials to be salvaged and recycled and handle materials in accordance with requirements for acceptance by designated facilities.

.1 On site source separation is recommended.

.2 Remove co mingled materials to off site processing facility for separation.

.3 Provide waybills for separated materials.

.7 Do work in compliance with Waste Reduction Workplan.

1.5 Hazardous Materials Report

.1 Comply with the Hazardous Assessment Report (Appendix B). Refer to Sections 01 11 55, 02 81 00, and 02 82 00.01.

1.6 Disposal of Wastes

.1 Do not bury rubbish or waste materials.

.2 Do not dispose of waste into waterways, storm, or sanitary sewers.

.3 Remove materials from deconstruction as deconstruction/disassembly Work progresses.

1.7 Use of Site and Facilities

.1 Execute work with least possible interference or disturbance to normal use of premises.

PART 2 PRODUCTS

2.1 NOT USED

PART 3 EXECUTION

3.1 Application

.1 Handle waste materials not reused, salvaged, or recycled in accordance with appropriate regulations and codes.

3.2 Cleaning

.1 Remove tools and waste materials on completion of Work, and leave work area in clean and orderly condition.

.2 Clean up work area as work progresses.

.3 Source separate materials to be reused/recycled into specified sort areas.

END OF SECTION

PART 1 GENERAL

1.1 Submission

.1 Prepare instructions and data by personnel experienced in maintenance and operation of described products.

.2 Revise content of documents as required before final submittal.

.3 Phasing of submission:

.1 2 weeks before substantial performance of the work, submit to Consultant 4 final copies of operation and maintenance manuals.

.4 Ensure spare parts, maintenance materials and special tools provided are new, neither damaged nor defective, and of same quality and manufacture as products provided in work.

.5 If requested, furnish evidence as to type, source and quality of products provided.

.6 Defective products will be rejected, regardless of previous inspections. Replace products at own expense

1.2 Format

.1 All as-built drawings and operation and maintenance (O&M) manuals listed under the Scope of Work shall be converted, where necessary, into Portable Data File (PDF) format permit for viewing using the Acrobat Reader software free from the internet. If documents are scanned they shall be scanned using OCR option on scanner and to have a minimum resolution of 300dpi.

.2 Documentation storage and retrieval system shall be structured based on a database framework with direct links to the appropriate PDF files. Documents retrieval and viewing shall be executed through a menu driven approach.

.3 The Program shall provide multi-level of password entry for access to add new or edit stored data by authorized users.

.4 Program shall be capable of storing separately and independently data of multiple buildings and shall be expandable for addition of new buildings and systems.

.5 Data of each building shall be accessible by the input of either the building name or building number as defined by the program user.

1.3 Contents, Each Volume

.1 Table of Contents – provide the following:

.1 Title of project

.2 Date of submission.

.3 Names, addresses, and telephone numbers of Consultant and Contractor with name of responsible parties.

.4 Schedule of products and systems, indexed to content of volume.

.2 For each product or system, list names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.

.3 Product data: mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.

.4 Drawings: supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.

.5 Building data shall be collected and stored in a database format as an integral part of the Program. Building data shall include the following:

.1 Building Name

.2 Building Address

.3 Facility Manager

.4 Building Photo

1.4 Operation and Maintenance Manual

.1 Record drawings:

.1 As work progresses, maintain accurate records to show all deviations from the Contract Drawings. Note on as-built drawings as changes occur. At completion supply:

.1 Two (2) set of CD's in AutoCad file format (version 2010) with all as-built information on the diskettes.

.2 Four (4) sets of printed as-built drawings.

.3 Submit one copy of check plots to Consultant prior to final printing of as-built drawings.

.4 Retain original logo and title block area a small company logo, the text "AS-BUILT" and the date.

.2 Final Drawings:

.1 Drawings shall be converted from the original electronic files, such as CAD, into PDF format. If only the hard copies of the 'as-built' drawings are available, they shall be scanned and saved in PDF format. PDF files of the 'As-built' drawings shall be enhanced with the following bookmarks to zoom into legible views on the computer screen as a minimum:

.1 Drawing Number and Title

.2 Drawing Notes

.3 Major Equipment Locations

.4 Cross-links to other related drawings

.5 Revisions

.3 Cost for transferring as-built information from marked up working set of drawings to electronic format using ACAD and plotting services shall be included in the Contract.

.2 Maintenance Manual:

.1 Upon completion of project submit to Departmental Representative three (3) CD R/disk copies and one paper (in 3" D ring, loose leaf binder with spine and face pockets, to match Facility's existing) of Operations and Maintenance Manual, made up as follows:

.1 All as-built drawings and operation and maintenance (O&M) manuals listed under the Scope of Work shall be converted, where necessary, into Portable Data File (PDF) format for viewing using the Adobe Acrobat Reader.

.2 Documentation storage and retrieval system shall be structured based on a database framework with direct links to the appropriate PDF files. Documents retrieval and viewing shall be executed through a menu driven approach.

.3 Organize files into CSI Masterformat numbering system or other approved descriptive titles. O&M data and as-built drawings shall be classified by their corresponding disciplines, including:

- .1 Architectural
- .2 Structural
- .3 Mechanical
- .4 Electrical
- .5 Data & Communication
- .6 Civil

.4 Program shall be capable of storing separately and independently data of multiple buildings and shall be expandable for addition of new buildings and systems.

.5 The manual shall, according to the type of services or disciplines, include the full contents of each hard copy of the O&M Manuals with the addition of Miscellaneous Maintenance Reports and Records, or as defined by the user. In general the following shall be included unless specifically excluded by the user:

- .1 Introduction
- .2 Consultant/Contractor/Suppliers List
- .3 System Description
- .4 Maintenance and Lubrication Schedules
- .5 Testing and Commissioning (T&C) Reports
- .6 Misc. Reports
- .7 Specifications
- .8 Equipment and/or point schedules as identified in the hard copy documents.
- .9 Others as stipulated by the user

.6 All Basic Documents PDF files shall be enhanced with appropriate bookmarks to facilitate searching of information within the document or linked to other relevant documents for references.

.7 Building systems data shall be identified by their services, disciplines, function, nature and specific scope. System data shall be classified into the following categories:

- .1 System Description
- .2 Schematic (where applicable)

.3 Equipment List

.8 Provide hot key buttons, where applicable, for direct access to drawings/data referenced on schematics. The same shall be applied to listed equipment for direct links to the corresponding equipment data.

.1 Equipment data shall be classified into the following categories:

.2 Equipment submittals

.3 T&C Report

.4 Maintenance Data

.5 Maintenance Records

.6 Photo

.9 Provide a summary screen to list all equipment classified under a specific system. On the summary screen, provide direct links to the corresponding equipment data under each category with addition links to the relevant 'As-Built' drawings.

.10 Program shall be executed by Professional Engineers with a minimum of 10 years post qualification experience in the field of Building Services Engineering.

.11 The Contractor shall provide a minimum of 3 past job references as proven record of similar undertakings commissioned by internationally renowned institutions or government agencies.

.12 Refer to Mechanical and Electrical Divisions for specific details for Mechanical and Electrical data.

.13 An example of the service provider is "Company: D-Elements Designing Services Inc. Contact Name: Ken Mak. Phone No: (604) 786-8892, Email: Kenneth.kc.mak@gmail.com

.2 Changes made by addenda and change orders.

1.5 Equipment and Systems

.1 Operating procedures – include the following:

.1 Start-up, break-in, and routine normal operating instructions and sequences.

.2 Regulation, control, stopping, shutdown, and emergency instructions.

.3 Summer, winter, and any special operating instructions.

.2 Maintenance requirements: list routine procedures for

.1 Each item of equipment and each system.

.3 Provide servicing and lubrication schedule, and list of lubricants required.

.4 Include manufacturer's printed operation and maintenance instructions.

.5 Include sequence of operation by controls manufacturer.

.6 Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

.7 Provide installed control diagrams by controls manufacturer.

.8 Provide Contractor's coordination drawings with installed colour coded piping diagrams.

.9 Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

.10 Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

.11 Additional requirements: as specified in individual specification Sections.

1.6 Manufacturer’s Documentation Reports

.1 When specified in individual Sections, require manufacturer to provide authorized representative to demonstrate operation of equipment and system, instruct Departmental Representative's indicated facility's personnel, and provide detailed written report that demonstration and instructions have been completed.

.2 Departmental Representative will provide list of personnel to receive instructions, and will coordinate their attendance at agreed-upon times.

1.7 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 on-site location as directed; place and store.

.4 Receive and catalogue all items. Submit inventory listing to the Departmental Representative. Include approved listings in maintenance manual.

.5 Obtain receipt for delivered products and submit to Departmental Representative.

1.8 Maintenance 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 on-site location as directed; place and store.

.4 Receive and catalogue all items. Submit inventory listing to the Departmental Representative. Include approved listings in maintenance manual.

.5 Obtain receipt for delivered products and submit to Departmental Representative.

1.9 Special Tools

.1 Provide special tools in quantities specified in individual specification Sections.

.2 Provide items with tags identifying their associated function and equipment.

.3 Deliver to location as directed; place and store.

.4 Receive and catalogue all items.

.1 Submit inventory listing to the Departmental Representative.

.2 Include approved listings in maintenance manual.

1.10 Warranties, Bonds, Test Reports, Inspection Reports

.1 Separate each Document 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, Bonds, Test Results, Inspection Reports executed in duplicate by subcontractors, suppliers, manufacturers, and inspection agencies within 10 days after completion of the applicable item of work.

.4 Except for items put into use with the Departmental Representative's permission, leave date of beginning of time of warranty until the date of substantial performance is determined.

.5 Verify that documents are in proper form, contain full information, and are notarized.

.6 Co-execute submittals when required.

.7 Retain warranties and bonds until time specified for submittal.

1.11 Completion

.1 Submit a written certificate that the following have been performed:

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

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

.3 Equipment and systems have been tested, adjusted and balanced, and are fully operational.

.4 Certificates required by the Boiler Inspection Branch, Fire Protection Engineering Services, PWGSC, Marshall and Township of Langley, whichever is applicable.

.5 Operation of systems has been demonstrated to the personnel indicated by the Departmental Representative.

.6 Work is complete and ready for final inspection.

END OF SECTION

PART 1 GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 01 11 55 - General Instructions

.2 Section 01 91 15 – Commissioning- Demonstration and Training.

1.2 ADMINISTRATIVE REQUIREMENTS

.1 Demonstrate scheduled 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 in accordance with Sections 20 00 01, 26 00 01, and 26 32 16.

.4 Ensure testing, adjusting, and balancing has been performed in accordance with Sections 20 00 01, 26 00 01, and 26 32 16, and equipment and systems are fully operational.

.4 Demonstration and Instructions:

.1 Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, and maintenance of each item of equipment at scheduled times, at the equipment location, in accordance with Section 01 91 15.

.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.

1.3 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.

1.4 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

PART 3 EXECUTION

3.1 NOT USED

END OF SECTION

PART 1 – GENERAL

1.1 DESCRIPTION

1. Related Sections: This section of the Specification forms part of the Contract Documents and shall be read, interpreted and coordinated with all other parts.

2. CES Engineering – Commissioning Authority: An independent firm (CES Engineering Ltd) specializing in building systems commissioning type of work has been retained by the Owner to act as the project Commissioning Authority. This firm will be responsible to manage and administrate the commissioning process on this project.

3. Commissioning Requirements: The administration of the commissioning process is based on *LEED v4 Energy and Atmosphere Credit Fundamental Commissioning and Verification, and Enhanced Commissioning* requirements.

4. **Commissioning Definition: Commissioning is a systematic process of ensuring that all building systems perform interactively according to the design intent and the owner's operational needs. This is achieved by beginning in the design phase and documenting the owner's project requirements, design intent and continuing through construction, acceptance and the warranty period with actual verification of performance. The commissioning process shall encompass and coordinate the traditionally separate functions of system documentation, equipment startup, control system calibration, testing and balancing, performance testing and training.**

Commissioning during the construction phase is intended to achieve the following specific objectives according to the Contract Documents:

1. Verify that applicable equipment and systems are installed according to the manufacturer's recommendations and to industry accepted minimum standards and that they receive adequate operational checkout by installing contractors.
2. Verify and document proper performance of equipment and systems.
3. Verify that O&M documentation left on site is complete.
4. Verify that the Owner's operating personnel are adequately trained.
5. Verify that applicable equipment and systems are installed as per Heritage Quality Assurance.
6. Verify that all applicable materials are tested and installed per quality assurance specified.

The commissioning process does not take away from or reduce the responsibility of the consultants or installing contractors to provide a finished and fully functioning product.

5. Abbreviations. The following are common abbreviations used in the Commissioning Specifications and in the Commissioning Plan. Definitions are found in Section 1.6.

OW-	Owner/Owner's Representative	PM-	Project Manager (of the Owner)
CA-	Commissioning Authority	GC-	General Contractor (prime)
Cx-	Commissioning	MC-	Mechanical Contractor
Cx Plan-	Commissioning Plan Document	CC	Controls Contractor
PC-	Prefunctional Checklist	TAB-	Test and Balance Contractor
FT-	Functional Performance Test	EC-	Electrical Contractor
A/E-	Architect and Design Engineers	Subs-	Subcontractors

1.2 COORDINATION

1. Commissioning Team. The members of the commissioning team consist of the Commissioning Authority (CA), the Project Manager (PM), the designated representative of the Owner's firm (OW), the General Contractor (GC), the architect and design engineers (A/E), the Mechanical Contractor (MC), the Electrical Contractor (EC), the TAB Contractor, the Controls Contractor (CC), any other installing subcontractors (Subs) or suppliers of equipment. The Owner's building or plant operator/engineer is also a member of the commissioning team. The commissioning team for this project includes the following members:

.1 Owner/Owner's Representative (OW): Parks Canada
.2 Project Manager (PM)
.3 Commissioning Authority (CA): CES Engineering Ltd
.4 Architect: Ratio Architecture Interior Design + Planning Inc
.5 Mechanical Consultant (ME): JM Bean & Co (Integral Group)
.6 Electrical Consultant (EE): L.P. Gander & Associates Ltd
.7 General Contractor (GC)
.8 Mechanical Contractor (MC)
.9 Sheet Metal Contractor
.10 Fire Protection Contractor
.11 Controls Contractor (CC)
.12 Testing and Balancing Agency (TAB)
.13 Division(s) 20 - 25 Specialty Equipment Vendor Specialists
.14 Electrical Contractor (EC)
.15 Division 26 Specialty Equipment Vendor Specialists

2. Management. The CA is hired by the Owner/User Group. The CA directs and coordinates the commissioning activities and the reports to the Architect and PM. All members work

together to fulfill their contracted responsibilities and meet the objectives of the Contract Documents.

3. Scheduling. The CA will work with the GC according to established protocols to define a schedule for commissioning activities. The GC will integrate all commissioning activities into the master schedule. All parties will address scheduling problems and make necessary notifications in a timely manner in order to expedite the commissioning process. The schedule shall include all necessary time-points and milestones, testing, documentation, training and commissioning activities.

The CA will provide the format for the initial schedule of primary commissioning events at the commissioning scoping meeting. The *Commissioning Plan* provides the format for this schedule.

A detailed commissioning schedule in day-by-day format shall be provided by the Contractor for pre-functional testing of all individual components, equipment and subsystems; and functional and integration testing of each completed system. This schedule shall include a detailed training schedule to demonstrate that there will be no conflicts with testing. The schedule of commissioning activities shall be produced in a Gantt chart format to a scale that will ensure legibility. This Gantt chart will show sequences of testing equipment and systems, interrelationship between tests, duration of tests and training periods. As construction progresses more detailed schedules are developed by the contractors.

The commissioning schedule shall include the following milestones (as appropriate):

1. Introductory commissioning meeting chaired by the Commissioning Authority: 30 days after general contractor award of contract.
2. Site Services (Permanent Power, Water and Gas connections)
3. Start-up and Pre-Functional Checks
4. Building Clean – Ventilation Activation dates for all major functional areas
5. Testing and Balancing (TAB) of Air and Water Systems
6. BAS Checkout
7. Functional Performance Testing
8. Integration Testing
9. O&M Manual and As-Builts Submissions
10. Owner Training
11. Occupancy (Life Safety)
12. Substantial Completion
13. Start of Contractor Warranty Period
14. Deferred / Seasonal Testing

The CA will monitor progress of commissioning against this schedule.

1.3 COMMISSIONING PROCESS

1. Commissioning Plan. The *Commissioning Plan* provided as part of the bid documents, is binding on the Contractor. The commissioning plan provides guidance in the execution of the commissioning process. Just after the initial commissioning scoping meeting the CA will update the plan which is then considered the "final" plan, though it will continue to evolve and expand as the project progresses. The *Specifications* will take precedence over the *Commissioning Plan.*

2. Commissioning Process. The following narrative provides a brief overview of the typical commissioning tasks during construction and the general order in which they occur.

    1. Commissioning during construction begins with a scoping meeting conducted by the CA where the commissioning process is reviewed with the commissioning team members.

    2. Additional meetings will be required throughout construction, scheduled by the CA with necessary parties attending, to plan, scope, coordinate, schedule future activities and resolve problems.

    3. Equipment documentation is submitted to the CA during normal submittals, including detailed start-up procedures.

    4. The CA works with the MC, EC and the Subs in developing startup plans and startup documentation formats, including providing the MC, EC and the Subs with pre-functional checklists to be completed, during the startup process.

    5. In general, the checkout and performance verification proceeds from simple to complex; from component level to equipment to systems and intersystem levels with prefunctional checklists being completed before functional testing.

    6. The MC, EC and the Subs, under GC direction, execute and document the prefunctional checklists and perform startup and initial checkout. The CA documents that the checklists and startup were completed according to the approved plans. This may include the CA witnessing start-up of selected equipment.

    7. The CA develops specific equipment and system functional performance test procedures. The MC, CC and the Subs review the procedures.

    8. The procedures are executed by the MC, EC and the Subs, under the direction of, and documented by the CA.

9. Items of non-compliance in material, installation or setup are corrected at the MC, EC and the Sub's expense and the system retested.

10. The CA reviews the O&M documentation for completeness.

11. Commissioning is completed before Substantial Completion.

12. The CA reviews, pre-approves and coordinates the training provided by the MC, EC and the Subs and verifies that is was completed.

13. Deferred testing is conducted, as specified or required.

1.4 RELATED WORK

Specific commissioning requirements are given in the following sections of these specifications, or are directly related to the commissioning process. All of the following sections apply to the Work of this section.

1. *01 91 14 – Commissioning Plan*
2. *01 91 15 – Commissioning Training*
3. *20 00 10 – Mechanical Systems Commissioning: Describes the Cx responsibilities of the mechanical, controls and TAB contractors and the pre-functional testing and startup responsibilities of each*
4. *26 00 10 – Electrical Systems Commissioning: Describes the Cx responsibilities of the electrical contractor and the pre-functional testing and startup responsibilities*

1.5 RESPONSIBILITIES

1. Overview: The responsibilities of various parties in the commissioning process are provided in this section. The responsibilities of the mechanical contractor, TAB and controls contractor are in *Section 20 00 10* and those of the electrical contractor in *Section 26 00 10*.

   It is noted that the commissioning services for the Project Manager, General Contractor, Architect, HVAC mechanical and electrical Consultants/engineers, and Commissioning authority are not provided by the contractors in this contract. That is, the Contractor is not responsible for providing their services. Their responsibilities are listed here to clarify the commissioning process.

   The contractors shall include the cost of providing their commissioning and testing services. The owner is not paying extra for contractors commissioning services.

2. All Parties

    1. Follow the Commissioning Plan.
    2. Attend commissioning scoping meeting and additional meetings, as necessary.

3. Architect (of A/E)

    Construction and Acceptance Phase

    1. Attend the commissioning scoping meeting and selected commissioning team meetings.
    2. Perform normal submittal review, construction observation, as-built drawing preparation, O&M manual review, etc., as contracted.
    3. Provide any design narrative documentation requested by the CA.
    4. Coordinate resolution of system deficiencies identified during commissioning, according to the contract documents

    Warranty Period

    5. Coordinate resolution of design non-conformance and design deficiencies identified during warranty-period commissioning.

4. Mechanical and Electrical Consultants (of the A/E)

    Construction and Acceptance Phase

    6. Perform normal submittal review, construction observation, as-built drawing preparation, O&M manual review etc., as contracted. One site observation should be completed just prior to system startup.
    7. Provide any design narrative and sequences documentation requested by the CA. The Consultants shall assist (along with the contractors) in clarifying the operation and control of commissioned equipment in areas where the specifications, control drawings or equipment documentation is not sufficient for writing detailed testing procedures.
    8. Attend commissioning scoping meetings and other selected commissioning team meetings.
    9. Participate in the resolution of system deficiencies identified during commissioning, according to the contract documents
    10. Provide a design overview presentation if requested at one of the training sessions for the Owner’s personnel.
    11. Witness testing of selected pieces of equipment and systems

    Warranty Period

    12. Participate in the resolution of non-compliance, non-conformance and design deficiencies identified during commissioning during warranty-period commissioning.

5. Commissioning Authority (CA)

    1. The primary role of the CA is to develop and coordinate the execution of a testing plan, observe and document performance—that systems are functioning in accordance with the documented design intent and in accordance with the Contract Documents. The Contractors will provide all tools or the use of tools to start, check-out and functionally test equipment and systems. The CA is not responsible for design concept, design criteria, compliance with codes, design or general construction scheduling, cost estimating, or construction management. The CA may assist with problem-solving non-conformance or deficiencies, but ultimately that responsibility resides with the General Contractor and the A/E.

    Construction and Acceptance Phase

    2. Coordinates and directs the commissioning activities in a logical, sequential and efficient manner using consistent protocols and forms, centralized documentation, clear and regular communications and consultations with all necessary parties, frequently updated timelines and schedules and technical expertise.
    3. Coordinate the commissioning work with the GC, ensure that commissioning activities are being scheduled into the master schedule.
    4. Revise, as necessary, *Commissioning Plan.*
    5. Plan and conduct a commissioning scoping meeting and other commissioning meetings.
    6. Request and review additional information required to perform commissioning tasks, including O&M materials, contractor start-up and checkout procedures.
    7. Before startup, gather and review the current control sequences and interlocks and work with contractors and design engineers until sufficient clarity has been obtained, in writing, to be able to write detailed testing procedures.
    8. Review normal Contractor submittals applicable to systems being commissioned for compliance with commissioning needs, concurrent with, or upon completion of, the A/E reviews.
    9. Write and distribute pre-functional tests and checklists.
    10. Develop an enhanced start-up and initial systems checkout plan with Subs.
    11. Perform site visits, as necessary, to observe component and system installations. Attends selected planning and job-site meetings to obtain information on construction progress. Review construction meeting minutes for revisions/substitutions relating to the commissioning process. Assist in resolving any discrepancies.
    12. Witness all or part of the HVAC piping test and flushing procedure, sufficient to be confident that proper procedures were followed. Notify owners project manager of any deficiencies in results or procedures.

13. Witness all or part of any ductwork testing and cleaning procedures, sufficient to be confident that proper procedures were followed. Notify owner's project manager of any deficiencies in results or procedures.
14. Approve prefunctional tests and checklist completion by reviewing prefunctional checklist reports and by selected site observation and spot checking.
15. Approve systems startup by reviewing start-up reports and by selected site observation.
16. Review TAB execution plan.
17. Oversee sufficient functional testing of the control system and approve it to be used for TAB, before TAB is executed.
18. Approve air and water systems balancing by spot testing, by reviewing completed reports and by selected site observation.
19. With necessary assistance and review from installing contractors, write the functional performance test procedures for equipment and systems. This may include energy management control system trending, stand-alone datalogger monitoring or manual functional testing. Submit to GC for review, and for approval if required.
20. Analyze any functional performance trend logs and monitoring data to verify performance.
21. Coordinate, witness and approve manual functional performance tests performed by installing contractors. Coordinate retesting as necessary until satisfactory performance is achieved.
22. Maintain a master deficiency and resolution log and a separate testing record. Provide the GC with written progress reports and test results with recommended actions.
23. Witness performance testing of smoke control systems by others and other owner contracted tests or tests by manufacturer's personnel over which the CA may not have direct control. Document these tests and include this documentation in the Commissioning Report.
24. Review equipment warranties to ensure that the Owner's responsibilities are clearly defined.
25. Oversee and approve the training of the Owner's operating personnel.
26. Review and approve the preparation of the O&M manuals.
27. Provide a final Commissioning Report (as described in this section).
28. Develop a Systems Manual.
29. Prepare a standard trend logging package of primary parameters that will provide the operations staff clear indications of system function in order to identify proper system operation and trouble shoot problems. The CA shall also provide any needed information on interpreting the trends.

Warranty Period

30. Coordinate and supervise required seasonal or deferred testing and deficiency corrections.

6. Owner/Owner's Representative (OW)

Construction and Acceptance Phase

1. Review and approve the final *Commissioning Plan—Construction Phase*.
2. Attend a commissioning scoping meeting and other commissioning team meetings.
3. Perform the normal review of Contractor submittals.
4. When necessary, observe and witness pre-functional checklists, startup and functional testing of selected equipment.
5. Assist the GC in coordinating the training of owner personnel.

Warranty Period

6. Assist the CA as necessary in the seasonal or deferred testing and deficiency corrections required by the specifications.

7. Project Manager (PM)

Construction and Acceptance Phase

1. Manage the contract of the A/E and of the GC.
2. Arrange for facility operating and maintenance personnel to attend various field commissioning activities and field training sessions according to the *Commissioning Plan*.
3. Provide final approval for the completion of the commissioning work.

Warranty Period

4. Ensure that any seasonal or deferred testing and any deficiency issues are addressed.

8. General Contractor (GC)

Construction and Acceptance Phase

1. Facilitate the coordination of the commissioning work by the CA and ensure that commissioning activities are being scheduled into the master schedule.
2. Include the cost of participating in the commissioning process as outlined in the specifications in the total contract price.
3. Furnish a copy of all construction documents, addenda, change orders and approved submittals and shop drawings related to commissioned equipment to the CA.
4. In each purchase order or subcontract written, include requirements for submittal data, O&M data, commissioning tasks and training.

5. Ensure that all Subs execute their commissioning responsibilities according to the Contract Documents and schedule.
6. A representative shall attend a commissioning scoping meeting and other necessary meetings scheduled by the CA to facilitate the Cx process
7. Coordinate the training of owner personnel.
8. Prepare O&M manuals, according to the Contract Documents, including clarifying and updating the original sequences of operation to as-built conditions.

Warranty Period

9. Ensure that Subs execute seasonal or deferred functional performance testing, witnessed by the CA, according to the specifications.
10. Ensure that Subs correct deficiencies and make necessary adjustments to O&M manuals and as-built drawings for applicable issues identified in any seasonal testing.

9. Equipment Suppliers

1. Provide all requested submittal data, including detailed start-up procedures and specific responsibilities of the Owner to keep warranties in force.
2. Assist in equipment testing per agreements with Subs.
3. Include all special tools and instruments (only available from vendor, specific to a piece of equipment) required for testing equipment according to these Contract Documents in the base bid price to the Contractor, except for stand-alone datalogging equipment that may be used by the CA.
4. Through the contractors they supply products to, analyze specified products and verify that the Consultant has specified the newest most updated equipment reasonable for this project's scope and budget.
5. Provide information requested by CA regarding equipment sequence of operation and testing procedures.
6. Review test procedures for equipment installed by factory representatives.

1.6 DEFINITIONS

Acceptance Phase: Phase of construction after startup and initial checkout when functional performance tests, O&M documentation review and training occurs.

Approval: Acceptance that a piece of equipment or system has been properly installed and is functioning in the tested modes according to the Contract Documents.

Architect / Engineer (A/E): The prime consultant (architect) and sub-consultants who comprise the design team, generally the HVAC mechanical Consultant/engineer and the electrical Consultant/engineer.

Basis of Design: The basis of design is the documentation of the primary thought processes and assumptions behind design decisions that were made to meet the design intent. The basis of design describes the systems, components, conditions and methods chosen to meet the intent. Some reiterating of the design intent may be included.

Commissioning Authority (CA): An independent agent, not otherwise associated with the A/E team members or the Contractor. The CA directs and coordinates the day-to-day commissioning activities. The CA does not take an oversight role like the GC. The CA is part of the Owner's team and reports directly to the OW/PM.

Commissioning Plan: An overall plan, developed before or after bidding, that provides the structure, schedule and coordination planning for the commissioning process.

Contract Documents: The documents binding on parties involved in the construction of this project (drawings, specifications, change orders, amendments, contracts, *Cx Plan*, etc.).

Contractor: The contractor in general or authorized representative.

Control system: The central building energy management control system.

General Contractor (GC): The General Contractor is responsible for providing all of the material, labor, equipment and services necessary for the construction of the project. The general contractor hires specialized subcontractors to perform all or portions of the construction work.

Datalogging: Monitoring flows, currents, status, pressures, etc. of equipment using stand-alone dataloggers separate from the control system.

Deferred Functional Tests: FTs that are performed later, after substantial completion, due to partial occupancy, equipment, seasonal requirements, design or other site conditions that disallow the test from being performed.

Deficiency: A condition in the installation or function of a component, piece of equipment or system that is not in compliance with the Contract Documents (that is, does not perform properly or is not complying with the design intent).

Design Intent: A dynamic document that provides the explanation of the ideas, concepts and criteria that are considered to be very important to the owner. It is initially the outcome of the programming and conceptual design phases.

Design Narrative or Design Documentation: Sections of either the Design Intent or Basis of Design.

Factory Testing: Testing of equipment on-site or at the factory by factory personnel with an Owner's representative present.

Functional Performance Test (FT): Test of the dynamic function and operation of equipment and systems using manual (direct observation) or monitoring methods. Functional testing is the dynamic testing of systems (rather than just components) under full operation (e.g., the chiller pump is tested interactively with the chiller functions to see if the pump ramps up and down to maintain the differential pressure setpoint). Systems are tested under various modes, such as during low cooling or heating loads, high loads, component failures, unoccupied, varying outside air temperatures, fire alarm, power failure, etc. The systems are run through all the control system's sequences of operation and components are verified to be responding as the sequences state. Traditional air or water test and balancing (TAB) is not functional testing, in the commissioning

sense of the word. TAB's primary work is setting up the system flows and pressures as specified, while functional testing is verifying that which has already been set up. The commissioning authority develops the functional test procedures in a sequential written form, coordinates, oversees and documents the actual testing, which is usually performed by the installing contractor or vendor. FTs are performed after prefunctional checklists and startup are complete.

Indirect Indicators: Indicators of a response or condition, such as a reading from a control system screen reporting a damper to be 100% closed.

Manual Test: Using hand-held instruments, immediate control system readouts or direct observation to verify performance (contrasted to analyzing monitored data taken over time to make the "observation").

Monitoring: The recording of parameters (flow, current, status, pressure, etc.) of equipment operation using dataloggers or the trending capabilities of control systems.

Non-Compliance: See Deficiency.

Non-Conformance: See Deficiency.

Over-written Value: Writing over a sensor value in the control system to see the response of a system (e.g., changing the outside air temperature value from 50F to 75F to verify economizer operation). See also "Simulated Signal."

Owner-Contracted Tests: Tests paid for by the Owner outside the GC's contract and for which the CA does not oversee. These tests will not be repeated during functional tests if properly documented.

Phased Commissioning: Commissioning that is completed in phases (by floors, for example) due to the size of the structure or other scheduling issues, in order minimize the total construction time.

Prefunctional Checklist (PC): A list of items to inspect and elementary component tests to conduct to verify proper installation of equipment, provided by the CA to the Sub. Prefunctional checklists are primarily static inspections and procedures to prepare the equipment or system for initial operation (e.g., belt tension, oil levels OK, labels affixed, gages in place, sensors calibrated, etc.). However, some prefunctional checklist items entail simple testing of the function of a component, a piece of equipment or system (such as measuring the voltage imbalance on a three phase pump motor of a chiller system). The word prefunctional refers to before functional testing. Prefunctional checklists augment and are combined with the manufacturer's start-up checklist. Even without a commissioning process, contractors typically perform some, if not many, of the prefunctional checklist items a commissioning authority will recommend. However, few contractors document in writing the execution of these checklist items. Therefore, for most equipment, the contractors execute the checklists on their own. The commissioning authority only requires that the procedures be documented in writing, and does not witness much of the prefunctional checklisting, except for larger or more critical pieces of equipment and some spot checking.

Project Manager (PM): The contracting and managing authority for the owner over the design and/or construction of the project.

Sampling: Functionally testing only a fraction of the total number of identical or near identical pieces of equipment. Refer to this Section, Part 3.6, F for details.

Seasonal Performance Tests: FT that are deferred until the system(s) will experience conditions closer to their design conditions.

Simulated Condition: Condition that is created for the purpose of testing the response of a system (e.g., applying a hair blower to a space sensor to see the response in a VAV box).

Simulated Signal: Disconnecting a sensor and using a signal generator to send an amperage, resistance or pressure to the transducer and DDC system to simulate a sensor value.

Specifications: The construction specifications of the Contract Documents.

Startup: The initial starting or activating of dynamic equipment, including executing prefunctional checklists.

Subs: The subcontractors to the GC who provide and install building components and systems.

Test Procedures: The step-by-step process which must be executed to fulfill the test requirements. The test procedures are developed by the CA.

Test Requirements: Requirements specifying what modes and functions, etc. shall be tested. The test requirements are not the detailed test procedures. The test requirements are specified in the Contract Documents.

Trending: Monitoring using the building control system.

Vendor: Supplier of equipment.

Warranty Period: Warranty period for entire project, including equipment components. Warranty begins at Substantial Completion and extends for at least one year, unless specifically noted otherwise in the Contract Documents and accepted submittals.

1.7 SYSTEMS TO BE COMMISSIONED

Equipment and Systems

Mechanical Systems

21 13 13 – Sprinkler System
22 10 11 – Plumbing Pumps
22 13 17 – Drainage Waste and Vent Piping
22 42 01 – Plumbing Specialties and Accessories
23 05 05 – Pipework
23 05 48 – Vibration and Seismic Control for Piping and Equipment

Electrical Systems

26 05 20 – Wire and Box Connectors 0-1000V
26 05 21 – Wires and Cables 0-1000V
26 05 29 – Hangers and Supports for Electrical Systems
26 12 17 – Dry Type Transformers up to 600V Primary
26 24 17 – Panelboards Breaker Type
26 28 23 – Disconnect Switches – Fused and Non-Fused
26 29 10 – Motor Starters to 600V
26 31 02 – Multiplex Fire Alarm System

26 32 10 – Power Generator Diesel

26 32 14 – Emergency Power Equipment

26 53 00 – Exit Lights

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

All standard testing equipment required to perform startup and initial checkout and required functional performance testing shall be provided by the Division contractor for the equipment being tested. For example, the mechanical contractor of Division(s) 20 - 25 shall ultimately be responsible for all standard testing equipment for the HVAC system and controls systems in this Division, except for equipment specific to and used by TAB in their commissioning responsibilities. Two-way radios shall be provided by the control contractor (CC).

Special equipment, tools and instruments (only available from vendor, specific to a piece of equipment) required for testing equipment, according to these Contract Documents shall be included in the base bid price to the Contractor and left on site.

All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified in the *Specifications.* If not otherwise noted, the following minimum requirements apply: Temperature sensors and digital thermometers shall have a certified calibration within the past year to an accuracy of 0.5°F and a resolution of + or - 0.1°F. Pressure sensors shall have an accuracy of + or - 2.0% of the value range being measured (not full range of meter) and have been calibrated within the last year. All equipment shall be calibrated according to the manufacturer's recommended intervals and when dropped or damaged. Calibration tags shall be affixed or certificates readily available.

PART 3 - EXECUTION

3.1 MEETINGS

1. Scoping Meeting. Within 90 days of commencement of construction, the CA will schedule, plan and conduct a commissioning scoping meeting with the entire commissioning team in attendance. Meeting minutes will be distributed to all parties by the CA. Information gathered from this meeting will allow the CA to revise the Draft 2 Commissioning Plan to its "final" version, which will also be distributed to all parties.

2. Miscellaneous Meetings. Other meetings will be planned and conducted by the CA as construction progresses. These meetings will cover coordination, deficiency resolution and planning issues with particular Subs. The CA will plan these meetings and will minimize unnecessary time being spent by Subs. Within final 3 months of construction these meetings may be held as frequently as one per week.

3.2 REPORTING

The CA will provide regular reports to the PM and GC, with increasing frequency as construction and commissioning progresses.

The CA will regularly communicate with all members of the commissioning team, keeping them apprised of commissioning progress and scheduling changes through memos, field reviews, progress reports, etc.

Field Reviews will be conducted and used to validate construction progress, equipment start-up progress and O&M requirements for the building systems. The CA shall complete Field Reviews at regular intervals throughout construction, and issue to PM and GC through appropriate channels.

Testing or review approvals and non-conformance and deficiency reports are made regularly with the review and testing as described in later sections.

A Final Commissioning Report will be compiled by the CA and submitted to the Owner/PM, which will include all acquired documentation, logs, minutes, reports, deficiency lists, communications, findings, unresolved issues, etc.

3.3 SUBMITTALS

The CA will provide appropriate contractors with a specific request for the type of submittal documentation the CA requires to facilitate the commissioning work. These requests will be integrated into the normal submittal process and protocol of the construction team. At minimum, the request will include the manufacturer and model number, the manufacturer's printed installation and detailed start-up procedures, full sequences of operation, O&M data, performance data, any performance test procedures, control drawings and details of owner contracted tests. In addition, the installation and checkout materials that are actually shipped inside the equipment and the actual field checkout sheet forms to be used by the factory or field technicians shall be submitted to the Commissioning authority. All documentation requested by the CA shall also be included by the Subs in their O&M manual contributions.

The CA will review submittals related to the commissioned equipment for conformance to the Contract Documents as it relates to the commissioning process, to the functional performance of the equipment and adequacy for developing test procedures. This review is intended primarily to aid in the development of functional testing procedures and only secondarily to verify compliance with equipment specifications. The Commissioning authority will notify the GC, PM or A/E as requested, of items missing or areas that are not in conformance with Contract Documents and which require resubmission.

The CA may request additional design narrative from the A/E and Controls Contractor, depending on the completeness of the design intent documentation and sequences provided with the Specifications.
These submittals to the CA do not constitute compliance for O&M manual documentation. The O&M manuals are the responsibility of the Contractor, though the CA will review and approve them.

3.4 START-UP, PREFUNCTIONAL CHECKLISTS AND INITIAL CHECKOUT

1. **Application.** **The following procedures apply to all equipment to be commissioned, according to *Paragraph 1.7, Systems to be Commissioned*. Some systems that are not comprised so much of actual dynamic machinery, e.g., architectural systems, electrical distribution panels, may have very simplified PCs and startup.**

2. **General.** **Pre-functional checklists are important to ensure that the equipment and systems are hooked up and operational. It ensures that functional performance testing (in-depth system checkout) may proceed without unnecessary delays. Each piece of equipment receives full pre-functional checkout. No sampling strategies are used. The pre-functional testing for a given system must be successfully completed prior to formal functional performance testing of equipment or subsystems of the given system.**

3. **Start-up and Initial Checkout Plan.** **The CA shall assist the commissioning team members responsible for startup of any equipment in developing detailed start-up plans for all equipment. The primary role of the CA in this process is to ensure that the contractor provides written documentation that each of the manufacturer-recommended procedures have been completed. Parties responsible for prefunctional checklists and startup are identified in the commissioning scoping meeting and in the checklist forms.**

   The CA obtains manufacturer installation, startup and checkout data, including actual field checkout sheets used by the field technicians from the contractor (through an RFI) or shop drawings.

   The CA copies all pages with important instructional data and procedures from the startup and checkout manuals not covered in manufacturer field checkout sheets and adds a signature line in the column by each procedure.

   The copied pages, along with the pre-functional checklist provided by the CA and the manufacturer field checkout sheets become the “Startup and Checkout Plan.”

   For systems that may not have adequate manufacturer startup and checkout procedures, particularly for components being integrated with other equipment, the Sub should provide the added necessary detail and documenting format to the CA for approval, prior to execution.

The CA transmits the full Startup Plan to the GC, who designates which trade or contractor is responsible to fill out each line item on the Prefunctional Checklist from the CA. The GC then transmits the full start-up plan to the Subs for their review and use. (This usually means that the Prefunctional Checklist, alone, will go to more than one Sub, while the full plan will go to the primary installing contractor.)

3.5 EXECUTION OF PREFUNCTIONAL CHECKLISTS AND STARTUP

Four weeks prior to startup, the Subs and vendors schedule startup and checkout with the GC and CA. The performance of the prefunctional checklists, startup and checkout are directed and executed by the Sub or vendor. When checking off prefunctional checklists, signatures may be required of other Subs for verification of completion of their work.

The Subs and vendors shall execute startup and provide the CA with a signed and dated copy of the completed start-up and prefunctional tests and checklists. The CA may review pre-functional checklists in progress, as necessary.

The site technician performing the line item task initials and dates on the prefunctional and manufacturer field checkout sheets, as they are completed. Only individuals that have direct knowledge and witnessed that a line item task on the prefunctional checklist was performed shall initial or check that item off. It is not acceptable for supervisors to fill out these forms unless they have directly witnessed the specific task.

3.6 DEFICIENCIES, NON-CONFORMANCE AND APPROVAL IN CHECKLISTS AND STARTUP

The Subs shall clearly list any outstanding items of the initial start-up and prefunctional procedures that were not completed successfully, at the bottom of the procedures form or on an attached sheet. The procedures form and any outstanding deficiencies are provided to the CA within two days of test completion.

The CA reviews the report and tracks issues and non-compliances in the Commissioning Issues Log, for follow-up by the Sub or GC. The CA shall work with the Subs and vendors to correct and retest deficiencies or uncompleted items. The CA will involve the GC and others as necessary. The installing Subs or vendors shall correct all areas that are deficient or incomplete in the checklists and tests in a timely manner, and shall notify the CA as soon as outstanding items have been corrected and resubmit an updated start-up report and response to the related Issues Log item. When satisfactorily completed, the CA recommends approval of the execution of the checklists and startup of each system to the Owner.

Items left incomplete, which later cause deficiencies or delays during functional testing may result in backcharges to the responsible party. Refer to Part 3.8 herein for details.

3.7 PHASED COMMISSIONING

The project may require startup and initial checkout to be executed in phases. This phasing will be planned and scheduled in a coordination meeting of the CA, GC, Mechanical, Electrical, TAB and controls contactors. Results will be added to the master and commissioning schedule.

3.8 FUNCTIONAL PERFORMANCE TESTING

This sub-section applies to all commissioning functional testing for all divisions.

The general list of equipment to be commissioned is found in Paragraph 1.7. The specific equipment and modes to be tested are found in Sections *20 00 10* and *26 00 10*. If specific testing requirements were not included in the bid documents and original specifications, they should be developed for this project for each piece of commissioned equipment.

The parties responsible to execute each test are listed with each test in Sections *20 00 10* and *26 00 10*.

1. **Objectives and Scope. The objective of functional performance testing is to demonstrate that each system is operating according to the documented design intent and Contract Documents. Functional testing includes validation of completed systems in all modes of operation. Additionally, during the testing process, areas of deficient performance are identified and corrected, improving the operation and functioning of the systems.**

   In general, each system should be operated through all modes of operation (seasonal, occupied, unoccupied, warm-up, cool-down, part- and full-load) where there is a specified system response. Verifying each sequence in the sequences of operation is required. Proper responses to such modes and conditions as power failure, freeze condition, low pressure, no flow, equipment failure, etc. shall also be tested. Specific modes required in this project are given in Sections *20 00 10* and *26 00 10*.

   The CA shall witness at a minimum, contractor functional testing for each piece of primary equipment, unless there are multiple units, in which case a sampling strategy may be used. In no case will the number of units witnessed be less than four on any one building, nor less than 20% of the total number of identical or very similar units. Sampling strategy is discussed further in section 3.8.3 below.

2. **Development of Test Procedures. Before test procedures are written, the CA shall obtain all requested documentation and a current list of change orders affecting equipment or systems, including an updated points list, program code, control sequences and parameters. Using the testing parameters and requirements in *Sections 20 00 10* and *26 00 10* the CA shall develop specific test procedures and forms to verify and document proper operation of each piece of equipment and system. CA obtains clarification, as needed, from contractors and the A/E regarding sequences and operation to develop these tests. Each**

Sub or vendor responsible to execute a test, shall provide assistance to the CA in developing the procedures (answering questions about equipment, operation, sequences, etc.). Prior to execution, the CA shall provide a copy of the primary equipment test procedures to the Subs (via the GC) who shall review the tests for feasibility, safety, equipment and warranty protection. The CA may submit the tests to the A/E for review, if requested.

The CA shall review owner-contracted, factory testing or required owner acceptance tests which the CA is not responsible to oversee, including documentation format, and shall determine what further testing or format changes may be required to comply with the *Specifications*. Redundancy of testing shall be minimized.

The purpose of any given specific test is to verify and document compliance with the stated criteria of acceptance given on the test form.

3. **Test Methods. Functional performance testing and verification may be achieved by manual testing (persons manipulate the equipment and observe performance) or by monitoring the performance and analyzing the results using the control system's trend log capabilities or by stand-alone dataloggers. Sections 20 00 10 and 26 00 10 specify which methods shall be used for each test. The CA follows the Specifications when given and uses judgement where needed to determine which method is most appropriate. The CA may substitute specified methods or require an additional method to be executed, other than what was specified, with the approval of the Owner. This may require a change order and adjustment in charge to the Owner. The CA will determine which method is most appropriate for tests that do not have a method specified.**

Simulated Conditions. Simulating conditions (not by an overwritten value) shall be allowed, though timing the testing to experience actual conditions is encouraged wherever practical.

Overwritten Values. Overwriting sensor values to simulate a condition, such as overwriting the outside air temperature reading in a control system to be something other than it really is, shall be allowed, but shall be used with caution and avoided when possible. Such testing methods often can only test a part of a system, as the interactions and responses of other systems will be erroneous or not applicable. Simulating a condition is preferable. e.g., for the above case, by heating the outside air sensor with a hair blower rather than overwriting the value, or by altering the appropriate setpoint to see the desired response. Before simulating conditions or overwriting values, sensors, transducers and devices shall have been calibrated.

Simulated Signals. Using a signal generator which creates a simulated signal to test and calibrate transducers and DDC constants is generally recommended over using the sensor to act as the signal generator via simulated conditions or overwritten values.

Altering Setpoints. Rather than overwriting sensor values, and when simulating conditions is difficult, altering setpoints to test a sequence is acceptable. For example, to see the AC compressor lockout work at an outside air temperature below 55F, when the outside air temperature is above 55F, temporarily change the lockout setpoint to be 2F above the current outside air temperature.

Indirect Indicators. Relying on indirect indicators for responses or performance shall be allowed only after visually and directly verifying and documenting, over the range of the tested parameters, that the indirect readings through the control system represent actual conditions and responses. Much of this verification is completed during prefunctional testing.

Setup. Each function and test shall be performed under conditions that simulate actual conditions as close as is practically possible. The Sub executing the test shall provide all necessary materials, system modifications, etc. to produce the necessary flows, pressures, temperatures, etc. necessary to execute the test according to the specified conditions. At completion of the test, the Sub shall return all affected building equipment and systems, due to these temporary modifications, to their pre-test condition.

Sampling. Not all pieces of identical equipment receive in-depth testing; multiple identical pieces of non-life-safety or otherwise non-critical equipment may be functionally tested using a sampling strategy. Significant application differences and significant sequence of operation differences in otherwise identical equipment invalidates their common identity. A small size or capacity difference, alone, does not constitute a difference. It is noted that no sampling by Subs is allowed in prefunctional checklist execution.

A common sampling strategy referenced in the *Specifications* as the “xx% Sampling—yy% Failure Rule” is defined by the following example.

1. xx = the percent of the group of identical equipment to be included in each sample.
2. yy = the percent of the sample that if failing, will require another sample to be tested.

The example below describes a 20% Sampling—10% Failure Rule.

1. Randomly test at least 20% (xx) of each group of identical equipment. In no case test less than three units in each group. This 20%, or three, constitute the “first sample.”
2. If 10% (yy) of the units in the first sample fail the functional performance tests, test another 20% of the group (the second sample)
3. If 10% of the units in the second sample fail, test all remaining units in the whole group.

4. If at any point, frequent failures are occurring and testing is becoming more troubleshooting than verification, the CA may stop the testing and require the responsible Sub to perform and document a checkout of the remaining units, prior to continuing with functionally testing the remaining units.

3.9 EXECUTION OF FUNCTIONAL PERFORMANCE TESTS

1. **Coordination and Scheduling. The Subs shall provide sufficient notice to the CA regarding their completion schedule for the prefunctional checklists and startup of all equipment and systems. The CA will schedule functional tests through the GC and affected Subs. The CA shall direct, witness and document the functional testing of all equipment and systems. The Subs shall execute the tests.**

   In general, functional testing is conducted after prefunctional testing and startup has been satisfactorily completed. For any given system, prior to performing functional testing, the CA waits until the prefunctional checklist has been submitted with the necessary signatures, confirming that the system is ready for functional testing.

   The control system is sufficiently tested by the installing contractor before it is used for TAB or to verify performance of other components or systems. The air balancing and water balancing is completed and debugged before functional testing of air-related or water-related equipment or systems. Testing proceeds from components to subsystems to systems. When the proper performance of all interacting individual systems has been achieved, the interfaces, integration and/or coordinated responses between systems is tested.

2. **Problem Solving: The CA will recommend solutions to problems found, however the burden of responsibility to solve, correct and retest problems is with the contractors, Subs and A/E.**

3. **Owner Engagement: The Owner's facilities operating staff are encouraged to attend and participate in the testing process. The CA will notify the Owner/PM, who will then notify the facility staff when the commissioning events will occur.**

3.10 DOCUMENTATION, NON-CONFORMANCE AND APPROVAL OF TESTS

1. **Documentation. The CA shall witness and document the results of all functional performance tests using the specific procedural forms developed for that purpose. Prior to testing, these forms are provided to the GC for review and approval and to the Subs for review. The CA will include the filled out forms in the System Manual.**

2. Non-Conformance

The CA will record the results of the functional test on the procedure or test form. All deficiencies or non-conformance issues shall be noted and reported to the GC on a standard non-compliance form.

Corrections of minor deficiencies identified may be made during the tests at the discretion of the CA. In such cases the deficiency and resolution will be documented on the procedure form.

Every effort will be made to expedite the testing process and minimize unnecessary delays, while not compromising the integrity of the procedures. However, the CA will not be pressured into overlooking deficient work or loosening acceptance criteria to satisfy scheduling or cost issues, unless there is an overriding reason to do so at the request of the GC.

As tests progress and a deficiency is identified, the CA discusses the issue with the executing contractor.

When there is no dispute on the deficiency and the Sub accepts responsibility to correct it:

1. The CA documents the deficiency and the Sub's response and intentions and they go on to another test or sequence. After the day's work, the CA submits the non-compliance reports to the GC for signature, if required. A copy is provided to the Sub and CA. The Sub corrects the deficiency, signs the statement of correction at the bottom of the non-compliance form certifying that the equipment is ready to be retested and sends it back to the CA.

2. The CA reschedules the test (through the GC) and the test is repeated.

If there is a dispute about a deficiency, regarding whether it is a deficiency or who is responsible:

1. The deficiency shall be documented on the non-compliance form with the Sub's response and a copy given to the GC and to the Sub representative assumed to be responsible

2. Resolutions are made at the lowest management level possible (preferably between CA or GC and the Sub). Other parties are brought into the discussions as needed. Final interpretive authority is with the A/E. Final acceptance authority is with the Owner.

3. The CA documents the resolution process.

4. Once the interpretation and resolution have been decided, the appropriate party corrects the deficiency, signs the statement of correction on the non-compliance form and provides it to the CA. The CA reschedules the test and the test is repeated until satisfactory performance is achieved

Cost of Retesting: The cost for the Sub to retest a prefunctional or functional test, if they are responsible for the deficiency, shall be theirs. If they are not responsible, any cost recovery for retesting costs shall be negotiated with the GC.

For a deficiency identified, not related to any prefunctional checklist or start-up fault, the following shall apply:

1. The CA and GC will direct the retesting of the equipment once at no "charge" to the contractors for their time. However, the CA's and GC's time for a second retest will be charged to the contractors, who may choose to recover costs from the responsible Sub.

2. The time for the CA and GC to direct any retesting required because a specific prefunctional checklist or start-up test item, reported to have been successfully completed, but determined during functional testing to be faulty, will be backcharged to the contractor, who may choose to recover costs from the party responsible for executing the faulty prefunctional test.

3. Refer to the Sampling Section for requirements for testing and retesting identical equipment.

The Contractor shall respond in writing to the CA and GC at least as often as commissioning meetings are being scheduled concerning the status of each apparent outstanding discrepancy identified during commissioning. Discussion shall cover explanations of any disagreements and proposals for their resolution.

The CA retains the original non-conformance forms until the end of the project.

Any required retesting by any contractor shall not be considered a justified reason for a claim of delay or for a time extension by the prime contractor.

3. Failure Due to Manufacturer Defect. If 10%, or three, whichever is greater, of identical pieces (size alone does not constitute a difference) of equipment fail to perform to the Contract Documents (mechanically or substantively) due to manufacturing defect, not allowing it to meet its submitted performance spec, all identical units may be considered unacceptable by the GC or PM. In such case, the Contractor shall provide the Owner with the following:

1. Within one week of notification from the GC or PM, the Contractor or manufacturer's representative shall examine all other identical units making a record of the findings. The findings shall be provided to the GC or PM within two weeks of the original notice.

2. Within two weeks of the original notification, the Contractor or manufacturer shall provide a signed and dated, written explanation of the problem, cause of failures, etc. and all proposed solutions which shall include full equipment submittals. The proposed solutions shall not significantly exceed the specification requirements of the original installation.
3. The GC or PM will determine whether a replacement of all identical units or a repair is acceptable.

4. Two examples of the proposed solution will be installed by the Contractor and the GC will be allowed to test the installations for up to one week, upon which the GC or PM will decide whether to accept the solution.

5. Upon acceptance, the Contractor and/or manufacturer shall replace or repair all identical items, at their expense and extend the warranty accordingly, if the original equipment warranty had begun. The replacement/repair work shall proceed with reasonable speed beginning within one week from when parts can be obtained.

4. Approval. The CA notes each satisfactorily demonstrated function on the test form. Formal approval of the functional test is made later after review by the CA and by the Owner, if necessary. The CA recommends acceptance of each test to the Owner using a standard form.

3.11 OPERATION AND MAINTENANCE (O&M) DOCUMENTATION

1. Standard O&M Manuals. Specific content and format requirements for the standard O&M manuals are detailed in Section *01 78 00*. Special requirements for the controls contractor and TAB contractor are found Section *20 00 10*.

2. CA Review and Approval. Prior to substantial completion, the CA shall review the O&M manuals to verify compliance with the Specifications. The CA will communicate deficiencies in the manuals to the GC, PM or A/E, as requested. Upon a successful review of the corrections, the CA recommends approval and acceptance of these sections of the O&M manuals to the GC, PM or A/E.

3. Warranty. A complete inventory of warranty items shall be provided by the Contractor. The CA also reviews each equipment warranty and verifies that all requirements to keep the

warranty valid are clearly stated. This work does not supersede the A/E's review of the O&M manuals according to the A/E's contract.

4. **"As-built" Drawings and Specifications. These are generally produced by the consultant from the project record documents maintained on the site and kept up-to-date with all changes as they occur and marked thereon by the Contractor. Accuracy will be verified by the Consultant before preparation of the "As-builts" and by the Commissioning Authority after submission by the Consultant. They shall be completed in time to be used for owner's training and demonstration sessions. For specific information regarding As-Builts refer to specification sections Architectural Section 01 33 00, Mechanical Section 20 00 00, Electrical Section 26 05 00.**

5. **Commissioning Records in O&M Manuals: Contractors shall include copies of all test reports and completed checklists in the O&M Manuals.**

The CA will compile a final Commissioning Report summarizing the results of the overall commissioning process under a separate cover. Refer to the Commissioning Plan for details.

3.12 DEMONSTRATION AND TRAINING OF OWNER PERSONNEL

Detailed information regarding contents, duration and instructors for any particular building system is included in Specification *Section 01 91 41 – Commissioning –Training*.

The Training Plans are produced conjointly by the Contractor and the Commissioning Authority to meet project-specific requirements and they include details provided by the Facility Property Manager relating to numbers and prerequisite qualifications and skills of trainees, type of training (i.e. observation, hands-on, classroom), etc.

The CA coordinates and schedules, with the GC, the overall training for the commissioned systems. The CA develops criteria for determining that the training was satisfactorily completed, including attending some of the training, etc. The CA advises the OW on the adequacy of the training provided based on these pre-determined success criteria.

Sample Training Agenda is included in Specification *Section 01 91 41 – Commissioning –Training*.

The Commissioning Schedule shall indicate proposed training dates for specific systems.

3.13 DEFERRED TESTING

Unforeseen Deferred Tests. If any check or test cannot be completed due to the building structure, required occupancy condition or other deficiency, execution of checklists and functional testing may

be delayed upon approval of the PM. These tests will be conducted in the same manner as the seasonal tests as soon as possible. Services of necessary parties will be negotiated.

Seasonal Testing. During the warranty period, seasonal testing (tests delayed until weather conditions are closer to the system's design) shall be completed as part of this contract. The CA shall coordinate this activity. Tests will be executed, documented and deficiencies corrected by the appropriate Subs, with facilities staff and the CA witnessing. Any final adjustments to the O&M manuals and as-builts due to the testing will be made.

3.14 WRITTEN WORK PRODUCTS

The commissioning process generates a number of written work products described in various parts of the *Specifications.* The following lists all the formal written work products and describes who is responsible to create them. In summary, the written products are:

Product	Developed By
1. Commissioning Plan	CA
2. Meeting Minutes	CA
3. Commissioning Schedules	CA with GC and Subs
4. Equipment documentation submittals	Subs
5. Sequence clarifications	Subs and A/E as needed
6. Prefunctional Checklists	CA and Subs
7. Startup and initial checkout plan	Subs and CA
8. TAB Plan	TAB
9. Field Reviews	CA
10. Prefunctional Checklists filled out	Subs
11. Final TAB Report	TAB
12. Issues Log (deficiencies)	CA
13. Commissioning Progress Reports	CA
14. Functional Test forms	CA
15. Filled out Functional Tests	CA
16. O&M Manuals	Subs
17. Overall training plan	CA and GC
18. Final Commissioning Report	CA

END OF SECTION

Part 1 GENERAL

1. Description

1. An independent firm (CES Engineering Ltd) specializing in building systems commissioning type of work has been retained by the Owner to act as the project Commissioning Authority (CA). This firm will be responsible to manage and administrate the commissioning process on this project.

2. Objective of Commissioning

The following are the objectives of the commissioning process:

2. To provide fully functional facility whose systems, equipment and components have been proven to meet all User's functional requirements before the date of acceptance, and which operate consistently at peak efficiencies and within specified energy budgets under all normal loads.

3. To fully train the Owner O&M personnel in all aspects of all installed systems.

4. To optimize life cycle costs.

5. To complete documentation relating to all installed equipment and systems.

3. Management

4. The CA is hired by the Owner/User Group. The CA directs and coordinates the commissioning activities and the reports to the Architect and Project Manager (PM). All members work together to fulfill their contracted responsibilities and meet the objectives of the Contract Documents.

5. SYSTEMS TO BE COMMISSIONED

Equipment and Systems

Mechanical Systems

21 13 13 – Sprinkler System
22 10 11 – Plumbing Pumps
22 13 17 – Drainage Waste and Vent Piping
22 42 01 – Plumbing Specialties and Accessories
23 05 05 – Pipework
23 05 48 – Vibration and Seismic Control for Piping and Equipment

Electrical Systems

26 05 20 – Wire and Box Connectors 0-1000V

26 05 21 – Wires and Cables 0-1000V
26 05 29 – Hangers and Supports for Electrical Systems
26 12 17 – Dry Type Transformers up to 600V Primary
26 24 17 – Panelboards Breaker Type
26 28 23 – Disconnect Switches – Fused and Non-Fused
26 29 10 – Motor Starters to 600V
26 31 02 – Multiplex Fire Alarm System
26 32 14 – Emergency Power Equipment
26 3 00 – Exit Lights

3. EXECUTION

1. Scheduling

1. The CA will work with the General Contractor (GC) and subs according to established protocols to schedule the commissioning activities. The CA will provide sufficient notice to the GC for scheduling commissioning activities. The GC will integrate all commissioning activities into the master schedule. All parties will address scheduling problems and make necessary notifications in a timely manner in order to expedite the commissioning process.

2. The CA will provide the initial schedule of primary commissioning events at the commissioning scoping meeting. As construction progresses more detailed schedules are developed by the CA.

2. Commissioning Process

The following section provides a brief overview of the typical commissioning tasks during construction and the general order in which they occur.

1. Commissioning during construction begins with a scoping meeting conducted by the CA where the commissioning process is reviewed with the commissioning team members.

2. Additional meetings will be required throughout construction, scheduled by the CA with necessary parties attending, to plan, scope, coordinate, schedule future activities and resolve problems.

3. Equipment documentation is submitted to the CA during normal submittals, including detailed start-up procedures.

4. The CA works with the Mechanical Contractor (MC), Electrical Contractor (EC) and the Subcontractors (Subs) in developing startup plans and startup documentation formats, including providing the MC, EC and the Subs with pre-functional checklists to be completed, during the startup process.

5. In general, the checkout and performance verification proceeds from simple to complex; from component level to equipment to systems and intersystem levels with prefunctional checklists being completed before functional testing.

6. The MC, EC and the Subs, under GC direction, execute and document the prefunctional checklists and perform startup and initial checkout. The CA documents that the checklists and startup were completed according to the approved plans. This may include the CA witnessing start-up of selected equipment.

7. The CA develops specific equipment and system functional performance test procedures. The MC, Controls Contractor (CC) and the Subs review the procedures.

8. The procedures are executed by the MC, EC and the Subs, under the direction of, and documented by the CA.

9. Upon completion of individual system tests, tests of the integrated systems shall be performed to verify that all components work together.

10. Items of non-compliance in material, installation or setup are corrected at the MC, EC and the Sub's expense and the system retested.

11. The CA reviews the O&M documentation for completeness.

12. Commissioning is completed before Substantial Completion.

13. The CA reviews, pre-approves and coordinates the training provided by the MC, EC and the Subs and verifies that is was completed.

14. Deferred testing is conducted, as specified or required.

4. O&M DOCUMENTATION

1. CA Review and Approval. Prior to substantial completion, the CA shall review the O&M manuals to verify compliance with the Specifications. The CA will communicate deficiencies in the manuals to the GC, PM or A/E, as requested. Upon a successful review of the corrections, the CA recommends approval and acceptance of these sections of the O&M manuals to the GC, PM or A/E. This work does not supersede the A/E's review of the O&M manuals according to the A/E's contract.

2. Warranties
   A complete inventory of warranty items will be provided by the Contractor to the Designer who will review same before submission to the Commissioning Authority who, in turn, recommends acceptance by the Project Manager.

5. TRAINING AND DEMONSTRATION

1. General

Training Plans are produced conjointly by the Designer and the Commissioning Authority to meet project-specific requirements and they include details provided by the Facility Property Manager relating to numbers and prerequisite qualifications and skills of trainees, type of training (i.e. observation, hands-on, classroom), etc.

2. Duration of Training

Duration of training for each system, instruction aids, etc. depends on systems complexity. The minimum number of hours for training sessions is identified in the list below:

Mechanical Systems – 4 hours

Electrical Systems – 4 hours

3. Responsibilities

Training will be under the direction of the Commissioning Authority and monitored by the Designer.

Instructors and trainers will include the Designer, Contractor, specialist subcontractors, equipment manufacturers, suppliers and installers; and factory-trained and certified equipment suppliers and manufacturers where noted in the specifications.

4. Details of Training

1. Training will include:

1. All aspects of operation under all normal, emergency and "what-if" modes, over the full range of operating ranges.
2. Detailed maintenance, troubleshooting, regular, preventive and emergency maintenance.

Training will consist of the following elements, to be completed, with demonstration of completeness, before date of acceptance:

Hands-on instruction relating to start-up; shut-down; emergency procedures; features of controls; monitoring; servicing; maintenance; performance verification and commissioning; reasons for, results of and implications on associated systems of adjustment of setpoints of control, limit and safety devices; interaction among systems during integrated operation; and troubleshooting diagnostics. Other elements will include system operating sequences, step-by-step directions for operation of valves, dampers, switches, adjustment of control settings and other specialized training relating to installed systems.

5. Training Materials

   Training materials will be in a form permitting future training procedures to be in the same degree of detail and may include any or all of the following:

   1. "As-built" contract documents
   2. O&M Manuals
   3. TAB and Commissioning Reports
   4. Installed Equipment

END OF SECTION

PART 1 – GENERAL

1.1 DESCRIPTION

The building systems demonstration and training for Owners Operating Personnel shall be coordinated by the Commissioning Authority. The demonstration and training shall include all components as identified in tables below.

1. Training Objectives: Training shall be in sufficient detail and of sufficient duration to meet the following objectives:
    1. Safe, reliable and energy-efficient operation of all systems in all normal and all emergency modes and under all conditions.
    2. Effective ongoing inspection and measurement of system performance.
    3. Proper preventive maintenance, diagnosis and troubleshooting.
    4. Service and repair of all systems, equipment and components.
    5. Ability to update documentation and input on future building modifications.
    6. Ability to operate equipment and systems under emergency conditions without assistance or until appropriate qualified assistance arrives.

    For training of O & M personnel to be effective, it is to be implemented during the later stages of construction, to allow for familiarization with the facility and the installed systems.

2. Long Term Ongoing Training: "Long-term" ongoing training is not included in commissioning activities. However, training courses and training materials must be designed to permit long term ongoing training well into the future.

3. Co-ordination and Monitoring: The Commissioning Authority shall co-ordinate all participants for training and shall monitor all training. Contractors shall co-ordinate and implement all training.

4. Responsibilities

    The Commissioning Authority shall:

    1. In conjunction with the Owner ensure all designated O & M personnel will be available for training during later stages of construction for purposes of familiarization with the facility and all installed systems,
    2. Review the quality of the Contractor's training and training materials meets all requirements of the project.

The Contractor shall:

3. Have overall responsibility to provide, coordinate, document, and record all training, and shall provide all training materials, training and classroom times. Note that the owner reserves the right to video record training sessions.
4. Contractor's personnel, professional trainers, manufacturer's resources for training purposes and be responsible for:

1. Direction of all training
2. Implementation of all training activities
3. Coordination among instructors
4. Quality of training and training materials.

Trainees shall include O & M personnel selected for operating and maintaining the project, the Facility Manager, building operators, maintenance staff, security staff, service contractors, and technical specialists (as applicable).

5. Instructors: Instructors shall include the following:
    1. Consultant and/or Commissioning Authority: To provide instruction on the Design Philosophy, Design Criteria, Design Intent, and description of all systems.
    2. Contractor: To provide instruction on the operation of specific systems, equipment or components, including start up, operation, shut down, features of controls, such as reasons for, results of, implications on associated systems of, adjustment of set points of control and limit safety devices.
    3. Factory trained and certified manufacturer's maintenance specialist personnel: to provide instruction on start-up, operation, care, maintenance, shut down of equipment for which they have certified installation, started up and carried out PV tests.
    4. Professional trainers: Where the Contractor is not deemed to be able to deliver the quality or level or training required.

6. Training Requirements:
    1. *Organization*: Training of O & M personnel shall consist of three main parts:
        1. Familiarization sessions organized for all systems during construction and installation stage and equipment commissioning. This may include review of installation, layout of equipment, systems and components, start-up and testing of the work, access to approved shop drawings, equipment operating and maintenance data. On- site observations may include still-photo records as deemed necessary by the O&M personnel – particularly of concealed elements.
        2. Hands on training: shall be provided on all systems, components and equipment and explanations of all commissioning procedures shall be given during the commissioning phase.
        3. Classroom sessions: shall be provided as necessary, with instruction regarding functional requirements, system philosophy, system operation and use of the Building Management Manual and all other commissioning documentation.

    2. Content:
        1. Training requirements for building systems are included in table format in this appendix and in the relevant commissioning specifications of various divisions.
        2. Training shall include:
            1. Review of the facility

2. Functional requirements
3. System philosophy – Design Criteria, design Intents, why the system was designed in this way, why certain settings are important and should not be changed without proper authority, limitations of each system, including emergency procedures
4. Review of system layout and equipment, components and controls
5. Use the printed installation, operation and maintenance instruction material included in the O&M manuals
6. Discussion of warranties and guarantees.
7. System operating sequences, including interaction between systems forming part of integrated systems, step by step directions for starting up and shutting down all systems, closing and opening valves, dampers and switches, adjusting control settings, turning motors on and off, and emergency procedures
8. Features of controls, monitoring, and procedures for performance verification
9. Reasons for, results of and implications on associated systems of adjustment of setpoints of control, limit and safety devices; interaction among systems during integrated operation
10. Maintenance and servicing of systems, equipment and components
11. Troubleshooting diagnosis – symptoms, signs, causes and corrective measures. For some equipment, this need only be a general knowledge, but should be enough to allow the operator to describe the problem adequately and to take emergency measures until qualified help arrives
12. Review of O & M documentation

3. Instructional Materials: All instructional material shall be produced in a digital electronic form that will permit future training for replacement O & M personnel to the same degree of detail and depth as supplied by initial training.

   Training materials shall include at least the following:

   1. “As Built” Contract Documents
   2. Operation and Maintenance (O&M) Manual – Copies of the O&M Manual shall be made available to O & M personnel prior to the familiarization sessions for retention throughout the training period for purposes of self study.
   3. TAB, Commissioning Reports

   Instructional material shall be supplemented as necessary by:

   4. Manufacturers training videos. These should be screened by the Commissioning Authority and reviewed by the Consultant at least six months prior to pre start up inspections before being included as part of the training material.
   5. Equipment models

   Instructors shall be responsible for the content and quality of training materials for all training sessions under their jurisdiction.

3. Training Plan
   1. A training Plan developed by the Contractor for each discipline based upon project requirements shall be provided within 12 weeks of award of General Contract.

2. Submit the training Plan to the Commissioning Authority for review and comment at least 12 weeks prior to the proposed training dates. Update and resubmit as required.
3. Include an agenda and a course outline summarizing the content and duration of training.
4. Co-ordinate the date(s) of the training session (s) with the Commissioning Authority. Commissioning Authority to organize the location and provide the lists of participants.
5. Prepare a summary of the training sessions. Indicate dates, subject matter, and all personnel present for training. After training, submit the training summary to the Commissioning Authority.
6. Record the time, date and subject matter of training sessions as they occur. Indicate all those who are present at each training session.

4. *Delivery of Training*
   1. Training shall normally be provided during regular working hours prior to take over of the project.
   2. Adequate time for training is to be included in Construction and Completion Schedule.
   3. Each training session should not be longer than three hours and provided between the hours of 08:30 – 11:30 and 13:00 – 16:00.
   4. Training is to be hands on, classroom, oral, written and audio/visual.
   5. Training is to be completed prior to acceptance of facility.
   6. Training should include demonstrations by the trained O & M personnel so as to show confidence in, and depth of understanding of, all systems and equipment, and to demonstrate completeness of training.
   7. Upon completion of these demonstrations, the contractors responsible for all training shall provide a written report signed by Instructors and witnessed by Consultant and/or Commissioning Authority. This report shall be submitted to the Commissioning Authority.
   8. The owner reserves the right to video record any or all training sessions. Video recording services will be professional quality and include copies of the session to be handed over to the owner for future use. Procurement of video production to be as directed by the owner (carried by the owner or other).

5. *Training Activities:*
   1. See the following attached typical training agenda.

   This is a broad scope outline summary for the Contractors and Commissioning Coordinator information and incorporation into the project training plan.

6. *Training Durations:*
   1. At a minimum, the training shall be provided as follows:

System	Duration
Mechanical System Design	½ hour (by consultant)
Fire Suppression Systems	1 hour
Plumbing System	1 hour
Mechanical System	1 hour
Electrical System Design	½ hour (by consultant)
Electrical Distribution	1 hour
Fire Alarm System	1 hour
Lighting and Control System	1 hour

1.2 TRAINING ACTIVITIES - MECHANICAL

MECHANICAL				
Systems and Goals	**Instructor**	**Content (approximately 30% Theory, 70% practical)**	**Duration**	**Instruction Materials and Tools**
Design Philosophy 1. General overview of design concepts 2. Awareness of interaction of mechanical systems	Engineer and/or Commissioning Authority (CA)	1. Explanation of mechanical and related electrical systems, their interaction 2. Site visit in early stages of project 3. Classroom sessions during commissioning stage	½ hour	1. Schematic of layouts & controls 2. Installed system, equipment 3. Design Criteria, Design Intents
Mechanical System 1. To learn details of all systems installed 2. To develop in depth knowledge of the operation of each system	Installing Contractor, Equipment Manufacturer, CA	1. Explanation of operational concepts of systems and components 2. Review of O & M Manuals 3. Equipment operation, setpoints, and adjustment 4. Preventive maintenance requirements 5. Warranty 6. Equipment troubleshooting 7. Observation during construction 8. Site visits, classroom sessions	1 hour	1. “As built” drawings 2. Systems Operations Manual 3. Maintenance Manual 4. Installed systems, equipment 5. Controls Schematics and Reports 6. Demonstration
Plumbing System 1. To learn details of all systems installed 2. To develop in depth knowledge of the operation of each system	Installing Contractor, Equipment Manufacturer, CA	1. Explanation of operational concepts of systems and components 2. Review of O & M Manuals 3. Equipment operation, setpoints, and adjustment 4. Preventive maintenance requirements 5. Warranty 6. Equipment troubleshooting 7. Observation during construction 8. Site visits, classroom sessions	1 hour	1. “As built” drawings 2. Systems Operations Manual 3. Maintenance Manual 4. Installed systems, equipment 5. Controls Schematics and Reports 6. Demonstration

MECHANICAL				
Systems and Goals	**Instructor**	**Content (approximately 30% Theory, 70% practical)**	**Duration**	**Instruction Materials and Tools**
Fire Suppression System 1. To learn details of all systems installed 2. To develop in depth knowledge of the operation of each system	Installing Contractor, Equipment Manufacturer, CA	1. Explanation of operational concepts of systems and components 2. Review of O & M Manuals 3. Equipment operation, setpoints, and adjustment 4. Preventive maintenance requirements 5. Warranty 6. Equipment troubleshooting 7. Observation during construction 8. Site visits, classroom sessions 4.	1 hour	1. “As built” drawings 2. Systems Operations Manual 3. Maintenance Manual 4. Installed systems, equipment 5. Controls Schematics and Reports 6. Demonstration

1.3 TRAINING ACTIVITIES - ELECTRICAL

ELECTRICAL				
Systems and Goals	**Instructor**	**Content (approximately 30% Theory, 70% practical)**	**Duration**	**Instruction Materials and Tools**
Design Philosophy 1. General overview of design concepts 2. Awareness of interaction of mechanical systems	Engineer and/or Commissioning Authority (CA)	1. Explanation of mechanical and related electrical systems, their interaction 2. Site visit in early stages of project 3. Classroom sessions during commissioning stage	½ hour	1. Schematic of layouts & controls 2. Installed system, equipment 3. Design Criteria, Design Intents
Electrical System 1. To learn details of all systems installed 2. To develop in depth knowledge of the operation of each system	Installing Contractor, Equipment Manufacturer, CA	1. Explanation of operational concepts of systems and components 2. Review of O & M Manuals 3. Equipment operation, setpoints, and adjustment 4. Preventive maintenance requirements 5. Warranty 6. Equipment troubleshooting 7. Observation during construction 8. Site visits, classroom sessions	1 hour	1. “As built” drawings 2. Systems Operations Manual 3. Maintenance Manual 4. Installed systems, equipment 5. Controls Schematics and Reports 6. Demonstration
Electrical Distribution 1. To learn details of all systems installed 2. To develop in depth knowledge of the operation of each system	Installing Contractor, Equipment Manufacturer, CA	1. Explanation of operational concepts of systems and components 2. Review of O & M Manuals 3. Equipment operation, setpoints, and adjustment 4. Preventive maintenance requirements 5. Warranty 6. Equipment troubleshooting 7. Observation during construction 8. Site visits, classroom sessions	1 hour	1. “As built” drawings 2. Systems Operations Manual 3. Maintenance Manual 4. Installed systems, equipment 5. Controls Schematics and Reports 6. Demonstration

ELECTRICAL				
Systems and Goals	**Instructor**	**Content (approximately 30% Theory, 70% practical)**	**Duration**	**Instruction Materials and Tools**
Fire Alarm 1. To learn details of all systems installed 2. To develop in depth knowledge of the operation of each system	Installing Contractor, Equipment Manufacturer, CA	1. Explanation of operational concepts of systems and components 2. Review of O & M Manuals 3. Equipment operation, setpoints, and adjustment 4. Preventive maintenance requirements 5. Warranty 6. Equipment troubleshooting 7. Observation during construction 8. Site visits, classroom sessions	1 hour	1. "As built" drawings 2. Systems Operations Manual 3. Maintenance Manual 4. Installed systems, equipment 5. Controls Schematics and Reports 6. Demonstration
Lighting and Control System 1. To learn details of all systems installed 2. To develop in depth knowledge of the operation of each system	Installing Contractor, Equipment Manufacturer, CA	1. Explanation of operational concepts of systems and components 2. Review of O & M Manuals 3. Equipment operation, setpoints, and adjustment 4. Preventive maintenance requirements 5. Warranty 6. Equipment troubleshooting 7. Observation during construction 8. Site visits, classroom sessions	1 hour	1. "As built" drawings 2. Systems Operations Manual 3. Maintenance Manual 4. Installed systems, equipment 5. Controls Schematics and Reports 6. Demonstration

END OF SECTION

PART 1 GENERAL

1.1 Related Work

.1 Section 01 11 55 - General Instructions

.2 Section 01 14 00 - Work Restrictions

.3 Section 01 35 33 - Health and Safety Requirements

.4 Section 01 35 43 - Environmental Procedures

.5 Section 01 51 00 - Temporary Facilities

.6 Section 01 74 19 - Construction / Demolition Waste Management and Disposal

1.2 Submittals

.1 All submittals shall be in accordance with Section 01 33 00 – Submittal Procedures.

1.3 Hazardous Materials Report

.1 Comply with the Hazardous Materials Assessment Refer (Appendix B.)

1.4 Precautions

.1 Should material resembling spray or trowel applied asbestos or any other designated substance be encountered in the course of demolition, stop work, take preventative measures and notify the Departmental Representative immediately. Do not proceed until written instructions have been received. The costs for all approved remediation of hazardous materials will be paid by means of Change Orders.

1.5 Protection

.1 Prevent movement, settlement or damage to adjacent structures and paving. Provide bracing and shoring as required. Make good damage and be liable for injury caused by demolition.

.2 Take precautions during demolition to support parts of structures not being demolished, and if safety of existing structure appears to be endangered, cease operations and notify Departmental Representative.

.3 Prevent debris from blocking drainage which must remain in operation.

.4 Take precaution during demolition to protect all adjacent finished surfaces. Make good any damage to adjacent surfaces.

.5 Except where otherwise noted, all exterior walls are to remain intact and provide a weathertight building envelope. Make good any damages due to demolition to exterior walls. Where exterior envelope elements are removed, provide temporary secure and weathertight closures.

.6 Fires burning and selling of waste of materials is not permitted on site.

.7 Do not bury waste or materials on site.

.8 Do not dispose of waste or volatile materials such as: mineral spirits, oil, petroleum based lubricants, or toxic cleaning solutions into storm or sanitary sewers. Ensure proper disposal procedures are maintained throughout project.

1.6 Health and Safety

.1 Do construction occupational health and safety in accordance with Section 01 35 33 – Health and Safety Requirements and the Workers' Compensation Board of BC latest regulations.

1.7 Waste Management and Disposal

.1 Separate waste management materials for reuse and recycling in accordance with Section 01 74 19 Construction / Demolition Waste Management and Disposal, and the Waste Management Plan to the maximum extent economically possible.

PART 2 PRODUCTS

2.1

.1 Demolition: all or part of existing sprinkler systems, as shown on drawings, to suit the work.

.2 Refer to Plumbing, Mechanical and Electrical drawings and specifications for material required for removal, capping and/or diversion.

.3 Items to be removed and turned over to Departmental Representative are noted on the drawings.

.4 Elements for removal and re-use are noted on the drawings.

PART 3 EXECUTION

3.1 Work

.1 Dispose of demolished materials off site except where noted otherwise. Refer to Section 01 74 19.

.2 Carefully remove all noted material in areas of renovation. Qualified tradesmen shall be used for the removal of all material scheduled for re-use. Contractor shall be responsible for making good, to the satisfaction of the Departmental Representative, all damage to materials and equipment to be reinstalled.

.3 Site-examine and record locations, conditions, etc., of all elements which must be removed then re-installed and made good after re-installation work.

.4 Where existing piping, conduits, wall assemblies, wiring, applied items and other elements are removed, patch and make good affected surfaces which are to remain. Patching and remedial materials shall match adjacent existing unless otherwise noted.

.5 Protect all existing elements and finishes not scheduled for replacement and store where directed as required. Make good where damaged.

.6 Layout and execute all cutting and demolition such as to cause the least amount of disruption to remaining existing finishes, materials, elements and equipment.

.7 Unless otherwise noted, all existing items noted as: "Remove and Dispose of" shall be considered as Contractor's salvage.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

.1	Section 01 01 50	General Instructions
.2	Section 01 33 00	Submittal Procedures
.3	Section 01 35 33	Health and Safety Requirements
.4	Section 01 74 21	Construction/Demolition Waste Management Disposal
.5	Section 01 74 11	Cleaning
.6	Section 02 82 00.01	Asbestos Abatement – Minimum Precautions

1.2 Igenis Essimod

.1 Reports:

.1 Stantec Consulting Ltd. Hazardous Building Materials Assessment Report (herein referred to as the Previous Environmental Report):

.1 Hazardous Building Materials Assessment – Gulf of Georgia Cannery, Richmond, BC, dated March 24, 2016.

.2 A copy of the Previous Report is attached in the Appendix of the Project Specifications.

.2 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.

.4 Hazardous Building Material: component of a building or structure that will cause adverse impact to environment or adversely affect health of persons, animals, or plant life when altered, disturbed or removed during maintenance, renovation or demolition.

.3 Reference Standards:

.1 Canadian Environmental Protection Act,1999 (CEPA 1999)

.1 Export and Import of Hazardous Waste and Hazardous Recyclable Material Regulations (SOR/2005-149).

.2 Department of Justice Canada

.1 Transportation of Dangerous Goods Act, 1992 (TDG Act) [1992], (c. 34).

.2 Transportation of Dangerous Goods Regulations (T-19.01-SOR/2001-286).

.3 Health Canada / Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.4 National Research Council Canada Institute for Research in Construction (NRC-IRC)

.1 National Fire Code of Canada (2015).

.5 WorkSafe BC

.1 British Columbia's Occupational Health and Safety Regulation (BC Reg. 296/97, including amendments to date of work)

.2 "Safe Work Practices for Handling Asbestos" (latest edition)

.3 "Safe Work Practices for Handling Lead" (latest edition)

.6 British Columbia Hazardous Waste Regulation (BC Reg. 63/88)

.7 The Federal PCB Regulations (SOR/2008-273).

.8 The British Columbia Waste Management Act - Ozone Depleting Substances and Other Halocarbons Regulation (BC Reg. 387/99).

.9 The Federal Halocarbons Regulation (July 2003).

.10 Canadian Construction Association

.1 Standard Construction Document CCA 82 "Mould Guidelines for the Canadian Construction Industry" (2004)

1.3 Action and Information Submittals

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

.2 Product Data for hazardous materials to be used by the Contractor to complete the Work:

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

.2 Submit two copies of WHMIS MSDS in accordance with Section 01 35 33 - 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.

.4 Construction/Demolition Waste Management:

.1 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating percentage of construction/demolition wastes were recycled or salvaged

.5 Low-Emitting Materials: submit listing of adhesives and sealants used in building, comply with VOC and chemical component limits or restrictions requirements.

1.4 Delivery, Storage and Handling

.1 Deliver, store and handle hazardous materials to be used by the Contractor to complete the Work in accordance with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver hazardous materials to be used by the Contractor 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.

.4 Storage and Handling Requirements:

.1 Co-ordinate storage of hazardous materials to be used by the Contractor to complete the Work 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 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.

.3 Storage of any fuels, oils or hazardous materials must not be situated within 30m from waterbodies, as measured from the High Water Mark. No re-fueling must occur within 30m from waterbodies, as measured from the High Water Mark.

.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 containers 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 Include provisions for Work of this Section in Waste Reduction Workplan as outlined in 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.

PART 3 EXECUTIONS

3.1 Hazardous Materials Abatement

.1 Scope of Abatement Activities.

.1 Abatement shall be conducted to handle, alter, remove and/or dispose of hazardous building materials as identified in the Previous Environmental Report in accordance with applicable regulations, guidelines, standards and/or best practices for such work, where such identified hazardous building materials will be impacted (handled, altered, damaged, removed) by the Work.

.2 Contractor is responsible for reviewing plans, specifications and reports such that they understand the locations and amounts of hazardous materials that will be impacted by the Work of this contract, and such that appropriate plans and budgets can be included in their overall bids.

.3 The listing below is a summary of the identified hazardous building material categories and associated removal and disposal regulations, guidelines and/or standards, based on the project scope of work.

.1 Asbestos-Containing Materials (ACMs)

.1 Refer to the Previous Environmental Report for identities and locations of ACMs that may require disturbance during the Work, including, but not limited to include:

.1 Blue pipe sealant applied to sprinkler piping throughout the Cannery Building (existing fire sprinkler system).

.2 Cement panel located behind (mounted behind) existing General Electric Transformer Panels throughout the Cannery Building.

.2 Actions that will disturb identified ACMs are to be conducted in accordance with the requirements of the WorkSafe BC publication “Safe Work Practices for Handling Asbestos”, latest edition, by appropriately trained personnel, further detailed below.

.1 Submit WorkSafeBC Notice of Project Form to WorkSafe BC and a copy to Departmental Representative, no less than seven (7) business days prior to start of work.

.2 Submit proof of Contractor's Asbestos Liability Insurance.

.3 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 of, within twenty (20) business days after disposal.

.4 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, within seven (7) business days prior to start of work, to Departmental Representative. Instruction and training related to respirators is to include, at a minimum:

.5 Fitting of equipment.

.6 Inspection and maintenance of equipment.

.7 Disinfecting of equipment.

.8 Limitations of equipment.

.9 Waste transportation to be conducted in accordance with BC Reg. 63/88 and the Federal Transportation of Dangerous Goods Regulation.

.10 Waste disposal to be conducted in accordance with BC Reg. 63/88.

.11 Notify Departmental Representative immediately of suspected ACM discovered during Work and not apparent from drawings, specifications, or report pertaining to Work. Do not disturb such material pending instructions from Departmental Representative.

.2 Lead and Lead-Containing Paints (LCPs)

.1 Refer to the Previous Environmental Report for identification and locations of lead-containing materials (including LCPs) that may require disturbance during the Work.

.2 Actions that will disturb lead-containing materials (including paints and materials coated with LCPs) are to be conducted in accordance with the requirements of the current version of the WorkSafe BC publication “Safe Work Practices for Handling Lead”, latest edition, keeping airborne exposure to lead dust to less than the 8-hour Occupational Exposure Limit (OEL) for lead of 0.05 milligram per cubic metre (mg/m^3).

.3 Although LCPs and items coated with LCPs will be disturbed and/or removed for disposal during the Work, unless deemed necessary through risk assessment or cost analysis conducted by the Contractor, comprehensive removal of LCPs from items or surfaces is not expected to be required during the Work

.1 Refer to the provisions of the WorkSafe BC publication “Safe Work Practices for Handling Lead”, latest edition,

for removal of LCPs from surfaces before any welding and torch-cutting, should the Contractor plan to use such methods to complete the Work.

.1 Contractor will be responsible for verification testing of surfaces where LCPs have been removed. Confirmation of acceptable results is to be provided to the Departmental Representative for review before proceeding with any welding or torch-cutting on surfaces where LCPs were present.

.4 Waste transportation to be conducted in accordance with BC Reg. 63/88 and the Federal Transportation of Dangerous Goods Regulation.

.5 Waste disposal to be conducted in accordance with BC Reg. 63/88.

.3 Polychlorinated Biphenyls (PCBs)

.1 Removal, alteration and/or disposal of PCB-containing equipment is not anticipated to be required during the Work.

.4 Mould

.1 Removal, alteration and/or disposal of mould-impacted building materials is not anticipated to be required during the Work.

.5 Mercury

.1 Removal, alteration and/or disposal of mercury-containing equipment is not anticipated to be required during the Work.

.6 Ozone-Depleting Substances (ODSs)

.1 Removal, alteration and/or disposal of ozone-depleting substances is not anticipated to be required during the Work.

.7 Silica

.1 When silica-containing materials are to be disturbed and/or removed (e.g., coring through concrete slabs, demolition of masonry, removal of ceramic tiles or concrete units), ensure dust control measures are employed such that airborne silica dust concentrations do not exceed the exposure limit as stipulated by BC Reg. 296/97 (Cristobalite and Quartz – each 0.025 mg/m^3). This would include, but not be limited to, the following:

.1 Providing workers with respiratory protection

.2 Wetting the surface of the materials, use of water or dust suppressing agents to prevent dust emissions

.3 Providing workers with facilities to properly wash prior to exiting the work area.

3.2 Cleaning

.1 Progress Cleaning: clean in accordance with Section 01 74 11 – Cleaning. 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.

.1 Dispose of hazardous waste materials in accordance with applicable federal and provincial acts, regulations, and guidelines.

.2 Send hazardous wastes to authorized hazardous waste disposal or treatment facilities.

.3 Burning, diluting, or mixing hazardous wastes for purpose of disposal is prohibited.

.4 Disposal of hazardous materials in waterways, storm or sanitary sewers, or in municipal solid waste landfills is prohibited.

.5 Dispose of hazardous wastes in weekly in accordance with applicable federal and provincial regulations.

.6 Minimize generation of hazardous waste to so all hazardous waste generated daily is packaged in accordance with applicable federal and provincial acts, regulations, and guidelines. Take necessary precautions to avoid mixing clean and contaminated wastes.

.7 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 Refer to the Previous Environmental Report in the Appendix for information pertaining to the asbestos-containing materials (ACMs) that have been identified and that is to be impacted by the Work.

.2 Contractor will be required to comply with requirements of this Section when disturbance to the following materials is required to complete the Work:

.1 Asbestos-containing blue pipe sealant applied to sprinkler piping throughout the Cannery Building (existing fire sprinkler system).

.2 Asbestos-containing cement panel located behind (mounted behind) existing General Electric Transformer Panels throughout the Cannery Building.

1.2 Section Includes

.1 Requirements and procedures for applicable procedures and personal protective equipment to be utilized during set-up of asbestos abatement work areas and for abatement of ACMs of the type described within.

1.3 Related Requirements

.1	Section 01 01 50	General Instructions
.2	Section 01 33 00	Submittal Procedures
.3	Section 01 35 33	Health and Safety Requirements
.4	Section 01 74 21	Construction/Demolition Waste Management
.5	Section 01 74 11	Cleaning
.6	Section 02 81 01	Hazardous Materials Use and Abatement

1.4 References

.1 Department of Justice Canada (Jus)

.1 Canadian Environmental Protection Act, 1999 (CEPA).

.2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.3 Transport Canada (TC)

.1 Transportation of Dangerous Goods Act, 1992 (TDGA)

.4 Underwriters' Laboratories of Canada (ULC)

.5 WorkSafe BC

.1 British Columbia’s Occupational Health and Safety Regulation (BC Reg. 296/97, including amendments to date of work)

.2 “Safe Work Practices for Handling Asbestos” (latest Edition)

.6 The current version of the British Columbia Hazardous Waste Regulation (BC Reg. 63/88)

1.5 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 (or vermiculite insulation materials with any asbestos) and are identified under Existing Conditions including fallen materials and settled dust.

.4 Asbestos Work Area: area where work takes place which will, or is to, disturb ACMs.

.5 Authorized Visitors: Departmental Representative 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.

1.6 Submittals

.1 Submittals in accordance with Section 01 11 55 – General Instructions and Section 02 81 01 – Hazardous Materials Use and Abatement.

1.7 Quality Assurance

.1 Regulatory Requirements: comply with Federal, Provincial, 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 Section 01 35 29.06 - Health and Safety Requirements.

.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 supplied 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.

1.8 Waste Management and Disposal

.1 Separate waste materials for reuse and recycling in accordance with Section 01 01 50 – General Instructions.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.4 Separate and place in designated containers steel metal plastic waste in accordance with Waste Management Plan.

.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, and Municipal regulations. Dispose of asbestos waste in sealed double thickness 6 mil 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.

1.9 Existing Conditions

.1 Reports and information pertaining to ACMs that is to be handled, removed, or otherwise disturbed and disposed of during this project are bound into this specification in the Appendix.

.2 Notify Departmental Representative of additional suspected ACMs discovered during Work and not apparent from drawings, specifications, or report pertaining to Work. Do not disturb such material pending instructions from Departmental Representative.

1.10 Scheduling

.1 Hours of Work: perform work during normal working hours.

1.11 Canada's Instructions

.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 is to 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 Section 01 35 33 - 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.

.4 The removal of existing blue pipe sealant applied to sprinkler piping is to be removed using wrap and cut methods.

.1 The contractor is to ensure that all locations where asbestos-containing blue pipe sealant material is present, the pipe sealant is covered with FR polyethylene sheeting and duct tape prior to disturbance.

.2 The contractor will cut the existing sprinkler pipe at locations where no asbestos-containing pipe sealant is present, and place the pipe ad associated pipe sealant into appropriate asbestos waste containers for disposal.

.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 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.

3.2 Air Monitoring

.1 From beginning of Work until completion of cleaning operations, Departmental Representative will separately engage an Environmental Specialist to take air samples inside and outside of Asbestos Work Area enclosure[s] in accordance with British Columbia's Occupational Health and Safety Regulation and the current version of the WorkSafeBC Manual entitled "Safe Work Practices for Handling Asbestos".

.1 Departmental Representative will be responsible for monitoring inside enclosure in accordance with applicable Provincial Occupational Health and Safety Regulations.

.2 If air monitoring shows that areas outside Asbestos Work Area enclosure[s] are contaminated, enclose, maintain and clean these areas in same manner as that applicable to Asbestos Work Area, at no additional cost to the Contract

.3 Ensure that respiratory safety factors are not exceeded.

.4 During the course of Work, the Environmental Specialist will measure fibre content of air outside Work areas by means of air samples analyzed by Phase Contrast Microscopy (PCM).

.1 Stop Work when PCM measurements exceed 0.05 f/cc and correct procedures.

.5 The Contractor is required to provide the Departmental Representative, with a copy to the Environmental Specialist, detailed schedule for work within the asbestos work area enclosure(s):

.1 Updated every 7 days before any proposed work

.2 Confirmed not less than 24hours and not more than 32 hours before each day of work in the area.

.3 Work within the area will not be accepted for payment unless Environmental Specialist has been notified.

END OF SECTION

1.0 GENERAL

1.1 RELATED SECTIONS

.1	Section 01 74 19	Waste Management and Disposal
.2	Section 03 10 00	Concrete Forming and Accessories
.3	Structural Drawings S101	Wood Products General Notes

1.2 REFERENCE STANDARDS

.1 Canadian Standards Association (CSA International)

- .1 CSA B111-1974 (R2003), Wire Nails, Spikes and Staples.
- .2 CAN/CSA-G164-M92 (R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.
- .3 CSA O121-08 (R2013), Douglas Fir Plywood.
- .4 CAN/CSA-O141-05 (R2014), Softwood Lumber.
- .5 CSA O151-09 (R2014), Canadian Softwood Plywood.
- .6 CAN/CSA-O325-07 (R2012), Construction Sheathing.
- .7 Comply with AWPA.M4 and revisions specified in CAN/CSA-080 Series, Supplementary Requirements to AWPA Standard M2.

.2 National Lumber Grades Authority (NLGA)

- .1 Standard Grading Rules for Canadian Lumber 2014.

1.3 QUALITY ASSURANCE

.1 Lumber identification: by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.

.2 Plywood identification: by grade mark in accordance with applicable CSA standards.

.3 Plywood, OSB and wood based composite panel construction sheathing identification: by grademark in accordance with applicable CSA standards.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 19 - Waste Management And Disposal.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard and packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.4 Divert unused wood materials from landfill to recycling, reuse and composting facility approved by Departmental Representative.

.5 Do not dispose of preservative treated wood through incineration.

.6 Do not dispose of preservative treated wood with materials destined for recycling or reuse.

.7 Dispose of treated wood, end pieces, wood scraps and sawdust at sanitary landfill approved by Departmental Representative.

.8 Dispose of unused wood preservative material at official hazardous material collections site approved by Departmental Representative.

.9 Do not dispose of unused preservative material into sewer system, into streams, lakes, onto ground or in other locations where they will pose health or environmental hazard.

2.0 PRODUCTS

2.1 LUMBER MATERIAL

.1 Lumber: unless specified otherwise, softwood, S4S, moisture content 19% or less in accordance with following standards:

.1 CAN/CSA-O141.

.2 NLGA Standard Grading Rules for Canadian Lumber.

.2 Furring, blocking, nailing strips, grounds, rough bucks, cants, curbs, fascia backing and sleepers:

.3 Board sizes: "Standard" or better grade.

.4 Dimension sizes: "Standard" light framing or better grade.

.5 Post and timbers sizes: "Standard" or better grade species except as indicated.

.4 Framing and board lumber: in accordance with NBCC 2010 Subsection 9.3.2, except as follows:

.1 Deck joists, studs, chords in built-up beams: D-Fir NLGA No.2 or better U.N.O.

.2 Post and Beams: D-Fir species, NLGA No.1 grade.

.3 Wall studs: D-Fir species, NLGA No.2 grade or better.

.4 Boardwalk plank: Yellow Cedar species, NLGA No.2 grade or better.

.

.3 Glued end-jointed (finger-jointed) lumber products are acceptable for framing of interior non-load bearing studs.

2.2 PANEL MATERIALS

.1 Douglas fir plywood (DFP): to CSA O121, standard construction.

.2 Canadian softwood plywood (CSP): to CSA O151, standard construction.

.3 Plywood, OSB and wood based composite panels: to CAN/CSA-O325.

2.3 PANEL MATERIALS END USES

.1 Roof sheathing: DFP sheathing grade square edge, 12.5 mm thick.

.2 Wall sheathing: DFP sheathing grade square edge, 12.5 mm thick.

.3 Miscellaneous plywood panels: DFP or CSP sheathing grade square edge, 19 mm thick, for wall backing, panel mounting boards and as indicated.

.4 Wall sheathing under wall waterproofing membrane: DFP sheathing grade T&G edge, 16 mm thick pressure preservative treated to para. 2.7.1.

2.4 SHEATHING PAPER

.1 Exterior wall sheathing paper:
.1 Single ply asphalt-kraft sheet conforming to CAN/CGSB 51.32M77, US st'd UUB-790a as a 30 minute water resistant paper applied in two layers.

2.5 DAMPROOF MEMBRANE

.1 Wood plates in contact with concrete: use pressure preservative treated wood D-Fir Grade No. 1 or better with compressible gasket filler of either 25 mm fibreglass insulation, closed cell polyethylene sponge 3 mm thick or roll roofing.
.1 Fibre glass insulation to: Section 07 21 30.
.2 Roll roofing: to CSA A123.2, Type S.
.3 Poly closed cell sponge gasket: as approved by Departmental Representative.

.2 Waterproofing membrane: Self-adhering or adhesive-applied SBS modified bituminous membrane minimum 1.5 mm thickness reinforced with material for application over primed substrate; of steel, aluminium, galvanized steel, gypsum board and plywood, conforming to the following:

.1 Tensile strength: 150 n/5 cm.
.2 Air permeance: less than 0.01 l/m sq. at 75 Pa pressure difference.
.3 Sheet membrane: conforming to CGSB 37-GP-56M-1980.
.4 Acceptable products:
.1 Perm-a-Barrier System 4000, Grace Membrane Group
.2 BlueSkin SA Air Barrier Membrane, Monsey-Bakor.
.3 Sopraseal Stick 1100, Soprema.
.4 QSC-705 Carlisle Coatings and Waterproofing.

2.6 ACCESSORIES

.1 Nails, spikes and staples: to CSA B111. All nailing shall be common nails. If P-nails (Power driven nails) are intended as substitution, submit P-nails information for Departmental representative's review prior to use. Adjustment of nails spacing or requirements may be required.

.2 Bolts: 12.5 mm diameter unless indicated otherwise, complete with nuts and cut steel washers. All bolts and anchor bolts shall conform to ASTM A307. Bolt holes shall be 1 mm larger than the bolt diameter. Bolts in wood shall not be less than 7 diameter from the end and 4 diameters from the edge unless otherwise detailed.

.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 Steel plates: All steel plates used in connection details shall be grade 300W.

.5 Lag screws: Lag screws shall be predrilled with a bit size of 65% of the shank diameter for the threaded portion. Lead holes shall be the same length as the unthreaded portion and the same diameter as the shank. Screw all lags into place. Cut washers shall be provided under heads which bear on wood.

.6 No checks or splits allowed at areas to be bolted or lagged.

.7 All bolts, steel plates/connections and nails for use with Yellow cedar wood to be hot dipped galvanized to ASTM A653 class G184 as produced by Simpson Strong Tie or approved equal by the Departmental representative.

.8 Galvanizing: to CSA G164 unless noted otherwise. Use galvanized fasteners for exterior work, interior highly humid areas and fire-retardant treated lumber.

.9 Joist/beam hangers, post bases: unless noted otherwise shall be hot dipped galvanized as per manufacture and approved by the Departmental representative.

2.7 FINISHES

.1 Galvanizing: to CAN/CSA-G164(Withdrawn) with zinc coating of 610g/m2 , use galvanized fasteners for exterior work, interior highly humid areas, pressure- preservative, and fire-retardant treated lumber.

.2 Stainless steel: use stainless steel Grade 316 or alloy for fastener for work mentioned in .1 above or alternative are acceptable and at contractors cost.

2.8 WOOD PRESERVATIVE

.1 Surface-applied wood preservative: clear, coloured, or copper napthenate or 5% pentachlorophenol solution, water repellent preservative.

.2 Pentachlorophenol use is restricted to building components that are in ground contact and subject to decay or insect attack only. Where used, pentachlorophenol-treated wood must be covered with two coats of an appropriate sealer.

.3 Structures built with wood treated with pentachlorophenol and inorganic arsenicals must not be used for storing food nor should the wood come in contact with drinking water.

3.0 EXECUTION

3.1 PREPARATION

.1 Comply with AWPA.M4, use copper napthenate to manufacturer's instructions.

.2 Treat surfaces of material with wood preservative, before installation.

.3 Apply preservative by dipping, or by brush to completely saturate and maintain wet film on surface for minimum 3 minute soak on lumber and one minute soak on plywood.

.4 Re-treat surfaces of PT Lumber and plywood exposed by cutting, trimming or boring with liberal brush application of preservative before installation.

.5 Treat material as indicated and as follows:

.1 Wood cants, fascia backing, curbs, nailers, sleepers on roof deck.

.2 Wood furring for member on outside surface of exterior masonry and concrete walls.

.3 Wood sleepers supporting wood subflooring over concrete slabs in contact with ground or fill.

.4 Plywood wall sheathing under water proofing membrane.

3.2 INSTALLATION

.1 Comply with requirement of NBCC 2015, Part 9 and General Notes on Structural Drawings. Where conflict exists, the more stringent requirements will apply.

.2 Install members true to line, levels and elevations.

.3 Construct continuous members from pieces of longest practical length.

.4 Install spanning members with “crown-edge” up.

.5 Install all exterior pressure treated timber sill plates using 16 DIA. Anchor bolts @ 1000o.c. into ground U.N.O.; Anchor interior non-structural wall sill plates with minimum 12 Dia. Anchor bolts @ 2400 o.c.

.6 Stud walls abutting a concrete or masonry wall shall be bolted to the wall with 12 Dia. Anchor bolts @ 600 o.c. through a double stud.

.7 Install lumber and panel materials so that grade-marks and other defacing marks are not visible or are removed by sanding at location (s) where exposed in final assembly.

.8 All built-up beams to be D-fir Grade No. 2 or better nailed through each lamination using 82 min. nails on a 150 mm grid.

.9 Install plywood roof sheathing with surface grain at right angles to roof framing. Provide solid blocking necessary to ensure maximum span on roof sheathing edge does not exceed 610 mm in either direction.

.10 Install sheathing over framing members as indicated using nails to NBCC part 9 requirements and in accordance with structural drawing.

.11 Install wall sheathing with panel side joints on solid bearing staggered at least 800 mm. Nail at perimeter edge 150 mm o.c. minimum and at interior of panels 300 mm o.c. minimum. Use minimum 65 mm long nails. Refer to general Notes on structural drawing for nailing pattern.

.12 Apply peel and stick waterproof membrane at all window and door openings at jambs, head and sill. Apply waterproofing membrane over wood framing where wood framed wall is adjacent to backfill and concrete.

.13 Apply building paper in two layer application over sheathing using staples or auto-nailer.

.14 Install furring, strapping and solid backing in walls and structures as required to space-out and support casework, cabinets, applied finishes, facings, pipe chases, wall mounted door stops, access hatches, electrical and mechanical fixtures, washroom accessories, benches, prefab showers, overhead door hardware and other work as required. Use solid blocking or 19 mm plywood securely nailed to framing members.

.15 Frame and strap for suspended gypsum board ceiling finishes.

.16 Align and plumb faces of furring and blocking to tolerance of 1:600.

.17 Install furring and blocking as required to space-out and support casework, cabinets, wall and ceiling finishes, facings, fascia, soffit, siding and other work as required.

.18 Install rough bucks, nailers and linings to rough openings as required to provide backing for frames and other work.

.19 Install wood cants, fascia backing, nailers, curbs and other wood supports as required and secure using galvanized, or steel fasteners.

.20 Install wood backing, dressed, tapered and recessed slightly below top surface of roof insulation for roof hopper.

.21 Install sleepers as indicated.

.22 Use caution when working with particle board. Use dust collectors and high quality respirator masks.

3.3 ERECTION

.1 Frame, anchor, fasten, tie and brace members to provide necessary strength and rigidity.

.2 Countersink bolts where necessary to provide clearance for other work.

3.4 SCHEDULES

.1 Provide electrical equipment backboards for mounting electrical equipment as indicated. Use 19 mm thick plywood on 19 x 38 mm furring around spacing, perimeter and at maximum 300 mm intermediate.

END OF SECTION 06 10 11

1.0 GENERAL

1.1 RELATED SECTIONS

.1 General Instruction Section 01 11 55

1.2 WORK INCLUDED

.1 Fabrication of boardwalk guard consisting of guard posts and rails, etc. shall be as shown on the contract drawings.

1.3 QUALITY ASSURANCE

.1 Grading:

.1 NBC Part 4 - Design, as applicable to Timber Construction

.2 Timber components and construction to CSA Standard O86.1 and according to N.L.G.A. Standard rules 2014 as applicable.

.3 Standards: CSA Standards S16.1 and O86.1 for Steel Connections.

1.4 REFERENCES:

.1 Canadian Standards Association (CSA International)

.1 CSA B111-1974 (R2003), Wire Nails, Spikes and Staples.
.2 CAN/CSA O86.1-01, Engineering Design in Wood.
.3 CAN/CSA-S16.1-01, Limit States Design of Steel Structures.

.2 National Lumber Grades Authority (NLGA)

.1 Standard Grading Rules for Canadian Lumber 2014.

.3 American Society for Testing and Materials International, (ASTM)

.1 ASTM A 307-03, Specification for Carbon Steel Bolts and Studs, 60,000psi Tensile.
.2 A653/A653M-07, Standard Specification for Steel Sheet, Zinc-coated (Galvanized), or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
.3 ASTM D1413-07, Standard Test Method for Wood Preservatives by Laboratory Soil-block Cultures.

1.5 SUBMITTALS

.1 Shop Drawings: submit drawings for all fabricated timber elements and connections of accordance with Section 01 11 55 – General Instructions.

.2 Indicate grades of timber, shop applied finishes and prestaining requirements, shop and erection details including cuts, holes, fastenings and connection hardware.

.3 Review of shop drawings to be for size and arrangement of original and auxiliary members only. Such review will not relieve Contractor of responsibility for general and detail dimensions and fit or any errors or omissions.

.4 Drawings showing erection procedures and erection bracing to be prepared by fabricator. Erection procedures and details and size of temporary bracing is the responsibility of the Fabricator.

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING

.1 Storage of pre-fabricated components in Contractor's storage yard, piled off the ground and stacked to provide maximum air circulation and ventilation until required at Construction Site.

.2 Protect with tarps from water staining, soiling, dust and other construction activity until pick-up.

1.6 CONDITIONS

.1 Examine all conditions on which the successful work of this section depends.

.2 Refer to Drawings and Details for specific framing and connecting requirements.

2.0 PRODUCTS

2.1 MATERIALS

.1 General: all materials shall be new and of the quality and grade specified. No seconds, off grades or materials not meeting tolerance specifications will be accepted in the finished construction.

.2 All heavy timber elements shall be properly air dried to a maximum of 19% moisture content prior to installation.

.3 All round timber components shall be timber logs with sizes indicated on drawings.

~~.4~~ All sizes are rough.

.5 Connections:

.1 All bolts and pins shall conform to ASTM A307
.2 All bolts and nuts must be fitted with cut steel washers
.3 All steel plate used in connection details shall be grade 300W
.4 All nails and spikes shall conformed to CSA-B111
.5 Bolt holes shall be 1mm larger than the bolt diameter

.6 Bolts in wood shall not be less than 7 diameter from the end and 4 diameter from the edge unless otherwise detailed.
.7 No checks or splits allowed at areas to be bolted, pinned or lagged.

.6 Galvanizing: to ASTM A653/A653M Class G185 for all connection fasteners and related hardware.

3.0 EXECUTION

.1 Comply with the requirements of NBC 2015 Part 4 and CSA Standards O86.1.

.2 Install members true to line, levels and elevation, brace and anchor until permanently secured by structure.

.3 Install lumber materials so that grade marks or other defacing marks in exposed areas are not visible or are removed by sanding.

.4 Splice and joint only at locations indicated on reviewed shop drawings.

.5 Fit all members closely and accurately to all other members and other assembles.

.6 Maintain protection of all Heavy timber members until installation is complete.

.7 Install all metal fasteners in strict accordance with manufacturer's instructions.

END OF SECTION 06 13 00

PART 1 GENERAL

1.1 Related Work

.1 Section 06 10 00 Rough Carpentry

.2 Section 09 90 00 Painting and Coating

1.2 Reference Standards

.1 Do millwork to “custom” grade to Millwork Standards of the Architectural Woodwork Manufacturer's Association of Canada, latest edition.

1.3 Submittals

.1 Submit duplicate 300 x 300mm samples of each type of solid wood or veneer to receive stain or natural finish, in accordance with Section 01 33 00.

.2 Submit duplicate 300 mm long samples of each type of trim and moulding, in accordance with Section 01 33 00.

1.4 Shop Drawings

.1 Submit shop drawings in accordance with Section 01 33 00.

.2 Clearly indicate details of construction, profiles, jointing, fastening and other related details.

1.5 Coordination & Verification

.1 Verify all dimensions & existing conditions on job site prior to all shop fabrication and work on site. Where major discrepancies occur, alert Departmental Representative immediately.

.2 Coordinate work of this section with that of wall, ceiling-framing, electrical and mechanical sections where millwork and trim interface with drywall partitions, ceiling suspension, plumbing, electrical outlets, etc.

.3 It shall be the responsibility of this section to verify the dimensions and installation details for all Departmental Representative supplied equipment and furnishings requiring cut-outs, adaptations and interfacing with millwork items.

1.6 Waste Management and Disposal

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 19 Construction / Demolition Waste Management and Disposal, and the Waste Reduction Workplan, and the Waste Management Plan to the maximum extent economically possible.

PART 2 PRODUCTS

2.1 Materials

.1 Softwood lumber: to C.S.A. 0141-1970 and National Lumber Grades Authority requirements, with maximum moisture content of 6% for interior work, lumber selected for paint finish, Fir species, to AWMAC custom grade.

.2 Veneer and solid lumber for transparent finish: Fir species, to AWMAC custom grade.

.3 Canadian softwood plywood: to C.S.A. 0151-M1978, solid two sides, select.

.4 Douglas Fir plywood: to C.S.A. 0121-M1978, good one side, sanded grade.

.5 Nails and staples: to C.S.A. B111-1974, galvanized for exterior work and interior highly humid areas, plain finish elsewhere.

.6 Fiberboard: Standard of Acceptance: 'Ranger Premium MDF Board', 'Medite'. Medium Density (MDF) to ANSI/A208.2 and tested in accordance with ASTM D1037.

PART 3 EXECUTION

3.1 Interior Trim

.1 Standing and running trim for transparent and painted finish shall be AWMAC custom grade construction.

.2 Trim shall be as detailed.

3.2 Installation

.1 Set and secure cabinetwork and finish carpentry items in place rigid, plumb and square.

.2 Use purpose designed fixture attachments for wall mounted components.

.3 When necessary to cut and fit on site, make material with ample allowance for cutting. Provide trim for scribing and site cutting.

.4 Counter-sink all semi-concealed anchorage devices used to wall mount components and conceal with solid plugs of species to match surrounding wood. Place flush with surrounding surfaces.

3.3 Transparent-Finished Veneer and Trim

.1 Where detailed, trim, panels, railing caps and items as noted shall be of Fir species as scheduled, all to AWMAC custom grade.

3.4 Repair of Small Openings in Existing Wood Flooring- Conservation Methods

.1 Undertake the repair and patching of existing wood floors, as indicated in the plans, as follows:

.1 Identify the species of wood of the existing floor boards;

.2 In each location to be patched, identify the grain direction and tightness of grain to be matched, and source similar new pieces of wood of the same species. Alternatively, source reclaimed wood of same species if available for use;

.3 Cut plugs of the same shape/size as the openings to be patched from the new/reclaimed piece of wood of the same species, matching the grain direction of each location to be patched. Plugs should be the virtually the same as the openings with only sufficient room around the plugs to allow for glue, resulting in a snug fit. On this site, openings are uniform circles, making it easier to cut plugs using the same sized circle cutting tool;

.4 The use of dowelling is not recommended, since the grain direction is typically lengthwise and will not match the existing floor boards. Additionally, the wood species is unlikely to be a match;

.5 Identify three (3) or more wood stain colors in attempt to closely match the original floor boards;

.6 Test wood stains on duplicate plugs (of the same wood species and grain direction) to determine the closest match, i.e. when the completed patch is viewed from 1.5m away, the plugs should visually blend into the original fabric. Testing of multiple layers of stain may be required. Note: Staining of new wood plugs prior to installation is recommended to ensure stain is not brushed or splattered on the original boards. The Departmental Representative to review colour samples for approval;

.7 Apply stain to wood plug prior to placement in floor board and install plug in existing floor board using wood glue, carefully aligning the grain direction and maintain a tidy application of glue. Upon close inspection, the glue line may be visible; however, from a distance of 1.5 m the repair should blend visually into the historic context; and

.8 Provide a sample complete floor repair installation for approval by the Departmental Representative prior to undertaking of the remaining repairs.

3.5 Replacement of Damaged Existing Floor Boards

.1 Repair rather than replace existing floor boards wherever possible, by patching, piercing-in, consolidating or otherwise reinforcing wood, using recognised conservation methods. Repair might include the limited replacement in-kind or replacement with compatible substitute material, of extensively deteriorated or missing wood.

.2 Ensure a minimal intervention approach by limiting replacement of historic material to only portions of boards that are extensively deteriorated or missing parts of wood elements, based on documentary and physical evidence. Retain all sound and repairable wood.

.3 Where additional material is needed, either reclaim wood from elsewhere in the building or source new wood to match properties and characteristics of the existing wood and its finishes or coatings (including species, grade, strength and finish, or the chemical makeup of its coating). Refer to Section 01 11 55 Part 1.23.

3.6 Schedule of Finish Carpentry Items

.1 Supply and install the following finish carpentry items as shown and detailed or as specified, complete with all anchors and fastenings required for a complete installation:

.1 Repair of Existing Wood Flooring by Conservation Methods;

.2 Provision of doors, door frames and door hardware (ref. Door Schedule and Sections 08 11 00 and 08 71 00;

.3 Provision of new wood wall finishes, baseboards and trims, as detailed.

END OF SECTION

PART 1 GENERAL

1.1 Work Included

.1 Batt thermal insulation in new interior walls, floors and roofs

1.2 Waste Management and Disposal

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 19, Construction / Demolition Waste Management and Disposal.

PART 2 PRODUCTS

2.1 Fiberglass Batt Thermal Insulation

.1 Where indicated in the cavities of new wood-framed interior walls, roofs and floors. Thicknesses as indicated in the drawings.

.2 Product shall comply with:

.1 Standard for Mineral Fibre Thermal Insulation for Buildings: CAN/ULC-S702-09

.2 Dimensional Tolerances: CAN/ULC-S702-09

.3 Thermal Transmission Properties: ASTM C 518

.4 Surface Burning Characteristics: Flame Spread 25 or less, Smoke Developed 50 or less: CAN/ULC-S102

.5 Smoulder Resistance: ULC-S129

.6 Corrosiveness: ASTM C 665

.7 Fungi Resistance: ASTM C 1338

.8 Noncombustible: ASTM E 136

PART 3 EXECUTION

3.1 Batt Insulation Installation

.1 Install insulation, in thicknesses as indicated, to maintain continuity of thermal protection to building elements and spaces.

.2 Fit insulation closely around electrical boxes, pipes, ducts, frames and other objects in or passing through insulation.

.3 Do not compress insulation to fit into spaces.

.4 Overlap thermal insulation sufficiently to maintain continuity.

END OF SECTION

PART 1 GENERAL

1.1 References

.1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.2 Underwriter's Laboratories of Canada (ULC)

.1 ULC-S115-05, Fire Tests of Firestop Systems.

.3 Sealing service penetrations in fire-rated assemblies must be done in accordance with this Section.

.4 Fire stopping and smoke seals within mechanical assemblies (i.e. inside ducts, dumpers) and electrical assemblies (i.e. inside cable trays) are specified in Mechanical and Electrical Divisions respectively.

1.2 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; (ref: BC Building Code, 2006): penetrating items that are cast in place in buildings of noncombustible construction or have "0" annular space in buildings of combustible construction.

.1 Words "tightly fitted" shall ensure that integrity of fire separation is such that it prevents passage of smoke and hot gases to unexposed side of fire separation.

1.3 Submittals

.1 Provide submittals in accordance with Section 01 33 00.

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit two copies of WHMIS MSDS - Material Safety Data Sheets.

.3 Shop Drawings:

.1 .1 Submit shop drawings in accordance with Section 01 33 00.

.2 .2 Submit shop drawings to show location, proposed material, reinforcement, anchorage, fastenings and method of installation.

.3 .3 Construction details shall accurately reflect actual job conditions.

.4 Samples:

.1 Submit duplicate 300 x 300 mm samples showing actual fire stop material proposed for project.

.5 Quality assurance submittals: submit following in accordance with Section 01 45 00.

.1 Test reports: in accordance with CAN/ULC-S101 for fire endurance and CAN/ULC-S102 for surface burning characteristics.

.1 Submit certified test reports from approved independent testing laboratories, indicating compliance of applied fire stopping with specifications for specified performance characteristics and physical properties.

.2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.3 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, cleaning procedures.

1.4 Quality Assurance

.1 Qualifications:

.1 Installer: company or person specializing in fire stopping installations with 5 (five) years documented experience approved by manufacturer.

.2 Pre-Installation Meetings: convene pre-installation meeting one week prior to beginning work of this Section, with contractor's representative and Consultant to:

.1 Verify project requirements.

.2 Review installation and substrate conditions.

.3 Review co-ordination with other building subtrades.

.4 Review manufacturer's installation instructions and warranty requirements.

1.5 Delivery, Storage and Handling

.1 Packing, shipping, handling and unloading:

.1 Deliver, store and handle materials in accordance with Section 01 60 00.

.2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.3 Deliver materials to the site in undamaged condition and in original unopened containers, marked to indicate brand name, manufacturer, ULC markings.

.2 Storage and Protection:

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

.2 Replace defective or damaged materials with new.

.3 Waste Management and Disposal:

.1 Separate waste materials for reuse, recycling, composting and anaerobic digestion in accordance with Section 01 74 19.

1.6 Cutting and Patching

.1 Firestop service penetrations as follows:

.1 Sleeve single, circular penetrants.

.2 Respective trades create multiple penetrations when the individual circular penetrants are no more than 4" apart.

.1 Trading creating the fire separations form an open, square or rectangular box around the multiple penetrants.

.2 Form box maximum 1" clear around the outer penetrants.

.3 Create multiple penetrations with square penetrants similar to the method for circular penetrants except that:

.1 Maximum clearance between penetrant and penetration is 2".

.2 Provide design specific clearance around fire dampers.

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 and conforming to specified special requirements described in PART 3.

.2 Fire stop system rating: F.

.2 Service penetration assemblies: systems tested to CAN/ULC-S115, and listed in ULC Guide No. 40 U19.

.3 Service penetration fire stop components: certified by test laboratory to CAN/ULC-S115, and listed in ULC Guide No. 40 U19.13 and ULC Guide No. 40 U19.15 under the Label Service of ULC.

.4 Fire-resistance rating of installed fire stopping assembly in accordance with BCBC, not less than the fire-resistance rating of surrounding floor and wall assembly.

.5 Fire stopping and smoke seals at openings intended for ease of re-entry such as cables: elastomeric seal; do not use cementitious or rigid seals at such locations.

.6 Fire stopping and smoke seals at openings around penetrations for pipes, ductwork and other mechanical items requiring sound and vibration control: elastomeric seal; do not use cementitious or rigid seals at such locations.

.7 Primers: to manufacturer's recommendation for specific material, substrate, and end use.

.8 Water (if applicable): potable, clean and free from injurious amounts of deleterious substances.

.9 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.

.10 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. 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 without interruption to vapour barrier.

.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 and ULC certification.

.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 Mechanical pipe insulation: ensure pipe insulation installation precedes fire stopping.

3.5 Field Quality Control

.1 Inspections: notify Consultant when ready for inspection and prior to concealing or enclosing fire stopping materials and service penetration assemblies.

3.6 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.

3.7 Schedule

.1 Fire stop and smoke seal at:

.1 Penetrations through fire-resistance rated masonry, concrete, and gypsum board partitions and walls.

.2 Top of fire-resistance rated masonry and gypsum board partitions.

.3 Intersection of fire-resistance rated masonry and gypsum board partitions.

.4 Control and sway joints in fire-resistance rated masonry and gypsum board partitions and walls.

.5 Penetrations through fire-resistance rated floor slabs, ceilings and roofs.

.6 Openings and sleeves installed for future use through fire separations.

.7 Around mechanical and electrical assemblies penetrating fire separations.

.8 Rigid ducts: greater than 129 cm^2: when specifically permitted by the fire damper manufacturer's detailed installation instructions, fire stopping to consist of bead of firestopping material between retaining angle and fire separation and between retaining angle and duct, on each side of fire separation.

END OF SECTION

PART 1 GENERAL

1.1 Summary

.1 This section specifies standards for caulking and sealants applied by this and other sections.

.2 Refer to other sections for additional caulking and sealants.

1.2 Reference Standards

.1 CAN/CGSB-19.13-M87 Sealing Compound, One-component, Elastomeric, Chemical Curing.

.2 CGSB 19-GP-14M-76 Sealing Compound, One Component, Butyl-polyisobutylene Polymer Base, Solvent curing.

.3 CAN/CGSB-19.17-M90 One-Component Acrylic Emulsion Base Sealing Compound.

.4 CAN/CGSB-19.21-M87 Sealing and Bedding Compound Acoustical.

.5 CAN/CGSB-19.22-M90 Mildew Resistant, Sealing Compound for Tubs and Tiles.

.6 CAN/CGSB-19.24-M90 Multi-component, Chemical Curing Sealing Compound.

1.3 Environmental and Safety Requirements

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

.2 Comply with requirements specified in the following sections:

.1 Section 01 35 43 – Environmental Procedures

.2 Section 01 74 19 – Construction / Demolition Waste Management and Disposal

.3 Conform to manufacturer's recommended temperatures, relative humidity, and substrate moisture content for application and curing of sealants including special conditions governing use.

.4 Sealant and substrate materials to be minimum 5ºC.

.5 Should it become necessary to apply sealants below 5ºC, consult sealant manufacturer and follow their recommendations.

1.4 Waste Management and Disposal

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 Waste Management and Disposal.

PART 2 PRODUCTS

2.1 Sealant Materials

.1 Sealants acceptable for use on this Project must be listed on CGSB Qualified Products List issued by CGSB Qualification Board for Joint Sealants. Where sealants are qualified with primers use only these primers.

2.2 Sealant Material Designations

.1 Urethanes One Part.

.1 Self-Levelling to CAN/CGSB-19.13, Type 1, colour as selected.

.2 Urethane one Part.

.1 Non-Sag to CAN/CGSB-19.13, Type 2, MCG-2-40, colour as selected.

.3 Silicones One Part.

.1 To CAN/CGSB-19.13.

.2 To CAN/CGSB-9.22 (Mildew resistant).

.4 Silicone Strip Sealant

.1 At heads of all aluminum curtainwall, Section 08 44 00:

.2 Approved product: Dow Corning “123 Silicone Seal”.

.5 Acoustical Sealant

.1 To CAN/CGSB-19.21

.6 Butyl.

.1 To CGSB 19-GP-14M

.7 Acrylic Latex One Part.

.1 To CGSB 19-17.

.8 Preformed Compressible and Non-Compressible back-up materials.

.1 Polyethylene, Urethane, Neoprene or Vinyl Foam.

.1 Extruded closed cell foam backer rod.

.2 Size: oversize 40 to 50%.

.2 Neoprene or Butyl Rubber.

.1 Round solid of Shore A hardness 70.

.3 High Density Foam.

.1 Extruded closed cell polyvinyl chloride (PVC), extruded polyethylene, closed cell, Shore A hardness 20, tensile strength 140 to 200 kPa, extruded polyolefin foam, 32 kg/m3 density, or neoprene foam backer, size as recommended by manufacturer.

.4 Bond Breaker Tape.

.1 Polyethylene bond breaker tape, which will not bond to sealant.

2.3 Sealant Selection

.1 Perimeters of exterior openings where frames meet exterior façade of building: Sealant type: one component urethane, non-sag.

.2 Coping joints and coping-to-façade joints & flashing joints: Sealant type: butyl.

.3 Interior control and expansion joints in floor surfaces: Sealant type: one component urethane self-levelling.

.4 Countertops (e.g. sinks, urinals, basins, vanities): Sealant type: silicone, mildew resistant.

.5 Exposed interior control joints in drywall: Sealant type: acrylic latex.

.6 Concealed joints in sound attenuated walls and ceilings: Sealant type: acoustic.

.7 Colour of sealants: selected by Consultant from manufacturer's standard range to match adjacent surfaces.

.8 Joint cleaner: xylol, methylethyleketon or non-corrosive type recommended by sealant manufacturer and compatible with joint forming materials.

2.4 Joint Cleaner

.1 Non-corrosive and non-staining type, compatible with joint forming materials and sealant recommended by sealant manufacturer.

.2 Primer: as recommended by manufacturer.

PART 3 EXECUTION

3.1 Preparation of Joint Surfaces

.1 Examine joint sizes and conditions to establish correct depth to width relationship for installation of backup materials and sealants.

.2 Clean bonding joint surfaces of harmful matter substances including dust, rust, oil, grease, and other matter which may impair work.

.3 Do not apply sealants to joint surfaces treated with sealer, curing compound, water repellent, or other coatings unless tests have been performed to ensure compatibility in materials. Remove coatings as required.

.4 Ensure joint surfaces are dry and frost free.

.5 Prepare surfaces in accordance with manufacturer's directions.

3.2 Priming

.1 Where necessary to prevent staining, mask adjacent surfaces prior to priming and caulking.

3.3 Back Up Material

.1 Apply bond breaker tape where required to manufacturer's instructions.

.2 Install joint filler to achieve correct joint depth and shape, with approximately 30% compression.

3.4 Mixing

.1 Mix materials in strict accordance with sealant manufacturer's instructions.

3.5 Application

.1 Sealant.

.1 Apply sealant in accordance with manufacturer's written instruction.

.2 Mask edges of joint where irregular surface or sensitive joint border exists to provide neat joint.

.2 Apply sealant in continuous beads.

.3 Apply sealant using gun with proper size nozzle.

.4 Use sufficient pressure to fill voids and joints solid.

.5 Form surface of sealant with full bead, smooth, free from ridges, wrinkles, sags, air pockets, embedded impurities.

.6 Tool exposed surfaces before skinning begins to give slightly concave shape.

.7 Remove excess compound promptly as work progresses and upon completion.

.8 Curing.

.1 Cure sealants in accordance with sealant manufacturer's instructions.

.2 Do not cover up sealants until proper curing has taken place.

.9 Cleanup.

.1 Clean adjacent surfaces immediately and leave work neat and clean.

.2 Remove excess and droppings, using recommended cleaners as work progresses,

.3 Remove masking tape after initial set of sealant.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

.1 Section 07 90 00 Sealants

.2 Section 08 71 00 Door Hardware

.3 Section 09 90 00 Painting and Coating

1.2 Reference Standards

.1 A924/A924M-99 Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.

.2 A653/A653M-02A Standard Specification for Steel Sheet, zinc-Coated (Galvanized) or zinc-Iron Alloy-Coated (Galvannealed) by the hot-Dip Process.

.3 A1011/A1011M-03 Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon Structural, High Strength low-Alloy and high Strength Low-Alloy with improved Formability.

.4 A1008/A1008M-03 Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, high-Strength Low-Alloy and high-Strength Low-Alloy with Improved Formability.

.5 C665-01e1 Standard Specification for mineral-fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.

.6 CAN/CSA G40.21-M1998 = Structural Quality Steels.

.7 CAN/CGSB-1.18-99 – Ready Mixed Organic Zinc-Rich Coating.

.8 CAN/ULC-S705.1-2001 – Thermal Insulation Spray Applied Rigid Polyurethane foam, Medium Density, material Specification.

.9 CSDFMA – Specifications for Commercial Steel Doors and Frames Canadian Steel Door and Frame Manufacturers' Association 1990.

1.3 Shop Drawings

.1 Submit shop drawings in accordance with Section 01 33 00.

.2 Clearly indicate each type of door and frame, material core thickness, mortises, reinforcements, anchorages, glazing, location of exposed fasteners and hardware arrangements. Include schedule identifying each unit, with door marks and numbers relating to numbering on drawings and in door schedule.

PART 2 PRODUCTS

2.1 Materials

.1 Sheet Steel (WGSC): tension leveled steel to STMA924M) galvanized to ASTMA653M, commercial steel (CS), type B, coating designation ZF120 (paintable Galvaneal).

.2 Hot rolled Carbon Steel Sheet (HRCS): commercial quality to ASTM A1011, for concealed reinforcement for materials, 2.7 mm minimum thickness.

.3 Cold rolled carbon steel sheet (CRCS) commercial quality to ASTM A1008, shop prime coated.

.4 Bituminous paint: to CAN/CGSB-1/108.

2.2 Components

.1 Frames: base thickness steel as follows:

.1 Interior: 1.6 mm steel having a strike bucket which will accept a 25mm throw deadbolt. Wedge in the area of the strike bucket to prevent spreading; Exterior: 1.6 mm steel having a strike bucket which will accept a 25mm throw deadbolt. Grout in the area of the strike bucket to prevent spreading.

.2 Doors: base thickness steel as follows:

.1 Interior: Hollow-core, metal, 45mm thick with 1.2 mm CRS; Exterior: Hollow-core, metal, 45mm thick with 1.2 mm CRS.

.3 Frame floor anchors and channel spreaders: minimum 1.6 mm thick base steel.

.4 Guard boxes: minimum 0.8 mm thick base steel.

.5 Steel frame anchors:

.1 Thickness and design listed by ULC for labeled door and frame assemblies.

.2 Stud walls: Twist in stud anchor with base anchor for commercial doors.

.6 Hinge, lock, strike, flush bolt and surface applied hardware reinforcing: 3 mm minimum base metal thickness. Prepare doors and frames to accommodate hardware specified in Section 08 71 00.

.7 Hinge, lock, strike, flush bolt and surface applied hardware reinforcing: 3 mm minimum base metal thickness.

.8 Door bumpers: black neoprene single stud.

.9 Reinforcing channel: to CAN/CSA G40.21-M, Type 300 W.

.10 Primer: to CGSB 1-GP-181M, zinc rich.

.11 Top caps: galvanized steel for all exterior doors, 0.9 mm base metal thickness.

2.3 Door Types

.1 (HCM) Doors: flush steel with full honeycomb core of 25mm size bonded resin – impregnated kraft reinforcement, with reinforcement for hardware.

.2 (ICM) exterior flush doors: of same construction as HCM door except with bonded core of polyurethane or isocyanurate board insulation to CAN/ULC-S705.2, RSI 1.9 minimum, with all steel hardware reinforcements and complete with steel top cap.

2.4 Fabrication

.1 Fabricate doors and frames as detailed: in accordance with Canadian Steel Door and Frame Manufacturer's Association (CSDFMA) "Canadian Manufacturing for Steel Doors and Frames", 1990; for hollow steel construction; ULC requirements and reviewed shop drawings except where specified otherwise. Fabricate frames for glazing, setup and welded in similar manner as for door frames.

.2 Mortise, reinforce, drill and tap doors and frames and reinforcements to receive hardware using templates provided by finish hardware supplier. Refer to Section 08 71 00.

.3 Touch up galvanized finish damaged during fabrication.

2.5 Frames

.1 Cut mitres and joints accurately and weld continuously on inside of frame profile.

.2 Grind welded corners to a flat plane, fill with metallic paste filler and sand to uniform smooth finish.

.3 Protect strike and hinge reinforcements in grout filled frames in masonry walls using guard boxes welded to frames.

.4 Weld in two channel spreaders per frame, to ensure proper frame alignment.

.5 Provide Z type snap-in stud type anchors for fixing at floor. All frames in masonry walls with Tee wire type anchors.

.6 Reinforce head of frames wider than 1220mm; reinforce exterior frame assemblies to resist wind loading.

.7 Install 3 bumpers on strike jamb for each single door and 2 bumpers at head for pairs of doors.

2.6 Doors

.1 Assemble components using spot or arc welding.

.2 Continuously weld longitudinal door edges, fill and grind smooth to conceal edge seams, Mechanical locked open seams no acceptable.

.3 Equip exterior doors with flush steel top caps to prevent water accumulation.

.4 Provide 3 mm thickness astragal for double doors predrilled and shipped loose.

.5 Touch up doors with primer where galvanized finish damaged during fabrication.

PART 3 EXECUTION

3.1 Frame Installation

.1 Set frames plumb, square, level and at correct elevation.

.2 Secure anchorages and connections to adjacent construction.

.3 Brace frames rigidly in position while building-in. Install temporary horizontal wood spreaders at third points of door opening to maintain frame width. Remove temporary spreaders after frames are built-in.

.4 Make allowance for deflection to ensure structural loads are not transmitted to frames.

.5 Fill frames with loose mineral wool thermal insulation at all exterior doors.

3.2 Door Installation

Install doors and hardware in accordance with hardware templates and manufacturer's instructions. Adjust operable parts for correct function.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

.1 Section 01 33 00 Submittal Procedures

.2 Section 01 61 10 Product Requirements

.3 Section 01 74 19 Construction Demolition Waste Management and Disposal

.4 Section 01 78 30 Closeout Submittals

.5 Section 08 11 00 Steel Doors and Frames

1.2 References

.1 Canadian Steel Door and Frame Manufacturers' Association (CSDFMA).

.1 CSDFMA Canadian Metric Guide for Steel Doors and Frames (Modular Construction): standard hardware location dimensions.

.2 ANSI (American National Standards Institute) / BHMA (Builder Hardware Manufacturer Association).

.1 ANSI/BHMA A156.1, Butts and Hinges.

.2 ANSI/BHMA A156.2, Preassembled 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 A156.13, Mortise Locks and Latches.

.8 ANSI/BHMA A156.16, Auxiliary Hardware.

.9 ANSI/BHMA A156.18, Materials and Finishes.

.10 UL 305, Panic Hardware

.3 National Building code of Canada (NBCC), 2015.

1.3 Hardware/Security Coordination

.1 Prior to preparation and submittal of hardware list, door hardware supplier’s hardware consultant shall arrange a coordination meeting with the following attendees:

.1 Hardware supplier’s hardware consultant

.2 Facility’s Building Maintenance Manager

.3 Departmental Representative

.4 General Contractor

.2 The final door hardware lists shall reflect all decisions made at said coordination meeting.

1.4 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 Hardware List:

.1 Submit contract hardware list in accordance with Section 01 33 00 Submittal Procedures.

.2 Indicate specified hardware, including make, model, material, function, size, finish and other pertinent information.

.3 Manufacturer's Instructions:

.1 Submit manufacturer's installation instructions.

.4 Closeout Submittals

.1 Provide operation and maintenance data for door closers, locksets, and panic hardware for incorporation into manual specified in Section 01 78 30 Closeout Submittals.

1.5 Quality Assurance

.1 Regulatory Requirements:

.1 Hardware for doors in fire separations and exit doors certified by a Canadian Certification Organization accredited by Standards Council of Canada.

.2 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.

.3 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.6 Delivery, Storage and Handling

.1 Packing, Shipping, Handling and Unloading:

.1 Deliver, store, handle and protect materials in accordance with Section 01 61 10 - Product Requirements.

.2 Package each item of hardware including fastenings, separately or in like groups of hardware, label each package as to item definition and location.

.2 Storage and Protection:

.1 Store finishing hardware in locked, clean and dry area.

1.7 Waste Disposal and Management

.1 Separate and recycle waste materials in accordance with Section 01 74 19 Construction / Demolition Waste Management and Disposal.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

1.8 Maintenance

.1 Extra Materials:

.1 Provide maintenance materials in accordance with Section 01 70 00 – Contract Closeout.

.2 Supply two sets of wrenches for door closers.

1.9 Coordination with Other Sections

.1 Coordinate certain door hardware items of this Section with interfacing sections including, but not limited to the following:

.2 Section 08 11 00 Steel Doors and Frames

1.10 Redundant Locksets

.1 Where existing locksets and other lock-bearing devices are to be removed and disposed of: turn-over to Departmental Representative and obtain receipt. In order to maintain building keying security, no existing locksets are to be removed from building.

PART 2 PRODUCTS

2.1 Hardware Items

.1 Use one manufacturer's products only for similar items.

.2 Interior hardware finish generally: BHMA625, satin chrome.

.3 Exterior hardware finish generally: BHMA630, Satin stainless steel.

2.2 Door Hardware

.1 Locksets

.1 Extra heavy-duty commercial/institutional grade one operational mortise locksets to ANSI/BHMA A156.13 Series 1000, grade one security, UL 10.C.

.2 6 pin (or 7) tumbler keying to facility's master system.

.3 Trim lever and rose to match existing.

.4 ANSI functions as scheduled. (Store room function, lever handle.)

.2 Butts and hinges

.1 To CAN/CGSB-69.18 heavy weight, high frequency, five knuckle, ball bearing (4), NRP at outswing locations.

.3 Door closers and accessories

.1 To CAN/CGSB-69.20 to match Facility's existing closers (verify) model and series. Arms and brackets to suit application.

.4 Door Stops

.1 Floor and wall mounted, cast type, heavy duty, finish to match locksets, complete with appropriate fixings.

.5 Panic Hardware

.1 Minimum to ANSI A156.3, (latest), Grade 1, to match building's existing Manufacturer, type, trim design and finish. Patch existing doors with appropriate weather-resistant fixtures where old hardware has been removed.

.6 Kickplates

.1 250 mm high x 25 mm less than door width, 16ga. Anodized aluminum to match other hardware, secure with matching countersunk screws.

2.3 Fastenings

.1 Use only fasteners provided by manufacturer. Failure to comply may void warranties and applicable licensed labels.

.2 Supply screws, bolts, expansion shields and other fastening devices required for satisfactory installation and operation of hardware.

.3 Exposed fastening devices to match finish of hardware.

.4 Use fasteners compatible with materials through which they pass.

.5 Use tamperproof fasteners in high security hardware.

2.4 Keying Schedule

.1 Prepare detailed keying schedule in conjunction with Departmental Representative to coordinate with facility's GMK and MK systems.

2.5 Keys

.1 Use standard construction cylinders for locks for Contractors' use during the construction period, if required.

.2 Issue instructions to employees and sub-trades, as necessary, to ensure safe custody of the construction set of keys.

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 instruction, and data sheets.

.2 Furnish metal door and frame manufacturers with complete instructions and templates for preparation of their work to receive hardware.

.3 Furnish manufacturer's instructions for proper installation of each hardware component.

3.2 Installation

.1 Install hardware to standard hardware location dimensions in accordance with Canadian Metric Guide for Steel Doors and Frames (Modular Construction) prepared by Canadian Steel Door and Frame Manufacturers' Association.

.2 Where door stop contacts door pulls, mount stop to strike bottom of pull.

.3 Use only manufacturer's supplied fasteners. Failure to comply may void manufacturer's warranties and applicable licensed labels. Use of "quick" type fasteners, unless specifically supplied by manufacturer is unacceptable.

.4 Remove construction cores when directed by Consultant; install permanent cores and check operation of locks.

3.3 Adjusting

.1 Adjust door hardware, operators, closures and controls for optimum, smooth operating condition, safety and for weather tight closure.

.2 Lubricate hardware, operating equipment and other moving parts.

.3 Adjust door hardware to provide tight fit at contact points with frames.

3.4 Cleaning

.1 Perform cleaning after installation to remove construction and accumulated environmental dirt.

.2 Clean hardware with damp rag and approved non-abrasive cleaner, and polish hardware in accordance with manufacturer's instructions.

.3 Remove protective material from hardware items where present.

.4 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

3.5 Demonstration

.1 Keying System Setup:

.1 Set up key control system with file key tags, duplicate key tags, numerical index, alphabetical index and key change index, label shields, control book and key receipt cards.

.2 Place file keys and duplicate keys in existing key cabinet on their respective hooks.

.3 Lock key cabinet and turn over key to Departmental Representative.

.2 Maintenance Staff Briefing:

.1 Brief maintenance staff regarding:

.1 Proper care, cleaning, and general maintenance of project's complete hardware.

.2 Description, use, handling, and storage of keys.

.3 Use, application and storage of wrenches for door closers.

.3 Demonstrate operation, operating components, adjustment features, and lubrication requirements.

3.6 Hardware Schedule

.1 Quantities shown in schedule are for one opening only. Include all hardware for each door listed in door schedule on drawings. See drawings for door layout and arrangement.

.2 Refer to "hardware heading" column in door schedule on drawings for location of each hardware heading group.

Group No. 1
Hinges, lock set, closer, door stop to 2 new interior doors (ref. Door Schedule)

Group No. 2
Panic hardware to 2 existing exterior Exit doors (ref. Door Schedule.) Remove old lock/latch and handle hardware, make good doors & finishes, typical

END OF SECTION

PART 1 GENERAL

1.1 Work Included

.1 All work and materials shall conform to the standards to the Master Painters Institute (MPI) Maintenance Repainting and Architectural Painting Specification Manuals, latest editions, and as herein specified, indicated on drawings and schedules.

.2 This section of work shall include all labour, materials, tools, scaffolds and other equipment, services and supervision required to prepare surfaces and to cover them with paint and/or stain as herein specified and as shown on the “Finish Schedule”, to the full intent of the specifications.

.3 Include certain scheduled previously painted and transparent finished surfaces and new unpainted / unfinished surfaces.

1.2 Work Excluded

.1 All factory and pre-finished items not scheduled and specified for painting.

.2 Shop-finished millwork shall conform to these specifications.

1.3 Requirements of Regulatory Agencies

.1 This work section requires full cooperation at all times with the MPDA in the performance of its duties.

1.4 Qualifications

.1 The paint products of the Paint Manufacturer shall be as listed in the MPI Maintenance Repainting and Architectural Painting Specification Manuals (latest edition), under “Paint Product Recommendation” section, or approved equivalent.

.2 This contractor shall have a minimum of five (5) years proven satisfactory experience, and shall maintain a qualified crew of painters throughout duration of the work who shall be qualified to fully satisfy the requirements of this specification. Only qualified journeymen (and apprentices) shall be engaged in painting and decorating work who have a provincial Tradesman Qualification certificate of proficiency.

.3 Painting and decorating inspection shall be performed by an Inspector assigned by the MPDA, this includes inspection of shop-finished millwork.

1.5 Submittals

.1 Submit a written request to the Departmental Representative for approval of Products from MPDA schedule, listing each of the materials proposed and surfaces to be covered. State clearly manufacturer’s name, brand name of material, and manufacturer’s product code.

.2 Paint colours shall be selected by Departmental Representative.

1.6 Product Handling

.1 Paint materials shall be delivered to the job site in sealed original labelled containers bearing manufacturer’s name, type of paint, brand name, designation and instruction for mixing and/or reducing.

.2 The Contractor shall provide adequate storage facilities. Paint materials shall be stored at a minimum ambient temperature of 7ºC in a well ventilated and heated single designated area.

.3 Take all necessary precautionary measures to prevent fire hazards and spontaneous combustion.

.4 Where toxic materials and both toxic and flammable solvents are used, appropriate precautions shall be taken and no smoking allowed as a regular procedure.

1.7 Environmental conditions

.1 Temperature, humidity and moisture content shall conform to the following:

Temperature:	No painting shall be performed when temperature on the surfaces, or the air in the vicinity of the painting work are below 5°C (41°F) for interior work and 10°C (50°F) for exterior work.
Relative Humidity:	Shall not be higher than 85%.
Moisture of Surfaces:	Tests shall be done by electronic “Moisture Metre”.
Wood:	Maximum moisture content 12%.

.2 Proper lighting shall be the Painting Contractor’s responsibility.

.3 All areas where painting and decorating work is proceeding require adequate continuous ventilation and sufficient heating facilities to maintain temperatures above 7°C (45°F) for 24 hours before and after paint application. Required heat and ventilation shall be provided by the Painting Contractor.

1.8 Protection

.1 Adequately protect other surfaces from paint and damage and make good any damage caused by failure to provide suitable protection, but this section will not be responsible for any damage caused by others.

.2 Furnish sufficient drop cloths, shields and protective equipment to prevent spray of dropping from fouling surfaces not being painted and in particular, surfaces within the storage and preparation area.

.3 Cotton waste, cloths and material, which may constitute a fire hazard, shall be placed in closed metal containers and removed daily from the site.

.4 Remove all surface hardware, electrical plates, fittings, fastenings, etc. prior to painting operation. These items shall be carefully stored, cleaned and replaced on completion of work in each area.

1.9 Quality Control

.1 The MPI Quality Assurance Program shall be in effect, and the inspection for the surfaces and of the application shall be by an Inspection Agency (inspector) assigned by the AQA Association. The inspection shall be in accordance with the standards contained throughout the MPI Manuals, and is applicable to contractors supplying the AQA Association’s Two Year Guarantee.

.2 Alkali content tests, and such other tests as shall be necessary, (e.g. moisture content, lighting, etc.) shall be performed by the Paint Inspector.

1.10 Finishing of Shelving

.1 With the exception of touch-up, schedule new shelving shall be shop finished.

1.11 Guarantee

.1 The Painting Contractor shall furnish the local MPI Accredited Quality Assurance Association's guarantee, in accordance with MPI Manuals requirements. The Guarantee shall cover making good defects in the painting work done under the specification due to faulty workmanship or defective materials supplied by the Painting Subcontractor which appear during a two (2) year period following "substantial" completion of the repainting.

.2 All work shall be in accordance with the MPI Maintenance and Architectural Painting Specification Manuals requirements and shall be inspected by the MPI Accredited Quality Assurance Association's guarantee, or the Maintenance Bond option.

PART 2 PRODUCTS

2.1 Materials

.1 Paint, varnish, stain, enamel, lacquer, and fillers used shall be of a type and brand herein specified and listed under "Paint Product Recommendations" as covered in the MPI Architectural Painting Specification Manual, latest edition, for specific purposes.

.2 Paint materials such as linseed oil, shellac, turpentine, etc. and any of the above materials not specifically mentioned herein but required for first class work with the finish specified shall be of the highest quality product of an approved manufacturer. All coating material shall be compatible.

.3 All materials shall be lead, hex. chromium, cadmium and mercury free and shall have low VOC content.

.4 Preference should be given to ISO 2002 registered manufacturers.

.5 Only qualified products with E2 "Environmentally Friendly" rating are acceptable for use on this project. Provide paint products meeting MPI "Environmentally Friendly" E2 ratings based on VOC (EPA Method 24) content levels. Use MPI listed materials having minimum rating where indoor air quality (odour) requirements exist.

.6 All material shall be premium Architectural grade unless otherwise specified.

PART 3 EXECUTION

3.1 General

.1 Method of paint application shall be generally by the accepted trade method. Painting coats specified are intended to cover surfaces satisfactorily when applied in strict accordance with recommendations.

.2 Apply each coat at the proper consistency. Each coat of paint shall be slightly darker than preceding coat unless otherwise approved.

.3 Sand lightly between coats to achieve the required finish. Each coat of finish should be dry and hard before a following coat is applied unless the manufacturer's directions state otherwise (4 hours for latex; 8 hours for alkyd).

.4 Tint filler to match wood when clear finished are specified; work filler well into the grain and before it has set wipe the excess from the surface.

.5 Application of paint shall be in strict accordance with MPI Architectural Painting Specification Manual requirements.

.6 Complete hiding is required on all finishes, including deep tone colours.

.7 Contractor shall employ sufficient tradesmen to carry out the job with no interruption, slow down or inconvenience to the project schedule and operations.

3.2 Condition of the Surfaces

.1 Prior to commencement of work of this section, thoroughly examine all surfaces scheduled to be painted.

.2 Report to Departmental Representative any condition adversely affecting this work.

.3 No painting work shall proceed until all defects have been corrected and surfaces are acceptable for painting.

.4 Commencement of work shall be held to imply acceptance of surfaces.

.5 All preparation work shall be the responsibility of the Painting Contractor (Refer to Surface Preparation).

3.3 Preparation of Surfaces

.1 Prior to commencement of work of this section, thoroughly examine all surfaces scheduled to be painted. Report to Departmental Representative any conditions adversely affecting this work. Prepare all interior surfaces for repainting in accordance with MPI Manual requirements.

.2 No painting work shall proceed until all defects have been corrected and surfaces are acceptable for painting. All preparation work shall be the responsibility of the Painting Contractor.

.3 Prepare all surfaces in accordance with the requirements in Chapter 3 of the MPI Architectural Painting Specification Manual (latest edition) and as herein specified.

.4 Remove and securely store all miscellaneous surface fittings/fastenings (eg: electrical places and frame stops), removable rating/hazard/instruction labels, prior to painting and replace upon completion. Carefully clean and replace all such items upon completion of repainting work in each area. Do not use solvent or reactive cleaning agents on items that will mar or remove finishes (eg: lacquer finishes).

.5 All surfaces shall be sanded prior to the application of any coatings.

.6 Allow full drying between coats, as per manufacturer's recommendations. Sand in between coats.

.7 Remove all loose and peeling paint from walls and woodwork to a sound surface.

.8 Loose and peeling paint not meeting ASTM Designation D3359-87 Test Method A-X cut scale 2A shall have the entire surface(s) removed to a sound surface.

.9 Repair all water damaged surfaces and spot prime with a stain blocking primer.

.10 Surface defects, such as nail/screw popping, paper tears, nicks and scratches, line gauges caused by chair back seat rests, tables, etc., shall be filled, sanded and spot primed with an approved primer and shall be considered normal surface preparation.

.11 Units severely contaminated with grease, smoke and tar – hand wash with detergent and rinse thoroughly prior to any surface preparation.

.12 All surfaces: applications shall be by brush/roller, including smooth ceilings.

.13 Allow full drying between coats, as per manufacturer's recommendations. Sand in between coats.

.14 Surface defects such as old paint runs on walls and wood works must be sanded smooth prior to the applications of any coating(s).

.15 Tape fill, sand and spot prime all structural cracks.

.16 Remove clear tape from walls, ceilings, doors, etc. Remove felt pen graffiti from doors, walls, etc. before priming. Prepare and paint all mechanical and electrical services with the appropriate primers, as per MPI Architectural Specification Manual, latest edition.

.17 Ensure that a transition primer is applied over alkyd surfaces where waterborne systems have been specified.

3.4 Mechanical and Electrical Equipment

.1 Paint exposed conduits, pipes, hangers and other mechanical and electrical equipment occurring in finished areas. Colour and texture shall match adjacent surfaces, except as noted otherwise.

.2 Keep sprinkler heads free of paint.

.3 Paint both sides and edges of plywood back-boards for equipment, to visually match adjacent wall finishes.

3.5 Field Quality Control

.1 In strict accordance with the MPI Architectural Painting Specifications Manual requirements.

3.6 Painting Schedule

.1 The following titles, grades and code numbers refer to those listed in the Master Painters Institute (MPI) Architectural Painting Specifications Manual and the Maintenance Repainting Manual, latest edition.

.2 Existing Interior Surfaces:

.1 Existing H.M. Doors and Frames D3 & D4: (Premium Grade) RIN 5.3J, G5, DSD3.

.3 New Interior Surfaces:

.1 Transparent Wood or Plywood Finishes: (Premium Grade) INT 6.3E polyurethane varnish (semi-gloss) over stain to samples as selected by Departmental Representative.

.2 Hollow Metal Doors & Frames: (Premium Grade) INT 5.3K, G5

.4 Existing Exterior Surfaces:

.1 Existing H.M. Doors and Frames: (Premium Grade) REX 5.3J, G5, DSD3.

3.7 Existing Surfaces

.1 Apply bonding primer #69 to all previously painted millwork, trim, steel handrails, doors and frames, bonding primer #17 to all wall surfaces in lieu of first coat.

3.8 Paint Colour Schedule

.1 To be issued as a separate document at a later date.

3.9 Cleaning

.1 Promptly as the work proceeds and on completion of the work, remove all paint where spilled, splashed or spattered; during the progress of the work keep the premises free from any unnecessary accumulation of tools, equipment, surplus materials and debris. At the conclusion of the work leave the premises neat and clean to the satisfaction of the Engineer.

END OF SECTION

PART 1 – GENERAL

1. Summary

1. The purpose of this section is to specify the Division 20 - 25 contractor's responsibilities in the commissioning process.

2. An independent firm (CES Engineering Ltd) specializing in building systems commissioning has been retained by the Owner to act as the project Commissioning Authority (CA). This firm will be responsible to manage and administrate the commissioning process on this project.

3. The list of commissioned equipment and systems is found in Section 01 91 13 Commissioning – General Requirements. Commissioning requires the participation of contractor to ensure that all systems are operating in a manner consistent with the Contract Documents. The general commissioning requirements and coordination are detailed in the same section.

4. Contractors shall be familiar with all parts of Section 01 91 13 Commissioning – General Requirements, 01 91 41 Commissioning – Training, and the Commissioning Plan issued by the CA and shall execute all commissioning responsibilities assigned to them in the Contract Documents.

2. Responsibilities

1. The responsibilities of the Project Manager, General Contractor, Architect, Mechanical and Electrical Consultants/Engineers (A/E), and Commissioning Authority in the commissioning process are provided in Section 01 91 13 Commissioning General Requirements.

2. This section defines the generally expected division of responsibilities between the trades responsible for delivering Divisions 20 - 25 work in its entirety, together with related work in the overall project. These responsibilities may be adjusted as required by the Contractor.

3. <u>Mechanical Controls and TAB Contractors</u>:

    1. Construction and Acceptance Phase:
        1. Include the cost of participating in the commissioning process as outlined in the specifications in the total contract price.
        2. In each purchase order or subcontract written, include requirements for submittal data, commissioning documentation, O&M data and training.
        3. Attend a commissioning scoping meeting and other meetings necessary to facilitate the Cx process.
        4. Contractors shall provide the CA with normal cut sheets and shop drawing submittals of commissioned equipment.

5. Provide additional requested documentation, prior to normal O&M manual submittals, to the CA for development of start-up and functional testing procedures.
    1. Typically this will include detailed manufacturer installation and start-up, operating, troubleshooting and maintenance procedures, full details of any owner-contracted tests, fan and pump curves, full factory testing reports, if any, and full warranty information, including all responsibilities of the Owner to keep the warranty in force clearly identified.
    2. In addition, the installation, start-up and checkout materials that are actually shipped inside the equipment and the actual field checkout sheet forms to be used by the factory or field technicians shall be submitted to the CA.
    3. The CA may request further documentation necessary for the commissioning process.
    4. This data request may be made prior to normal submittals.
6. Provide a copy of the O&M manuals and submittals of commissioned equipment, through normal channels, to the CA for review and approval.
7. During construction, maintain as-built red-line drawings for all drawings and final CAD as-builts for contractor-generated coordination drawings. Update after completion of commissioning (excluding deferred testing). Prepare red-line as- built drawings for all drawings and final as-builts for contractor- generated coordination drawings.
8. Contractors shall assist (along with the design engineers) in clarifying the operation and control of commissioned equipment in areas where the specifications, control drawings or equipment documentation is not sufficient for writing detailed testing procedures.
9. Provide assistance to the CA in preparing the specific functional performance test procedures as specified in Section 01 91 13 and in this section. Subs shall review test procedures to ensure feasibility, safety and equipment protection and provide necessary written alarm limits to be used during the tests.
10. Develop a full start-up and initial checkout plan using manufacturer's start-up procedures and the pre-functional checklists from the CA for all commissioned equipment.
11. Submit manufacturer's detailed start-up procedures and the full start-up plan to CA for review and approval prior to startup. Refer to the Commissioning Plan and this section for further details on start-up plan preparation.
12. Be proactive in seeing that commissioning processes are executed and that the CA have the scheduling information needed to efficiently execute the commissioning process.
13. During the startup and initial checkout process, execute the mechanically related portions of the pre-functional checklists for all commissioned equipment.
14. Perform and clearly document all completed startup and system operational checkout procedures, providing a copy to the CA.
15. Address current A/E punch list items before scheduling functional testing. Air and water TAB shall be completed with discrepancies and problems remedied before functional testing of the respective air- or water-related systems.
16. Provide skilled technicians to execute starting of equipment and to execute the functional performance tests. Ensure that they are available and present during the agreed upon schedules and for sufficient duration to complete the necessary tests, adjustments and problem-solving.
17. Perform functional performance testing under the direction of the CA for specified equipment in Section 01 91 13.

18. Assist the CA in interpreting system monitoring data, as necessary.
19. Correct deficiencies (differences between specified and observed performance) as interpreted by the CA, GC and A/E and retest the equipment.
20. Prepare O&M manuals according to the Contract Documents, including clarifying and updating the original sequences of operation to as-built conditions.
21. Provide training of the Owner's operating staff using expert qualified personnel, as specified.
22. Coordinate with equipment manufacturers to determine specific requirements to maintain the validity of the warranty.

2. Warranty Phase
    1. Execute seasonal, deferred or post occupancy functional performance testing, witnessed by the CA, according to the specifications.
    2. Correct deficiencies and make necessary adjustments to O&M manuals and as-built drawings for applicable issues identified in any seasonal testing.

4. Mechanical Contractor: The responsibilities of the mechanical contractor, during construction and acceptance phases in addition to those listed in 1.2.3 are:
    1. Provide startup for all mechanical equipment.
    2. Assist and cooperate with the TAB contractor:
        1. Putting all mechanical equipment and systems into operation and continuing the operation during each working day of TAB and commissioning, as required.
        2. Providing temperature and pressure taps according to the Construction Documents for TAB and commissioning testing.
        3. Install a P/T plug at each water sensor which is an input point to the control system.
    3. Prepare a preliminary schedule for Division 23 and 25 piping system(s) testing, flushing and cleaning, equipment start-up and TAB start and completion for use by the CA. Update the schedule as appropriate.
    4. Notify the GC or CA depending on protocol, when pipe and duct system testing, flushing, cleaning, startup of each piece of equipment and TAB will occur.
    5. Be responsible to notify the GC or CA ahead of time, when commissioning activities not yet performed or not yet scheduled will delay construction.

5. TAB Contractor: The duties of the TAB contractor, in addition to those listed in 1.2.3 are:

    1. Submit the outline of the TAB plan and approach for each system and component to the CA, GC and the controls contractor four weeks prior to starting the TAB. This plan will be developed after the TAB has some familiarity with the control system. The submitted plan will include:
        1. Certification that the TAB contractor has reviewed the construction documents and the systems with the design engineers and contractors to sufficiently understand the design intent for each system.
        2. An explanation of the intended use of the building control system. The controls contractor will comment on feasibility of the plan.
        3. All field checkout sheets and logs to be used that list each piece of equipment to be tested, adjusted and balanced with the data cells to be gathered for each.
        4. Discussion of what notations and markings will be made on the piping drawings during the process.
        5. Copies of the final test report forms to be used.

6. List of all water flow, system capacity and efficiency measurements to be performed and a description of specific test procedures, parameters, formulas to be used.
7. Details of how total flow will be determined (pump curves, circuit setter, flow station, ultrasonic, etc.).
8. The identification and types of measurement instruments to be used and their most recent calibration date.
9. Specific procedures that will ensure that water side is operating at the lowest possible pressures and provide methods to verify this.
10. Details of any TAB work to be done in phases (by floor, etc.), or of areas to be built out later.
11. Details regarding specified deferred or seasonal TAB work.
12. Details of any specified false loading of systems to complete TAB work.
13. Plan for hand-written field technician logs of discrepancies, deficient or uncompleted work by others, contract interpretation requests and lists of completed tests (scope and frequency).
14. Plan for formal progress reports (scope and frequency).
15. Plan for formal deficiency reports (scope, frequency and distribution).

2. A running log of events and issues shall be kept by the TAB field technicians.
   1. Submit hand-written reports of discrepancies, deficient or uncompleted work by others, contract interpretation requests and lists of completed tests to the CA and GC at least twice a week.

3. Communicate in writing to the controls contractor all setpoint and parameter changes made or problems and discrepancies identified during TAB which affect the control system setup and operation.

4. Provide a draft TAB report to the CA within two weeks of completion including a full explanation of the methodology, assumptions and the results in a clear format with designations of all abbreviations.

5. Provide the CA with any requested data, gathered, but not shown on the draft reports.

6. Provide a final TAB report for the CA with details, as in the draft.

PART 2 – PRODUCTS

1. Test Equipment

1. Contractor shall provide all test equipment necessary to fulfill the testing requirements of this section.

2. Contractors shall submit a list of equipment to be used and copies of latest equipment calibration certificates to the Commissioning Authority and Consultant for approval.
    1. The equipment to be provided shall include, but is not limited to:
        1. pressure measurements: manometers, pressure gauges, digital pressure readers, pressure trending devices;
        2. temperature measurements: thermometers, digital thermometers, thermocouples, temperature trending devices;
        3. rotative speed: tachometer;
        4. sound measurement: electronic sound level meter for acoustic measurement with octave band analysis;
        5. vibration measurement: accelerometer;
        6. electrical measurements: voltmeter, ammeter and wattmeter
        7. Any other equipment specified by the manufacturer to perform required testing and verification.

3. Refer to Section 01 91 13 for additional requirements

2. Test Equipment Calibration

1. All equipment shall be calibrated and carry current certification in accordance with the manufacturer's instructions.

2. A copy of test equipment specifications and calibration certificates must be included in a dedicated submittal for each division.

PART 3 – EXECUTION

1. Submittals

1. Contractor shall provide submittal documentation relative to commissioning as required in Part 1 of this section, 01 91 13 Commissioning - General Requirements, and the Commissioning Plan.

2. The following are required submissions as outlined in this specification. Additional technical submittals shall be provided as requested at the initial commissioning meetings and dependent on the technical scope of the project.

2. Pre-Startup

1. Carry out any Factory Acceptance Tests and off-site pre-commissioning as otherwise directed by the technical specifications of Divisions 20 - 25.

3. Start-up, Pre-functional Checklists and Initial Checkout

1. General
    1. The sub-contract trades shall follow the start-up and initial checkout procedures listed in this section, in 01 91 13 and in Divisions 20 - 25.
    2. The Contractor has start-up responsibility and is required to complete systems and sub-systems so they are fully functional, meeting the design objectives of the Contract Documents.
    3. The following system start-up procedures are presented as a minimum standard of acceptance to validate the commissioning of the identified systems. Requirements listed in the mechanical consultant's specification sections may differ from the requirements listed below. The most onerous requirements shall be carried by the contractor in all cases.

2. Phase 1 - System and Equipment Readiness
    1. Before starting up any systems or equipment, provide written verification stating that the specific system or item of equipment is ready for starting and the following conditions have been met:
        1. Copies of all tests and certificates have been submitted to the Consultant and/or CA.
        2. All safety controls have been installed, wired, dry tested, and are fully operational.
        3. The permanent electrical wiring connections have been made to all equipment and that power is available.
        4. Qualified operating personnel are available and ready to operate the equipment.
        5. All systems have been checked and are physically complete and ready to operate, including all wiring and controls.
        6. Correct operation of all equipment and machinery, pump rotation, etc. has been confirmed.
        7. All equipment lubrication and pre-start checks have been carried out.
        8. Proper overload protection has been provided for all motors, controls, and control circuits.
        9. All system flushing, chemical cleaning, chemical water treating, chlorinating, charging, fluid operating levels, etc. have been checked and are complete.
        10. All systems have been checked for pressure and leakage
        11. All vibration isolators and seismic restraints have been checked, adjusted, and shimmed as necessary
        12. All control and alarm functions have been checked and are operational.
        13. Any self-diagnostic packaged control systems have been checked and are operational.
        14. Strainers, traps, filters, etc. have been cleaned out. All strainers and traps shall be tagged with the date of inspection and cleaning noted.
    2. All deficiencies shall be recorded and reviewed by the commissioning team, and shall be corrected and verified prior to proceeding to the next Commissioning Phase.
    3. When all the above has been completed in a satisfactory manner the contractors may proceed to Phase 2 – System Activation, Testing and Balancing.

3. Phase 2 - System Activation, Testing and Balancing: This phase shall include, but not necessarily be limited to the following:
    1. Mechanical Systems - General
        1. Activation of all systems, sub-systems, and equipment.
        2. Check out operation of all equipment and machinery. Check rotational direction of all moving equipment.

3. Check for any abnormal equipment vibration and noise. Determine cause and rectify.
4. Complete all system identification, labels, nameplates, pipe identification, colour coding, flow arrows, sprinkler signs, hydraulic data plates, etc.
5. Adjust vibration isolators and seismic restraints as required.
6. Clean out all strainers, traps, filters, etc. All strainers and traps shall be tagged with the date of inspection and cleaning noted.
7. All deficiencies shall be recorded and reviewed by the commissioning team, and shall be corrected and verified prior to proceeding further.
8. If, in the opinion of the Consultant and/or CA, field operations and testing indicates that any item of equipment or machinery does not meet the specifications, the Owner may request that testing of the equipment in question be carried out by an independent testing laboratory or testing agency. In the event that the tested equipment or machinery proves to meet the specification, the Owner shall pay for the independent lab testing. If the equipment or machinery does not meet the specification the Contractor will be responsible to pay the costs of all testing and the costs of all alterations to the equipment or machinery to bring it up to specifications, any subsequent testing, or the complete cost of replacing the equipment or machinery with new equipment or machinery that meets the specifications.

2. Fire Suppression Systems:
   1. Commissioning of fire protection systems will be considered complete upon preparation and submittal by Contractor of completion certificates required by applicable NFPA Standards, demonstration of proper system operation to local Fire Chief and any other authorities, including Owner's insurance underwriter as required, and coordination and cooperation with fire alarm system commissioning procedures. Testing shall include all flow switches, alarm valves, dry valves, pressure switches, valve monitors, etc.
   2. Manufacturer's authorized representative shall provide commissioning of the Heat Trace and Nitrogen systems including a written report on forms provided by manufacturer.

3. Plumbing Systems: Provide start-up, set up, adjustment and recording of the operational data for all systems and components as related to the project, including but not limited to
   1. Incoming municipal water pressure.
   2. Operation of trap primers
   3. Verification of pump operation.
   4. Set points for all control devices.
   5. Testing and certification of all backflow preventers.
   6. Sump pump operation and high-water alarms.

4. Functional Performance Testing

1. General
   1. Refer to Section 01 91 13 for a list of systems to be commissioned and to Divisions 20 - 25 technical specifications for a description of the process and for specific details on the required functional performance tests.

2. The commissioning procedures and functional testing do not relieve the contractor of the responsibility to provide all products and labour required to furnish the Owner with complete, functional building systems, or partially shift that responsibility to the CA, or Owner.
3. Functional testing is intended to begin upon completion of the Start-Up, Prefunctional Checklists and Initial Checkout - Phase 2 – System Activation, Testing and Balancing
4. Functional testing may proceed prior to the completion of systems or sub-systems at the discretion of the CA, GC, and Owner.
5. The functional performance testing phase shall not commence until the Start-Up activities have been completed to the satisfaction of the CA. Beginning system testing before full completion, does not relieve the Contractor from fully completing the system, including all pre-functional checklists as soon as possible.

2. Phase 3 – Verification of System Performance
   1. Mechanical Equipment functional performance testing process shall include, but not be limited to, the following:
      1. Confirming the ease of access to all equipment requiring servicing, including motors, filters, etc.
      2. Confirming the operation of all systems and equipment under all modes of operation, including emergency power and fire alarm mode.
      3. Inspecting and verifying that all piping systems, drain pans, etc., are clean and that the recommended water treatment is up to specification.
      4. Any failure will result in termination of inspection and future 100% inspections will be at the contractor's cost.
      5. Final Acceptance:
         1. This phase shall consist of verifying to CA that the deficiencies as identified during "Demonstration" have been rectified. If deficiencies are still found, the Contractor will have one week to correct them and costs for additional inspection shall be billed to the contractor.
         2. Demonstrate compliance with "System Performance".
         3. Demonstrate and simulate compliance with Sequences of Operation through all modes of operation.
         4. Demonstrate complete operation of Operator Interface.
         5. Additionally, the following items shall be demonstrated:
            1. Optimum Start/Stop. The contractor shall supply a trend data output showing the capability of the algorithm. The hour-by-hour trends shall include the output status of all optimally started and stopped equipment, as well as temperature sensor inputs of affected areas.
            2. Operational logs for each system that indicate all setpoints, operating points, valve positions, mode, and equipment status shall be submitted to the CA. These logs shall cover three 48-hour periods and have a sample frequency of not more than 10 minutes.
            3. A power failure for the building will be simulated and proper system operation and recovery observed.

         6. Integration Testing:
            1. Upon completion of individual system tests, tests of the integrated systems shall be performed to verify that all components work together.

5. Testing Documentation, Non-Conformance, and Approvals

1. Refer to Section 01 91 13 for specific details on non-conformance issues relating to pre-functional checklists and tests.

2. Refer to Section 01 91 13 for issues relating to functional performance tests.

6. Operation and Maintenance (O&M) Manuals

1. Contractor shall compile and prepare documentation for all equipment and systems covered in the Divison 20 - 25 sections of the Performance Specification documents.

2. Contractor shall deliver O&M documents according to Section 01 91 13 Commissioning General Requirements and other applicable sections of the Performance Specification documents.

3. The CA shall receive a copy of the O&M manuals for review.

4. Systems Manual Requirements: The contractor shall provide the following information to the CA to assist in compilation of the Systems Manual. The CA is responsible for production of the Systems Manual.

   Information to be provided by the contractor includes:
   1. Approved equipment submittals including Sequence of Operation
   2. Contractor & Supplier listing with contact information
   3. All data generated during the commissioning process, including start-up reports, evaluation checklists and completed test certificates and reports
   4. Equipment Operating schedules including set points
   5. Manufacturer's recommended calibration and preventive maintenance instructions.

5. Special Control System O&M Manual Requirements:
   In addition to documentation that may be specified elsewhere, the controls contractor shall compile and organize at minimum the following data on the control system in labeled 3-ring binders with indexed tabs.

   1. Three copies of the controls training manuals in a separate manual from the O&M manuals.

   2. Operation and Maintenance Manuals containing:
      1. Specific instructions on how to perform and apply all functions, features, modes, etc. mentioned in the controls training sections of this specification and other features of this system. These instructions shall be step- by-step. Indexes and clear tables of contents shall be included. The detailed technical manual for programming and customizing control loops and algorithms shall be included.
      2. Full as-built set of control drawings (refer to Submittal section above for details).
      3. Full as-built sequence of operations for each piece of equipment.
      4. Full points list.
      5. Full print out of all schedules and set points after testing and acceptance of the system.

6. Full as-built print out of software program.
7. Electronic copy on disk of the entire program for this facility.
8. Control equipment component submittals, parts lists, etc.
9. Warranty requirements.
10. Copies of all checkout tests and calibrations performed by the Contractor (not commissioning tests).

3. The manual shall be organized and subdivided with permanently labeled tabs for each of the following data:
   1. Sequences of operation
   2. Control drawings
   3. Points lists
   4. Controller / module data
   5. Sensors and DP switches
   6. Valves and valve actuators
   7. Program setups (software program printouts)

4. Field checkout sheets and trend logs should be provided to the CA for inclusion in the Commissioning Report.

6. Special TAB Documentation Requirements:
   1. The TAB will compile and submit the following with other documentation that may be specified elsewhere in the Specifications.
      1. Final report containing an explanation of the methodology assumptions, test conditions and the results in a clear format with designations of all uncommon abbreviations and column headings.
      2. The TAB shall mark on the drawings where all traverse and other critical measurements were taken and cross reference the location in the TAB report.

   2. Review and Approvals
      1. Review of the commissioning related sections of the O&M manuals shall be made by the A/E and by the CA. Refer to Section 01 91 14 for details.

7. Review of the commissioning related sections of the O&M manuals shall be made by the A/E and by the CA. Refer to Section 01 91 13 for details.

7. Training of Owner Personnel

1. Demonstration and training shall not proceed until the following tasks and deliverables have been completed and reviewed/approved by the CA:
   1. Functional Performance Testing Completed, including Issues Log summarizing status/remaining issues. Systems verified to be operating to design intent.
   2. O&M Manuals have been reviewed, approved, and final version submitted to the owner
   3. Record Drawings completed and submitted to the owner. In the absence of final Record Drawings, a full colour, full size scanned copy of the as-builts may be provided by the contractor in both hard and digital copy.

2. Detail information regarding contents, duration and instructors for any particular system is included in Section 01 91 41: Commissioning – Demonstration and Training.

3. Mechanical Contractor: The mechanical contractor shall have the following training responsibilities:
    1. Provide the CA with a training plan two weeks before the planned training according to the outline described in Section 01 91 41.
    2. Provide designated Owner personnel with comprehensive orientation and training in the understanding of the systems and the operation and maintenance of each piece of equipment including, but not limited to, pumps, controls, etc.
    3. Training shall normally start with classroom sessions followed by hands-on training on each piece of equipment, which shall illustrate the various modes of operation, including startup, shutdown, fire/smoke alarm, power failure, etc.
    4. During any demonstration, should the system fail to perform in accordance with the requirements of the O&M manual or sequence of operations, the system will be repaired or adjusted as necessary and the demonstration repeated.
    5. The appropriate trade or manufacturer's representative shall provide the instructions on each major piece of equipment. This person may be the start-up technician for the piece of equipment, the installing contractor or manufacturer's representative. Practical building operating expertise as well as in-depth knowledge of all modes of operation of the specific piece of equipment are required. More than one party may be required to execute the training
    6. The controls contractor shall attend sessions other than the controls training, as requested, to discuss the interaction of the controls system as it relates to the equipment being discussed.
    7. The training sessions shall follow the outline in the Table of Contents of the operation and maintenance manual and illustrate whenever possible the use of the O&M manuals for reference.

4. The TAB contractor shall have the following training responsibilities: TAB shall meet with facility staff after completion of TAB and instruct them on the following:
    1. Go over the final TAB report, explaining the layout and meanings of each data type.
    2. Discuss any outstanding deficient items in control, ducting or design that may affect the proper delivery of air or water.
    3. Identify and discuss any equipment and pumps that are close to or are not meeting their design capacity.
    4. Discuss any temporary settings and steps to finalize them for any areas that are not finished.
    5. Other salient information that may be useful for facility operations, relative to TAB.

8. Deferred and Seasonal Testing

1. Refer to Section 01 91 13 for general requirements of post occupancy and deferred testing.

2. The Contractor shall allow for at least two separate 4-hour visits to the site for general trouble shooting and overseeing the operation and maintenance of all systems and equipment during the first full year warranty period following the final commissioning and Substantial Completion being issued.
    1. These site meetings are over and above normal trouble and warranty call backs.

2. These site visits shall be coordinated with post-occupancy review performed by the design professionals and Commissioning Authority.
3. The purpose of these site visits is to investigate and troubleshoot the system operations and any problems and to ensure that all systems and equipment are being properly operated and maintained.

3. The Owner's Facility Group shall be responsible for notification to all relevant contractors and/or suppliers who would be involved in the adjustment, repair, or replacement of any part of a system under warranty. The CA shall be informed by the Owner of all major commissioning-related issues identified during the warranty phase.

4. Following each visit to the site, the Contractor shall submit a detailed report to the Owner's Facility Group, CA, and the Consultant outlining his findings at the site, any problems encountered with the operation and maintenance of all systems, and any repair work or correctional action taken and the outcome of same.

9. Written Work Products

1. Contractor's written work products will consist of the startup and initial checkout plan and functional testing described in this section and Section 01 91 13 Commissioning – General Requirements and the completed startup, initial checkout and pre-functional, and functional checklists.

END OF SECTION

PART 1 General

1.1 RELATED SECTIONS

.1	Section 01 33 00	Shop Drawings, Product Data and Samples
.2	Section 01 35 33	Health and Safety Requirements
.3	Section 01 45 00	Quality Assurance
.4	Section 01 74 19	Waste Management and Disposal
.5	Section 01 78 00	Closeout Submittals
.6	Section 21	Fire Suppression
.7	Section 22	Plumbing
.8	Section 26	Electrical

1.2 SUBMITTALS

.1 Submittals: in accordance with Section 01 33 00 - Shop Drawings, Product Data and Samples.

.2 Shop Drawings to Show:

- .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 - Shop Drawings, Product Data and Samples: use MCAC "Shop Drawing Submittal Title Sheet". Identify section and paragraph number.

.5 Closeout Submittals:

- .1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
- .2 Operation and maintenance manual approved by, and final copies deposited with, Departmental Representative before final inspection.
- .3 Operation Data to Include:
  - .1 Control schematics for systems including environmental controls.
  - .2 Description of systems and their controls.
  - .3 Description of operation of systems at various loads together with reset schedules and seasonal variances.
  - .4 Operation instruction for systems and component.
  - .5 Description of actions to be taken in event of equipment failure.
  - .6 Valves schedule and flow diagram.
  - .7 Colour coding chart.

.4 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.

.5 Performance Data to Include:

.1 Equipment performance verification test results.

.2 Special performance data as specified.

.6 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.

.7 Additional Data:

.1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.

.8 Site Records:

.1 Departmental Representative will provide 1 set of reproducible mechanical drawings. Provide sets of white prints as required for each phase of work. Mark changes as work progresses and as changes occur. Include changes to existing mechanical systems, control systems and low voltage control wiring.

.2 Transfer information weekly 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.

.9 As-Built Drawings:

.1 Prior to start of Testing and Adjusting, 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 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.

.1

1.3 HEALTH AND SAFETY

.1 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 33 - Health and Safety Requirements.

1.4 QUALITY ASSURANCE

.1 Quality assurance is to be conducted in accordance with the requirements of Section 01 45 00 - Health and Safety Requirements.

1.5 MAINTENANCE

.1 Furnish spare parts in accordance with Section 01 78 00 - Closeout Submittals as indicated in the detailed product specification clauses.

.2 Provide access doors for concealed expansion joints, traps, strainers, cleanouts, balance dampers, fire dampers, other parts requiring accessibility for operating and maintenance.

.3 In suspended panel ceilings, use panel in place of access door; provide in such panel a button or other means of identification and easy removal when necessary.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Waste Management and Disposal:

.1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 ACCESS DOORS

.1 Access door size shall be as indicated and where not indicated, make 305mm x 406mm minimum or 610mm x 457mm where persons have to enter. For acoustical ceilings, conform to architectural panel pattern.

.2 Unless otherwise indicated, access doors shall be hinged, flush type, steel framed panel, 14 gauge minimum, satin finished galvanized steel or type 304 stainless steel, with anchor straps for wet areas, washrooms, and all walls finished in ceramic tile.

.3 Hinges shall be concealed, spring hinge to allow door to open 175°. Locking devices shall be flush cam type, screwdriver operated, doors and frames shall have prime coated rust inhibiting paint, unless made of stainless steel.

.4 Where doors are required in fire rated walls, access doors shall be uninsulated and for all fire rated ceilings and walls where maximum temperature rise limitation is applicable, shall be insulated. All fire rated access doors shall have Warnock Hersey or ULC listed 2 hour fire rating and shall be installed in accordance with NFPA 80 and manufacturer’s installation instructions.

Part 3 Execution

3.1 CLEANING

.1 Clean interior and exterior of all systems including strainers.

3.2 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 - SUBMITTALS.

.2 Manufacturer's Field Services:

.1 Where specified, obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.

.2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

.3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

3.3 DEMONSTRATION

.1 Departmental Representative will use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.

.2 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.

.3 Use operation and maintenance manual and as-built drawings as part of instruction materials.

.4 Instruction duration time requirements as specified in appropriate sections.

3.4 PROTECTION

.1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

END OF SECTION 21 05 01

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 01 50 General Instructions

.2 Section 01 35 33 Health and Safety Requirements

.3 Section 01 45 00 Quality Control

.4 Section 23 05 00 Common Work Results – Mechanical

1.2 REFERENCES

.1 National Building Code of Canada (NBCC), 2015

.2 American National Standards Institute/National Fire Prevention Association (ANSI/NFPA)

- .1 ANSI/NFPA 13-2016, Installation of Sprinkler Systems.
- .2 NFPA 24-2013, Standard for Installation of Private Fire Service Mains and Their Appurtenances.
- .3 ANSI/NFPA 25-2014, Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems.
- .4 NFPA 307 -2016, Standard for the Construction and protection of Marine Terminal, Piers and Wharves.

.3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

- .1 Material Safety Data Sheets (MSDS).

.4 Underwriter's Laboratories of Canada (ULC).

.5 American Society for Testing and Materials (ASTM)

- .1 ASTM A193 – Alloy-Steel and Stainless Steel Bolting Materials for High Temperature or High Pressure Service and Other Special Purpose Applications
- .2 ASTM A312 – Seamless and Welded Austenitic Stainless Steel Pipe
- .3 ASTM A351 – Castings, Austenitic, Austenitic-Ferritic (Duplex), for pressure Containing Parts
- .4 ASTM A-276 – Stainless Steel Bars and Shapes.
- .5 ASTM D-2000 – Standard Classification System for Rubber Products in Automotive Application.

1.3 SAMPLES

.1 Submit samples of following:

- .1 Each type of sprinkler head.
- .2 Signs.

1.4 DESIGN REQUIREMENTS

.1 Design, supply, installation and testing of automatic dry pipe fire suppression sprinkler systems in accordance with required and advisory provisions of NFPA 13-2016 for superstructure and NFPA 307-2016 for substructure, by hydraulic calculations for uniform distribution of water over design area. Automatic sprinkler system shall be hydraulically designed using water supply test data obtain by testing

to NFPA 291 Recommended Practice for Fire Flow Testing and Marking of Hydrants. Test shall be conducted by or under the direct supervision of the sprinkler system designer. Flow test is required for the purposes of detailed design and production of hydraulic calculations. Use the worst-case water supply data.

.2 Design and provide each system to give full consideration to blind spaces, piping, electrical equipment, ducts, and other construction and equipment in accordance with detailed shop drawings.

.3 Locate sprinkler heads in consistent pattern with ceiling grid, lights, and air supply diffusers.

.4 Devices and equipment for fire protection service: ULC approved for use in sprinkler systems.

.5 Design systems for earthquake protection for buildings in seismic zone applicable.

.6 Location of Sprinkler Heads:

.1 Locate heads in relation to ceiling and spacing of sprinkler heads not to exceed that permitted by NFPA 13-2016.

.2 Uniformly space sprinklers on branch.

.7 Water Distribution:

.1 Make distribution uniform throughout the area in which sprinkler heads will open.

.8 Water Supply:

.1 Base hydraulic calculations on static and residual pressures using the water supply test data obtain by testing to NFPA 291 Recommended Practice for Fire Flow Testing and Marking of Hydrants. For design purpose, the available water supply pressures shall be de-rated by a 10% safety factor.

1.5 SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 11 55 – General Instructions.

.2 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 11 55 - General Instructions.

.2 Shop Drawings:

.1 Submit shop drawings in accordance with Section 01 11 55 - General Instructions.

.2 Shop drawings: submit drawings stamped sealed and signed by professional engineer registered or licensed in Province of B.C. Indicate:

.1 Materials (piping, fittings, couplings and etc.).

.2 Finishes.

.3 Method of anchorage

.4 Number of anchors.

.5 Supports.

.6 Reinforcement.

.7 Assembly details.

.8 Accessories.

.3 Drawings: Sprinkler heads and piping system layout.

.1 Prepare detail working drawings of system layout in accordance with NFPA 13 using full size contract drawings.

.2 Show data essential for proper installation of each system.

.3 Show details, plan view, elevations, and sections of systems supply and piping.

.4 Show piping schematic of systems supply, devices, valves, pipe, and fittings.

.4 Design Data:

.1 Calculations of sprinkler system design.

.2 Indicate type and design density of each system.

.3 Assurance of Professional Design and Commitment for Field Review.

.1 Provide Assurance commitment letters (Schedules B-1 and B-2) at the commencement of the project, in accordance with the building code and for Building Permit application.

.2 Provide Assurance of Professional Field Review and Compliance (Schedule C-B) at the completion of the project.

.4 Delivery and Fabrication Reports.

.1 Substructure material product as delivered and fabrication reports shall be provided for all materials prior to installation in accordance with Section 01 45 00.

.2 Noncompliant materials are not permitted to be used within the fire protection systems.

.5 Closeout Submittals:

.1 Submit maintenance and engineering data for incorporation into manual specified in Section 01 11 55 – General Instructions in accordance with ANSI/NFPA 20.

.2 Manufacturer's Catalog Data, including specific model, type, and size for:

.1 Pipe, couplings and fittings.

.2 Sprinkler heads.

.3 Pipe hangers and supports.

.4 Mechanical couplings.

.3 Field Test Reports:

.1 Preliminary tests on piping system.

.2 Formal tests and inspections.

.3 Reports for all field fabricated pipe for the substructure in accordance with Section 01 45 00.

.4 Records:

.1 As-built drawings, Contractor’s Materials and Test Certificates and substructure pipe fabrication logs of each system.

.1 After completion, but before final acceptance, submit complete set of as-built drawings (prints) of each system for record purposes.

.2 Submit drawings in digital file versions with title block similar to full size contract drawings.

.5 Operation and Maintenance Manuals:

.1 Provide maintenance data for incorporation into manual specified in Section 01 11 55 - General Instructions.

.2 Provide detailed hydraulic calculations including summary sheet, and Contractors Material and Test Certificate for aboveground piping and other documentation

for incorporation into manual specified in Section 01 11 55 - General Instructions in accordance with ANSI/NFPA 13.

1.6 QUALITY ASSURANCE

.1 Qualifications:

- .1 Installer: company or person specializing in sprinkler systems with documented experience.
- .2 All work shall be carried out by Sprinkler Pipe Fitters who carry a "Certificate of Qualification" for this trade as issued by the B.C. Province Ministry of Labour.
- .3 All Sprinkler Pipe Fitters shall have manufacturer training or demonstrated experience in proper use of grooving tools, application of groove and installation of grooved piping products for stainless steel applications.

.2 Health and Safety:

- .1 Do construction occupational health and safety in accordance with Section 01 35 33 - Health and Safety Requirements.

.3 Inspections and Tests:

- .1 All sprinkler system piping is to be evaluated in accordance with Section 01 45 00.
- .2 All inspections, examinations and tests required by the "Authorities and Agencies having jurisdiction" specified shall be arranged and paid for by the fire protection contractor, as necessary to obtain complete and final acceptance of the fire protection system. All backflow preventers shall be selected, installed, verified and tested in accordance with CAN/CSA-B64.10: Manual for the Selection and Installation of Backflow Prevention Devices.
- .3 Provide Contractor's Material and Test Certificates and all required test papers as may be requested by all parties having jurisdiction and duly witnessed by Departmental Representative, showing proof of:
  - .1 Underground hydrostatic test of 1400 kPa (200 PSI).
  - .2 Flushing of underground main to be provided as per NFPA 13, 2013.
  - .3 Hydrostatic test of overhead piping @ 1400 kPa (200 PSI).
  - .4 Verification of all alarm and trouble devices installed under this contract.
- .4 Provide the services of the Professional Engineer who designed the fire protection systems for “Field Review” of the installation. Construction period review reports shall be submitted during the construction period.
- .5 If welding is required, the Contractor shall submit a copy of the welder's certification to the Engineer for Record purposes prior to starting work. Hot Works, the process as described in Section 5.2. Hot Works of the 2015 NFCC shall be followed. The successful bidder must demonstrate that they have a hot works program in place and it is to be reviewed by the responsible authority or local fire service before starting any work.

1.7 MAINTENANCE

.1 Extra Materials:

- .1 Provide maintenance materials in accordance with Section 01 01 55 - General Instructions.

.2 Provide spare sprinklers and tools as required by ANSI/NFPA 13.

1.8 DELIVERY, STORAGE AND HANDLING

.1 Packing, shipping, handling and unloading:

.1 Deliver, store and handle in accordance with Section 01 11 55 – General Instructions.

.2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Storage and Protection:

.1 Store materials indoors in dry location.

.2 Store and protect materials from exposure to harmful weather conditions and at temperature and humidity conditions recommended by manufacturer.

.3 Waste Management and Disposal:

.1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 11 55 – General Instructions.

Part 2 Products

2.1 UNDERGROUND PIPE AND FITTINGS

.1 Underground water pipe shall be PVC pipe conforming to AWWA Standard C900-75 "Poly (Vinyl Chloride) (PVC) Pressure Pipe 4 through 12 inch (100 through 300mm) for water", CSA B137.3 ULC CEx448, and UNI-B-3-80. The pipe is to be Class 150psi (Dimensional Ratio (DR)-18 with cast iron outside diameter) and integral bell gasket joint. Gaskets are to be bonded into the ring groove prior to shipment. Underground fittings shall have joints and pressure rating compatible with pipe used. Risers to be cement lined ductile iron.

.2 Substructure risers shall be stainless steel ASTM A312, Type 316S, Schedule 40. Roll or Cut grooved as appropriate to the pipe material, wall thickness, pressure, size and method of joining. Use pipe manufacturer’s roll sets specifically designed for grooving schedule 40 stainless steel pipe. Refer to coupling manufacturer’s recommendations. Provide compatible fittings with the connected piping materials.

.3 All underground piping for fire mains shall be installed, clamped and anchored and flushed and hydrostatically pressure tested according to requirements of NFPA 13, 2016 and NFPA 24 latest Editions. Flushing shall be done through 100mm (4") minimum diameter piping.

.4 At all changes in direction and at tees, ells, plugs, caps, bends, and hydrants, anchor mains as per NFPA 24 latest Edition. Pipe clamps and tie rods, thrust blocks, or other approved methods or devices may be used. Continuously threaded rod shall not be used for underground applications.

.5 Piping and fittings wall thickness, outside diameter, ovality, end flare diverging from the North American standards is prohibited for this project.

2.2 PIPE, FITTINGS & VALVES

.1 **Pipe to be Steel Sprinkler Pipe Certified for Canada (cUL) and comply with NFPA 13 and ASTMA-53 Standards.**

.1 Ferrous piping to NFPA 13 shall be stainless steel and shall meet or exceed one of the following standards for substructure:

.1 65mm (2.5”) and larger - ASTM A312, Type 316S, Sch. 40.

.2 50mm (2”) and smaller - ASTM A312, Type 316S, Sch. 40, pipe, dimensions conforming to ANSI/ASME B36.19M-1985.

.2 All thickness for pressures up to 2070 kPa (300 psi) for substructure shall be as follows:

.1 Joined by shop welding or roll grooving:

.1 Up to and incl. 125mm (5") – Schedule 40
.2 150mm (6") – 3.40mm (0.134) Schedule 40
.3 200mm, 250mm (8", 10") – 4.78mm (0.188") Schedule 40

.2 Joined by threaded fittings or cut grooves:
.1 Up to 200mm (8") – Schedule 40
.2 200mm (8") and larger – Schedule 40

.3 Hot-Dipped Galvanized Welded and Seamless Steel Pipe – ASTM A795, schedule 40 for superstructure.

.4 Provide compatible fittings at the connections between dissimilar pipes.

.2 Fittings and joints (65mm and larger) to ANSI/NFPA 13 type 316 stainless steel for substructure and hot dipped galvanized for superstructure, provide compatible fittings with the connected piping materials:

.1 Grooved couplings, fittings and valves are to be of the same manufacturer.

.2 Grooving tools shall be of the same manufacturer as the grooved components.

.3 Grooving roll sets are to be specific to stainless steel and for the appropriate pipe schedule for stainless steel pipe applications.

.4 Stainless Steel Mechanical Couplings: Manufactured in two or more segments of cast stainless steel, conforming to ASTM A-351, A-743, and A-744. Gaskets shall be pressure-responsive synthetic rubber, grade to suit the intended service, conforming to ASTM D-2000. Mechanical coupling bolts shall be stainless steel, type 316, meeting the physical properties of ASTM A-193, grade B8M, Class2.

.1 Rigid Type: Cast with key designed to clamp the bottom of the groove to provide an essentially rigid joint.

.2 Flexible Type: Use in locations where vibration attenuation and stress relief are required.

.5 Grooved End Fittings: Fittings shall be manufactured of stainless steel conforming to ASTM A-403, WPW, WPW/S9, or CR/S9, or shall be fabricated from stainless steel pipe conforming to ASTM A312, with factory grooved ends. Fittings shall be type 316/316L stainless steel.

.6 50mm and larger sizes shall be Schedule 40 and joined by welding or groove joining methods.

.3 Fittings and joints to ANSI/NFPA 13 type 316 stainless steel and hot dipped galvanized (50mm and smaller):

.1 ASTM A-312 stainless steel housings with ASTM A-276 and A-312 outlets and stainless steel plain or grooved ends, type 316, complete with synthetic rubber Grade "H" (HNBR) seals rated for applicable services to +210 Deg F [+98 Deg C]; Grade "E" EPDM for applicable services to +250 Deg F [+120 Deg C]; or Grade "O" Fluoroelastomer for applicable services to +300 Deg F [+149 Deg C]. System shall be rated to 500 psi (3447 kPa) unless noted otherwise.

.1 Flange Adapters: ANSI Class 150 flange adapter, Van Stone type with stainless steel back-up flange and Press ends. Rated for services to 275 psi (1876 kPa).

.2 Unions: Threaded union, 316/316L stainless steel, with Press ends.

.1 Press system shall be FM approved for fire protection services.

.2 System piping 50mm (2") and smaller shall be Schedule 40 and screwed joints, or with cut grooved joints, material and IPS dimensions.

.1 Grooved joints with two ductile iron housing segments, flush seal gasket for dry service, zinc-electroplated steel bolts and nuts. Cast with offsetting angle pattern bolt pads for rigidity and visual pat-to-pad offset contact.

.2 The type of joint will be of the "flush seal" type except between the black and galvanized steel which will be of the type "ready to install".

.4 Valves:

.1 ULC listed for fire protection service.

.2 Up to NPS 2: type 316 stainless steel and hot dipped galvanized, screwed ends, O. S. & Y. gate.

.3 NPS 2 1/2 and over, type 316 stainless steel and hot dipped galvanized indicating butterfly valve; O.S. & Y gate.

.1 Grooved End Valves:

.1 Butterfly Valves: 2" – 8" / 50 – 200 mm: 300 psi (2068 kPa CWP), suitable for bi-directional and dead-end service to full rated pressure. Grooved end stainless steel body and disc, grade CF8M, conforming to ASTM A351, with blow-out proof 17-4PH stainless steel stems to ASTM A564. Disc shall be connected to the stem without the use of fasteners or pins, and be offset from the disc centerline to provide a full 360°continuous contact with the seating surface when closed. Seat shall be pressure responsive, EPDM or lubricated Nitrile. Stem seals shall be of the same material as the seats. Valve shall have standard ISO flange mounting for ease of actuation. Valve provided with lever handle or gear operator as required. The handle shall be zinc-plated carbon steel or fully stainless steel, latch lock type with infinitely variable and memory stop features.

.2 Butterfly Valves: Grade CF8M stainless steel body and disc, 316 stainless steel stem, PTFE impregnated glass fabric bearings with 316 stainless steel backing, with synthetic rubber seal. (Grade to suit the intended service.) Valve stem shall be offset from the disc centerline to provide full 360-degree circumferential seating. Bubble-tight, dead-end or bi-directional service to 300 psi (2065 kPa) CWP.

.3 Ball Valves: Grade CF8M stainless steel body, 316 stainless steel ball and stem, TFE seats, fluoroelastomer seals, standard port, two-piece valve.

.4 Swing check valves, type 316 stainless steel for S.S. piping and hot dipped galvanized for galvanized piping.

.5 Ball drip, type 316 stainless steel for S.S. piping and hot dipped galvanized for galvanized piping.

.6 All water supply and zone isolation valves shall be monitored with tamper switches. Electric wiring for control and alarm components will be provided Under Division 26.

.7 Valves controlling water supply and alarm shut-off shall be of O. S. & Y. type with rising stem or approved gear operated butterfly valves with supervisory switch. Where a grooved piping system is installed, grooved end isolation/control valves may be used. Valves shall be supervised by a factory installed double throw/double pole switch.

.8 All O. S. & Y. gate valves, hot dipped galvanized shall be monitored with tamper switches. Electric wiring for control and alarm components shall be provided under Division 26.

.5 Pipe hangers:

.1 ULC listed for fire protection services, type 316 stainless steel for S.S. piping and hot dipped galvanized for all galvanized piping.

.2 Hanger standards shall conform to NFPA 13. Use "C" clamps complete with lock nuts and restraining straps. Hangers shall be supplied and installed in accordance with NFPA 13. C-type clamps used to attach hangers to the building structure shall be equipped with lock nuts and retaining straps.

.3 Sway bracing shall be installed as per NFPA 13, type 316 stainless steel for S.S. piping and hot dipped galvanized for all galvanized piping.

.6 Piping and fittings wall thickness diverging from North American standards is prohibited for this project.

.7 Ensure fittings, mechanical couplings and rubber gaskets wall thickness diverging from the North American manufacturer is prohibited for this project.

2.3 BACKFLOW PREVENTION

.1 Provide a double check valve assembly as indicated on the Fire Protection Drawings.

.2 Backflow prevention stations shall be listed by Underwriter's Laboratories Canada (U.L.C.), hot dipped galvanized.

.3 Backflow prevention stations shall be in complete accordance with CAN/CSA-B64.10 "Selection, Installation, Maintenance and Field Testing" and American Water Works Association - Western Canada Section and Pacific Northwest Section - 1990 Fifth Edition.

.4 Complete testing of all reduced pressure principle backflow prevention devices shall be carried out under this Section prior to final acceptance of fire protection systems. A certificate shall be submitted duly signed and witnessed that testing was satisfactory.

2.4 SPRINKLER HEADS

.1 General: to ANSI/NFPA 13 and ULC listed for fire services, PTFE-electroless Nickel coated. Provide compatible connection fittings, corrosion resistance.

.2 Sprinkler shall be protected from mechanical injury by standard guards where necessary. The proximity of sprinklers to heating units shall be taken into consideration in determining the temperature rating.

.3 Adjacent to each sprinkler alarm valve, provide one (1) 12-sprinkler capacity Underwriters approved cabinet complete with various type and temperatures of sprinklers in ratio to the numbers installed of each type along with a standard sprinkler wrench.

2.5 SUPERVISORY SWITCHES

.1 General: to ANSI/NFPA 13 and ULC listed for fire service.

.2 Valves:

.1 Mechanically attached to valve body, with normally open and normally closed contacts and supervisory capability.

.3 Pressure or flow switch type:

.1 With normally open and normally closed contacts and supervisory capability.

.2 Provide switch with circuit opener or closer for automatic transmittal of alarm over facility fire alarm system.

.3 Connect into building fire alarm system.

.4 Connection of switch: Section 26 31 02 – Multiplex Fire Alarm System.

2.6 PRESSURE GAUGES

.1 Provide pressure gauges, hot dipped galvanized at the following locations:

.1 Dry pipe valve

.2 Compressor

.2 Pressure gauges shall be ULC listed stem mount or wall mount type with Bourdon phosphor bronze tube, brass socket, 6 mm [1/4"] lower connection, aluminum case in black enamel finish, chrome removable slip ring, stainless steel rotary type movement, minimum 90mm [3 1/2"] dial of 1% of full scale range and pressure range to suit application, with lever handle cock and brass 6 mm [1/4"] NPT snubber to suit service.

2.7 FIRE DEPARTMENT CONNECTION

.1 Provide connections approximately 1.5 m above finish grade, location as indicated.

.2 To ANSI/NFPA 13 and ULC S543 listed, Siamese type.

.3 Type 316 stainless steel exposed of approved two-way type with 2.5 inch National Standard female hose threads with plug, chain, and identifying fire department connection escutcheon plate. Confirm compatibility with the Fire Department.

.4 Thread specifications: compatible with local Fire Department.

2.8 PIPE SLEEVES

.1 Provide pipe sleeves where piping passes through walls, floors, and roofs.

.2 Secure sleeves in position and location during construction.

.3 Provide sleeves of sufficient length to pass through entire thickness of walls, floors, and roofs.

.4 Provide 2.5 cm minimum clearance between exterior of piping and interior of sleeve or core-drilled hole.

.1 Firmly pack space with mineral wool insulation.

.2 Seal space at both ends of sleeve or core-drilled hole with plastic waterproof cement which will dry to firm but pliable mass, provide mechanically adjustable segmented elastomeric seal.

.3 In fire walls and fire floors, seal both ends of pipe sleeves or core-drilled holes with ULC listed fill, void, or cavity material.

.5 Sleeves in Masonry and Concrete Walls, Floors, and Roofs:

.1 Provide hot-dip galvanized steel, ductile-iron, cast-iron sleeves.

.2 Core drilling of masonry and concrete may be provided in lieu of pipe sleeves when cavities in core-drilled hole are completely grouted smooth.

.6 Sleeves in Other Than Masonry and Concrete Walls, Floors, and Roofs:

.1 Provide 0.61 mm thick galvanized steel sheet.

2.9 ESCUTCHEON PLATES

.1 Provide split hinged type, type 316 stainless steel plates for piping passing through walls, floors, and ceilings in exposed spaces.

.2 Provide stainless steel type 316 plates in finished spaces.

.3 Provide stainless steel type 316 plates in unfinished spaces.

2.10 SPARE PARTS CABINET

.1 For storage of maintenance materials, spare sprinkler heads and special tools.

.2 Construct to sprinkler head manufacturer’s standard.

2.11 INSPECTOR’S TEST CONNECTION

.1 Locate inspector's test connection at hydraulically most remote part of each system, provide test connections approximately 3m above floor for each sprinkler system or portion of each sprinkler system equipped with alarm device.

.2 Provide test connection piping to location where discharged without property damage.

.3 Provide discharge orifice of same size as corresponding sprinkler orifice.

2.12 SIGNS

.1 Attach properly lettered and approved metal signs to each valve and alarm device to ANSI/NFPA 13.

.2 Permanently fix hydraulic design data nameplates to riser of each system.

2.13 DRY PIPE VALVE

.1 ULC listed.

.2 Type 316 stainless steel and hot dipped galvanized, flanged type, sized to suit water main.

.3 Components:

- .1 Accelerator.
- .2 Air maintenance device with low pressure alarm.
- .3 Alarm pressure switch with supervisory capability.
- .4 Pressure gauges.
- .5 Drain valve.
- .6 Test valve with associated piping.
- .7 Shut off valve - OS & Y with tamper-proof device wired back to fire alarm panel.

2.14 ON SITE NITROGEN GENERATOR SUPPLY SYSTEM

.1 Automatic Nitrogen Generator.

.2 ULC listed.

- .1 Provide a Nitrogen Generator in the Maintenance Building to service all dry zones as required by the system size and pressure requirement stipulated in the drawings and installed per manufacturer's instructions.
- .2 The Nitrogen Generation System shall include:
  - .1 Integrated Lubricated Air Compressor, 208/3/60 power.

.1 The integrated lubricated air compressor shall be sized appropriately for the application and capable of achieving system air pressure within 30 minutes in accordance with requirements of NFPA 13.

.2 Air compressor(s) shall be capable of producing a continuous volume of compressed air that is sufficient to meet the design requirements of the fire protection system. When multiple risers are used the compressor must be sized to handle the combined flow and pressure requirements of all system riser(s) serving a specific zone as shown on the drawings.

.2 Automatic Drain Valve

.1 The automatic drain valve shall be capable of removing all liquid moisture from the air storage tank and nitrogen pre-filters.

.2 The automatic drain valves shall be piped to a drain.

.3 Nitrogen Membrane

.1 The nitrogen membrane shall be capable of producing a minimum of 98% nitrogen.

.4 Air Filtration

.1 The air filtration shall include a 5 micron filter and a coalescing filter.

.5 Nitrogen Control Panel

.1 The nitrogen control panel shall include run time monitor with excess runtime alarm.

.2 The nitrogen control panel shall have an audible alarm and visual indication.

.3 The nitrogen control panel shall contain dry contact for BMS notification (NC&NO Contacts available).

.4 The nitrogen control panel shall be ULC.

.6 Air Bypass Alarm

.1 The air bypass alarm shall monitor the bypass valve in the nitrogen cabinet.

.7 Air Storage Tank and Nitrogen Storage Tank

.1 The air and nitrogen storage tanks shall conform to ASME standard for pressure vessel.

.8 Portable Nitrogen Analyzer

.1 The portable nitrogen analyzer shall be battery operated and able to be used to obtain purity readings at all nitrogen purge valve locations. One required per jobsite.

.3 The Nitrogen Generator System shall be designed to achieve a nitrogen concentration of 98% or greater and maintain that concentration within the system continuously.

.4 Each sprinkler system shall have an IntelliPurge Nitrogen Purge Valve (INS-PV) furnished with a restricted orifice to restrict venting to a minimum to attain the 98% or greater nitrogen purity level.

.5 The fire sprinkler contractor shall install all interconnecting piping between the air storage tank, nitrogen storage tank and the sprinkler risers to allow adequate nitrogen supply to all risers.

.6 The fire sprinkler contractor shall determine the operating pressure range for the dry pipe nitrogen generator and set the air maintenance device for each zone to the correct setting.

Coordination of this final setting shall be achieved with input from the dry pipe valve manufacture.

.7 Manufacturer shall provide technical start-up services and training on all nitrogen generation systems as well as provide instruction and training to site engineers and departmental representatives once commissioning has been complete.

.8 Nitrogen Purging System

Each sprinkler system shall have an IntelliPurge Nitrogen Purge Valve (INS-PV) furnished to attain the 98% or greater nitrogen purity level.

.1 Furnish and install an IntelliPurge Nitrogen Purge Valve (INS-PV) at the furthest point from the fire sprinkler riser for each fire sprinkler riser.

.2 The INS-PV be supplied with a restricted orifice which size is determined by the total system pressure requirements.

.3 The INS-PV shall have a zirconium nitrogen sensor that can shut off the purge valve after 98% nitrogen has been achieved throughout the fire sprinkler system.

.4 The INS-PV shall monitor the nitrogen level in the fire protection system periodically.

.5 The INS-PV shall have a BMS alarm relay to indicate trouble if nitrogen purity drops below desired purity.

.6 The INS-PV shall be able to connect to the IntelliPurge Remote Annunciator for remote monitoring of multiple IntelliPurge nitrogen purge valves.

.7 The INS-PV shall be closed during hydrostatic and air pressure testing of the fire sprinkler system and then placed in the open position for the commissioning, treatment and operation of the system.

.8 120V AC transformer for each INS-PV.

.9 IntelliPurge Remote Annunciator (INS-RA)

.1 Provide IntelliPurge Remote Annunciator (INS-RA) conveniently located for ease of access for facility management.

.2 The INS-RA shall be able to control up to 27 INS-PV units.

.3 The INS-RA shall be password protected.

.4 The INS-RA shall have local visual indicator for purge trouble alarms.

.5 The INS-RA shall be able to record history of the IntelliPurge Nitrogen Purge Valve.

.6 The INS-RA shall be provided with wall adapter transformer.

.10 Air Maintenance Device

.1 The Air Maintenance Device shall be equipped with an adjustable pressure regulator that is capable of setting the required pressure for the fire sprinkler system.

.2 The Air Maintenance Device shall be listed or approved for fire sprinkler application.

.3 The Air Maintenance Device shall be installed per manufacturer’s specifications

.11 Supervision and Training

A Consulting Services Package for Commissioning the nitrogen generator shall be provided by manufacturer. Contact manufacturer to schedule commissioning at least 3 weeks in advance. The fire sprinkler contractor shall have to assist in final system commissioning. The fire sprinkler contractor shall confirm that all the Nitrogen Generator

System connections have been made as specified and as indicated in the manufacturer's installation instructions.

.12 Piping: Type 316 stainless steel, NPS 3/4 screwed joints and fittings, to ANSI/NFPA 13.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTION

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

3.2 WATER CONNECTION

.1 Connect sprinkler system supply line to water main and run service line into the building system.

.2 Lay underground supply pipe to local authority standards at minimum 1200 mm (48") depth of bury or below frost line, whichever is greater.

.3 Install frost-proof casing around riser from the underground main to protect against freezing.

3.3 ABOVE GROUND PIPING SYSTEMS

.1 Provide fittings for changes in direction of piping and for connections.

- .1 Make changes in piping sizes through tapered reducing pipe fittings, bushings will not be permitted.
- .2 Perform welding in shop; field welding will not be permitted.
- .3 Conceal piping in areas with suspended ceiling.

3.4 PIPE INSTALLATION

.1 Install piping pitched to drain as per NFPA 13. Do not hang piping from plaster ceilings.

.2 Keep interior and ends of new piping and existing piping thoroughly cleaned of water and foreign matter.

.3 Keep piping systems clean during installation by means of plugs or other approved methods. When work is not in progress, securely close open ends of piping to prevent entry of water and foreign matter.

.4 Inspect piping before placing into position.

.5 Install spare parts cabinet as indicated.

.6 Valve identification:

- .1 Identify drain valve and auxiliary valves.

.7 Piping exposed in superstructure to be installed with labelling and stencilling faced up or at locations not visible by the public.

.8 Do not cut, bore or otherwise damage treated wood unless approved in writing. If cutting treated wood is approved, treat all field cuts and damage in accordance with CSA-080-series 15 with minimum of two coats of field preservative treatment as identified in the standard.

.9 Piping installed in the substructure to be provided with type 316 stainless steel hangers, sway bracings and seismic restraints that are ULC/UL approved, system design and approved by the Engineer. Provide type 316 S.S piping protection from high tide approved by Departmental representative.

.10 Contractor to provide proof of completion of installation training by grooved mechanical coupling manufacturer or manufacturer's representative on site prior to start of construction. Typical for other grooved piping installations for this project.

3.5 DISINFECTION

.1 Disinfect new piping.

.2 Fill piping systems with solution containing minimum of 50 parts per million of chlorine and allow solution to stand for minimum of 24 hours.

.3 Flush solution from systems with clean water until maximum residual chlorine content is not greater than 0.2 part per million or residual chlorine content of domestic water supply.

.4 Obtain at least two consecutive satisfactory bacteriological samples from piping, analyzed by certified laboratory, and submit results prior to piping being placed into service.

3.6 FIELD QUALITY CONTROL

.1 Site Test, Inspection:

- .1 Perform test to determine compliance with specified requirements in presence of Departmental Representative.
- .2 Test, inspect, and approve piping before covering or concealing.
- .3 The coupling manufacturer's representative shall periodically visit the jobsite and review installation. Contractor shall remove and replace any joints deemed improperly installed.

.2 Preliminary Tests:

- .1 Hydrostatically test each system at 200 psig for a 2 hour period with no leakage or reduction in pressure.
- .2 Flush piping with potable water in accordance with NFPA 13.
- .3 Piping above suspended ceilings: tested, inspected, and approved before installation of ceilings.
- .4 Test alarms and other devices.
- .5 Test water flow alarms by flowing water through inspector's test connection. When tests have been completed and corrections made, submit signed and dated certificate in accordance with NFPA 13.

.3 Formal Tests and Inspections:

- .1 Do not submit request for formal test and inspection until preliminary test and corrections are completed and approved.
- .2 Submit written request for formal inspection at least 15 days prior to inspection date.
- .3 Repeat required tests as directed.
- .4 Correct defects and make additional tests until systems comply with contract requirements.
- .5 Furnish appliances, equipment, instruments, connecting devices, and personnel for tests.
- .6 Authority of Jurisdiction, will witness formal tests and approve systems before they are accepted.
- .7 Altered and relocated sprinkler system to be inspected and tested in conformance with NFPA 25.

3.7 PLACING IN SERVICE

.1 When the entire fire protection system has been completed to the satisfaction of the Departmental Representatives and when operating and maintenance instructions have been provided, the Fire Protection Contractor shall, in the presence of the Departmental Representative, demonstrate the complete operation and maintenance required to the operating personnel. A complete operational test conducted on the entire installation for the purpose of verification of compliance with all applicable standards and codes shall be carried out.

.2 Three copies of a complete operating manual shall be provided, which must include the following:

- .1 Detailed instructions for the normal maintenance of all installed equipment including operational procedures, frequency of operational checks, service instructions and troubleshooting instructions.
- .2 Valve schedule for all valves including location, service type and normal position for all systems.
- .3 Schematic showing the location of each excess pressure pump breaker, inspectors test valves, low point drains and flow switches where applicable.
- .4 Warranties and certificates.
- .5 Manufacturer's operating and maintenance manuals.
- .6 Description of the operation of each system and the function of each piece of equipment.
- .7 Lubrication schedule for all lubricated equipment including recommended lubricants.

END OF SECTION 21 13 13

Part 1 General

1.1 SUMMARY

.1 Section Includes:

- .1 Materials and installation for plumbing pumps.

1.2 RELATED SECTION

.1	Section 01 01 50	General Instructions
.2	Section 01 35 33	Health and Safety Requirements
.3	Section 01 91 00	Commissioning
.4	Section 22 42 01	Plumbing Specialties and Accessories
.5	Section 23 05 00	Common Work Results for Mechanical
.6	Section 23 08 00	Commissioning of Mechanical Systems

1.3 REFERENCES

.1 Electrical Equipment Manufacturers Advisory Council (EEMAC).

.2 National Electrical Manufacturers Association (NEMA).

- .1 NEMA MG 1-2011, Motors and Generators.

.3 National Sanitation Foundation (NSF) / American National Standards Institute (ANSI).

- .1 NSF/ANSI 61, Drinking Water System Components.

1.4 SUBMITTALS

.1 Submittals in accordance with Section 01 01 50 – General Instructions.

.2 Product Data:

- .1 Submit manufacturer's printed product literature, specifications and data sheet for equipment.

.3 Shop Drawings.

- .1 Submit shop drawings to indicate:
  - .1 Equipment, including connections, fittings, control assemblies and ancillaries. Identify whether factory or field assembled.
  - .2 Wiring and schematic diagrams.
  - .3 Dimensions and recommended installation.
  - .4 Pump performance and efficiency curves.

.4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

1.5 CLOSEOUT SUBMITTALS:

.1 Submit maintenance data in accordance with Section 01 01 50 – General Instructions.

.2 Include:

.1 Shop drawings.

.2 Details of operation, servicing, maintenance.

.3 List of recommended spare parts.

1.6 HEALTH AND SAFETY

.1 Do construction occupational health and safety in accordance with Section 01 35 33 - Health and Safety Requirements.

1.7 DELIVERY STORAGE AND DISPOSAL

.1 Waste Management and Disposal:

.1 Separate waste materials for recycling in accordance with Section 01 01 50 – General Instructions.

.2 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan

.3 Fold up metal banding, flatten and place in designated area for recycling.

1.8 QUALITY ASSURANCE

.1 All potable water system components shall conform to NSF/ANSI Standard 61.

Part 2 Products

2.1 SANITARY SUMP PUMP SUBMERSIBLE

.1 Provide as indicated on drawings, sanitary duplex drainage – pump station as specified herein or approved equal.

.2 The assembly shall be underground, two pumps, automatic sewage pump station. Each pump station shall be furnished with piping, valves, and all necessary automatic controls, two submersible pumps, float type liquid level controls and a duplex pump control panel. Provide 1525 mm diameter precast reinforced concrete sections installed to suit, depth as indicated on drawings. Provide a slide rail assembly with lifting chains, sealing flange, pump carrier and galvanized rails to suit sump depth. Provide 50mm inlet, 50mm discharge, 2-50mm electrical and 50mm vent coupling. H20 sealed cover and frame to suit and accept and allow duplex pump removal, non-slippery surface, gas tight; upper rail support.

.3 Pumps shall be heavy duty cast iron, non-clog type sewage, oil filled, submersible pumps.

Each pump shall have a capacity of 3.8 L/s against a total dynamic head of 105 kPa operating at a maximum speed of 3,450 RPM with a recessed non-clog type impeller which passes 50mm solids. Pump motors to be 1 HP, 208V, 3 PH, 3450 RPM and 60 cycle. Pumps shall be furnished in standard construction c/w 15 meters of power cable and adaptors for pipe size indicated.

.4 Each pump shall be provided complete with a lift-out slide rail system assembly. Each rail shall include a 50mm cast iron discharge assembly, upper and lower guide rail support, pump carrier and galvanized pump lifting chains.

.5 Provide 4 float type, non-mercury, liquid level controls for automatic pump control of the liquid level. A support bracket with strain relief connectors shall be supplied. A CEMA 4 junction box shall be provided for electrical connection.

.1 FS#4 High water alarm

.2 FS#3 Lag pump #2 on FS#2 Lead pump #1 on FS#1 Off-alternate pumps

.6 A duplex automatic 2 pump control panel shall be furnished in a CEMA 1 enclosure with the following equipment.

.1 Inner door mounted controls.

.2 Pump circuit breaker disconnects.

.3 Magnetic contactors with 3 leg overloads.

.4 H.O.A. selector switches for each pump.

.5 Run lights for each pump.

.6 Automatic alternator relay.

.7 Pump motor overload alarm and automatic interlock to lag pump.

.8 Lead-lag pump selector switch.

.9 High level alarm with buzzer, light and silencing switch, test switch and automatic reset.

.10 Provide also remote alarm panel to repeat light and buzzer signal, silencing switch and lamicoid label reading "High Water in Sewage Sump".

.11 Arrange with electrical contractor for wiring in accordance with manufacturer's installation instructions.

.7 Set inlet invert and provide cover suited for chamber. Provide 50mm cast iron check valve and 50mm ball type isolation valve shall be factory installed on the discharge of each pump. Piping shall be schedule 40 PVC pipe fabricated to suit the installation. A 50mm discharge NPT coupling shall be furnished for connection to forcemain and field piping to complete the installation.

Part 3 Execution

3.1 INSTALLATION

.1 Install in accordance with National Plumbing Code and local authority having jurisdiction.

.2 Install in accordance with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and data sheet.

.3 Make piping and electrical connections to pump and motor assembly and controls as indicated.

.4 Ensure pump and motor assembly do not support piping.

3.2 FIELD QUALITY ASSURANCE

.1 Site Tests/Inspection:

.1 Check power supply.

.2 Check starter protective devices.

.2 Start-up, check for proper and safe operation.

.3 Check settings and operation of hand-off-auto selector switch, operating, safety and limit controls, audible and visual alarms, over-temperature and other protective devices.

3.3 START-UP

.1 General:

.1 In accordance with Section [01 91 13 - General Commissioning (Cx) Requirements]: General Requirements, supplemented as specified herein.

.2 Procedures:

.1 Check power supply.
.2 Check starter O/L heater sizes.
.3 Start pumps, check impeller rotation.
.4 Check for safe and proper operation.
.5 Check settings, operation of operating, limit, safety controls, over-temperature, audible/visual alarms, other protective devices.
.6 Test operation of hands-on-auto switch.
.7 Test operation of alternator.
.8 Adjust leakage through water-cooled bearings.
.9 Adjust shaft stuffing boxes.
.10 Adjust leakage flow rate from pump shaft stuffing boxes to manufacturer's recommendations.
.11 Check base for free-floating, no obstructions under base.
.12 Run-in pumps for 12 continuous hours.
.13 Check installation, operation of mechanical seals, packing gland type seals. Adjust as necessary.
.14 Adjust alignment of piping and conduit to ensure full flexibility.
.15 Eliminate causes of cavitation, flashing, air entrainment.
.16 Measure pressure drop across strainer when clean and with flow rates as finally set.
.17 Replace seals if pump used to degrease system or if pump used for temporary heat.
.18 Verify lubricating oil levels.

3.4 PERFORMANCE VERIFICATION (PV) – SANITARY PUMPS

.1 Application tolerances:

.1 Flow: plus 10%; minus 0%.
.2 Pressure: plus 10%; Minus 5%.

.2 PV Procedures:

.1 Fill sump at rate slower than capacity of pump #1.
.2 Record levels at which pump #1 starts and stops. Determine flow rate by observing time taken to down water level.
.3 Fill sump at rate faster than capacity of pump #1 but slower than capacities of pumps #1 and #2 operating in parallel.
.4 Record levels at which pumps start and stop - water level rising and water level falling.
.5 Verify operation of alternator.
.6 Adjust water level controls as necessary.
.7 Fill sump at rate faster than capacities of pumps #1 and #2 operating in parallel.
.8 Record levels at pump starts and stops - water level rising and falling.
.9 Check operation of alternator.
.10 Adjust level controls as necessary.
.11 Check level at which high water level alarm starts and stops. Adjust as necessary.

.3 Check removability of pumps for servicing without interfering with installation or operation of other equipment.

.4 Verify non-clog capability and maximum size of solids, using procedures recommended by manufacturer.

3.5 REPORTS

.1 In accordance with Section 01 91 00 – Commissioning, and Section 23 08 00 – Commissioning of Mechanical Systems, and supplemented as specified.

.2 Include:

- .1 PV results on approved PV Report Forms.
- .2 Product Information report forms.
- .3 Pump performance curves (family of curves) with final point of actual performance.

3.6 CLEANING

.1 Proceed in accordance with Section 01 01 50 – General Instructions.

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION 22 10 10

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 Shop Drawings, Product Data and Samples

.2 Section 01 35 33 Health and Safety Requirements

.3 Section 01 74 19 Waste Management And Disposal

.4 Section 01 78 00 Closeout Submittals

1.2 REFERENCES

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

- .1 ASTM B 32-03, Specification for Solder Metal.
- .2 ASTM B 306-02, Specification for Copper Drainage Tube (DWV).
- .3 ASTM C 564-03a, Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.

.2 Canadian Standards Association (CSA International).

- .1 CAN/CSA-B70-02, Cast Iron Soil Pipe, Fittings and Means of Joining.
- .2 CAN/CSA-B125-01, Plumbing Fittings.

1.3 SUBMITTALS

.1 Submittals in accordance with Section 01 33 00 - Shop Drawings, Product Data and Samples.

.2 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.4 HEALTH AND SAFETY

.1 Do construction occupational health and safety in accordance with Section 01 35 33 - Health and Safety Requirements.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Place materials defined as hazardous or toxic in designated containers.

.4 Handle and dispose of hazardous materials in accordance with CEPA, TDGA, Regional and Municipal regulations.

.5 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan

.6 Fold up metal banding, flatten and place in designated area for recycling.

Part 2 Products

2.1 COPPER TUBE AND FITTINGS

.1 Above ground sanitary, storm and vent, Copper Type DWV to: ASTM B 306.

- .1 Fittings.
  - .1 Cast brass: to CAN/CSA-B125.
  - .2 Wrought copper: to CAN/CSA-B125.

.2 Solder: tin-lead, 50:50, type 50A or lead free, tin-copper alloy 95:5, type TA to ASTM B 32.

2.2 CAST IRON PIPING AND FITTINGS

.1 Buried sanitary storm and vent, cast iron (minimum NPS 2) to: CAN/CSA-B70.

- .1 Joints.
  - .1 Mechanical joints.
    - .1 Neoprene or butyl rubber compression gaskets: to ASTM C 564 or CAN/CSA-B70.
    - .2 Stainless steel clamps.

.2 Above ground sanitary storm and vent: Cast iron to CAN/CSA-B70.

- .1 Joints.
  - .1 Mechanical joints.
  - .2 Neoprene or butyl rubber compression gaskets with stainless steel clamps.

2.3 ABS PIPING

.1 Drainage piping under the building, provided that such piping does not pass through any fire separations, may be as follows, at the contractor's option:

- .1 Underground sanitary drainage piping under building, 150mm in diameter and smaller, certified to the current version of CSA B181.1, ABS Drain, Waste and Vent Pipe and Fittings. Piping shall be solid wall in construction. Cell core piping is not acceptable.

.2 The use of ABS piping inside building is not permitted.

2.4 PVC PIPING

.1 Drainage piping under the building may be as follows, at the contractor's option:

- .1 Underground sanitary drainage piping under building, 100mm in diameter or larger, certified to the current version of CSA B181.2, PVC Drain, Waste and Vent Pipe and Fittings.

.2 The use of PVC drain pipe inside building is not permitted.

2.5 PRE-INSULATED PIPING SYSTEM

.1 The section of underground and above ground piping shall be pre-insulated piping system.

.2 The system shall consist of the specified pipe insulated with polyurethane foam for straight sections and preformed polyurethane foam for all fittings. All pipe joints shall be socket or butt welded for 50mm and smaller, and butt welded for 65mm and larger. Pipe shall be supplied in 12.2m lengths, unless shorter lengths are needed, with piping exposed at each end for field joint fabrication. The insulation shall be formed-in-place closed-cell polyurethane foam providing intimate contact with both the core pipe and casing pipe. It shall be 90-95 percent closed cell with a 32 kg/m3. density. Provide a thermal conductivity coefficient of 0.023 W/(m K) at 23°C.

MINIMUM INSULATION THICKNESS

Pipe Size (mm)	Insulation Thickness (mm)	
	Sprinkler	Drain
25 – 200	50	50

.3 Insulation shall be 50mm thick for 150mm and small pipe, nominal 32 kg/m3 density.

.4 All straight sections, fittings, anchors and other accessories shall be factory fabricated to job dimensions and designed to minimize the number of field welds. Each system shall be computer analyzed by the piping system manufacturer to determine stress on the service pipe and anticipated thermal movement of the service pipe. The system design shall be in strict conformance with ANSI B31.1, latest edition. Factory trained field technical assistance shall be provided for critical periods of installation such as unloading, field joint instruction and testing.

.5 End seals, gland seals and anchors shall be designed and factory fabricated to prevent the ingress of moisture into the system.

.6 All straight sections of the insulated piping system shall be filament wound polyester resin/fiberglass reinforcement composite directly applied on the insulating foam. Thermoplastic casing material such as PVC or PE shall not be allowed. All fittings of the insulated piping system shall be prefabricated to minimize field joints and jacketed in a chopped spray up, polyester resin/fiberglass-reinforced composite, directly applied onto the insulating foam to as thickness related to the filament-wound jacket thickness.

.7 The casing shall be seamless high-density polyethylene with a minimum thickness of 120 mils with integral heat trace channel. Field joints shall be made only on straight pipe sections. Fitting insulation and casing shall be factory applied. The end of each pipe casing joint shall be sealed to the carrier pipe with a preformed flexible polyethylene end seal or by turning down the jacket to seal against the service pipe. End seals shall be factory applied and bonded to the jacket and carrier pipe. End seals/jacket combinations are to be certified by an independent testing laboratory at 60 kPa head pressure for 48-hour test period to maintain a watertight seal. End seal certification shall be submitted for approval. Mastic end seals are not acceptable. O-Ring seals are not acceptable. Provide a preformed heat shrink end seal at all field cuts.

.8 Underground piping shall be bedded in compacted granular material ASTM C33 gradation 67, with pea gravel 203 mm under, around and 152 mm over laid pipe. Cover with densely compacted backfill. Piping trench for a distance of 2440 mm out from building shall not have pea gravel or sand but shall be select backfill densely compacted as specified for building floor slab backfill.

.9 **Prepare shop drawings to scale indicating the entire site plan with all underground and above ground piping thereon. Elevations of all piping shall be indicated. Details of piping and bedding shall be drawn indicating size materials and arrangement. All shop drawings shall be submitted to the pipe manufacturer for their review and shall bear their stamp of approval prior to A/E review**. Excavation for and laying of pipe shall not be started until these shop drawings are approved.

.10 Prior to fabrication, the Contractor shall review drawings of all disciplines, visit the site and make on-site measurements to ascertain that no interferences will be encountered upon installation. If

there are any significant deviations from the Contract Drawings, produce "Interference Drawings." Before fabricating the piping and installing related equipment, the Contractor shall send a letter to the Owner stating that no interferences exist in the proposed installation. By submitting this letter, the Contractor certifies that he has performed the above requirements and no interferences will result during installation. There will be no additional compensation for minor deviations.

Part 3 Execution

3.1 INSTALLATION

.1 In accordance with Section 23 05 05 - Installation of Pipework.

.2 Install in accordance with Canadian Plumbing Code, Provincial Plumbing Code and local authority having jurisdiction.

.3 Install buried pipe on 150 mm bed of clean washed sand, shaped to accommodate hubs and fittings, to line and grade as indicated. Backfill with 150 mm of clean washed sand.

.4 Install above ground piping parallel and close to walls and ceilings to conserve headroom and space, and to grade as indicated.

.5 Piping installed in the substructure to be provided with type 316 stainless steel hangers, sway bracings and seismic restraints that are design and approved by the Engineer. Provide type 316 S.S piping protection from high tide approved by Departmental representative.

3.2 TESTING

.1 Pressure test buried systems before backfilling.

.2 Hydraulically test to verify grades and freedom from obstructions.

3.3 PERFORMANCE VERIFICATION

.1 Cleanouts:

- .1 Ensure accessible and that access doors are correctly located.
- .2 Open, cover with linseed oil and re-seal.
- .3 Verify that cleanout rods can probe as far as the next cleanout, at least.

.2 Test to ensure traps are fully and permanently primed.

END OF SECTION 22 13 17

Part 1 General

1.1 SUMMARY

.1 Section Includes:

- .1 The supply and installation of Plumbing Specialties and Accessories.

.2 Products Installed but not Supplied Under this Section:

- .1 Install rough-in for equipment supplied by others, complete with valves on hot and cold water supplies, waste and vent.
- .2 Equipment installed by others.
  - .1 Connect with unions.
- .3 Equipment not installed.
  - .1 Capped for future connection by others.

1.2 RELATED SECTION

.1	Section 01 33 00	Shop Drawings, Product Data and Samples
.2	Section 01 74 19	Waste Management & Disposal
.3	Section 01 78 00	Closeout Submittals
.4	Section 01 35 33	Health and Safety Requirements.

1.3 REFERENCES

.1 American Society for Testing and Materials (ASTM)

- .1 ASTM A 126-95(2001), Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.
- .2 ASTM B 62-93, Specification for Composition Bronze or Ounce Metal Castings.

.2 American Water Works Association (AWWA)

.3 Canadian Standards Association (CSA)

- .1 CSA-B64 Series-01, Backflow Preventers and Vacuum Breakers.
- .2 CSA-B356-00, Water Pressure Reducing Valves for Domestic Water Supply Systems.

.4 Plumbing and Drainage Institute (PDI)

- .1 PDI-WH201-92, Water Hammer Arresters Standard.

1.4 SUBMITTALS

.1 Submittals in accordance with Section 01 33 00 - Shop Drawings, Product Data and Samples.

.2 Indicate, for all plumbing specialties and accessories:

- .1 Dimensions, construction details, roughing-in dimensions.

1.5 CLOSEOUT SUBMITTALS:

.1 Submit maintenance data in accordance with Section 01 78 00 - Closeout Submittals.

.2 Include:

.1 Description of plumbing specialties and accessories, giving manufacturer's name, type, model, year, capacity.

.2 Details of operation, servicing, maintenance.

.3 List of recommended spare parts.

1.6 HEALTH AND SAFETY

.1 Do construction occupational health and safety in accordance with Section 01 35 33 - Health and Safety Requirements.

1.7 DELIVERY STORAGE AND DISPOSAL

.1 Waste Management and Disposal:

.1 Separate waste materials for recycling in accordance with Section 01 74 19 - Waste Management and Disposal.

.2 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan

.3 Fold up metal banding, flatten and place in designated area for recycling.

Part 2 Products

2.1 CLEANOUTS

.1 Cleanout plugs: heavy cast iron male ferrule with brass screws and threaded brass or bronze plug. Sealing-caulked lead seat or neoprene gasket.

.2 Access covers:

.1 Wall access: face or wall type, polished nickel bronze or stainless steel round cover with flush head securing screws, beveled edge frame complete with anchoring lugs.

.1 Floor access: round cast iron body and frame with adjustable secured nickel bronze top cast box with anchor lugs and:

.1 Plugs: bolted bronze with neoprene gasket.

.2 Cover for unfinished concrete floors: cast iron round gasket, vandal-proof screws.

.3 Cover for terrazzo finish: polished [nickel bronze] [brass] with recessed cover for filling with terrazzo, vandal-proof locking screws

.4 Cover for tile and linoleum floors: polished nickel bronze with recessed cover for linoleum or tile infill, complete with vandal-proof locking screws.

.5 Cover for carpeted floors: polished nickel bronze with deep flange cover for carpet infill, complete with carpet retainer vandal-proof locking screws.

2.2 WATER HAMMER ARRESTOR

.1 Copper construction, bellows type: to PDI-WH201.

2.3 BACK FLOW PREVENTER

.1 To CSA-B64 Series, Type and size: as indicated

.2 Application: as indicated.

2.4 VACUUM BREAKER

.1 To CSA-B64 Series.

2.5 STRAINERS

.1 860 kPa, Y type with 20 mesh, monel, bronze or stainless steel removable screen.

.2 NPS2 and under, bronze body, screwed ends, with brass cap.

.3 NPS2 1/2 and over, cast iron body, flanged ends, with bolted cap.

2.6 HOSE BIBBS AND SEDIMENT FAUCETS

.1 Bronze construction complete with integral back flow preventer, hose thread spout, replaceable composition disc, and chrome plated in finished areas.

Part 3 Execution

3.1 INSTALLATION

.1 Install in accordance with Canadian Plumbing Code provincial codes, and local authority having jurisdiction.

.2 Install in accordance with manufacturer's instructions and as specified.

3.2 CLEANOUTS

.1 In addition to those required by code, and as indicated, install at base of soil and waste stacks, and rainwater leaders.

.2 Bring cleanouts to wall or finished floor unless serviceable from below floor.

.3 Building drain cleanout and stack base cleanouts: line size to maximum NPS4.

3.3 WATER HAMMER ARRESTOR

.1 Install on branch supplies to each fixture or group of fixtures and where indicated.

3.4 BACK FLOW PREVENTERS

.1 Install in accordance with CAN/CSA-B64 Series, where indicated and elsewhere as required by code.

.2 Pipe discharge to terminate over nearest drain and/ or service sink.

3.5 HOSE BIBBS AND SEDIMENT FAUCETS

.1 Install at bottom of all risers, at low points to drain systems, and as indicated.

3.6 TRAP SEAL PRIMERS

.1 Install for all floor drains and elsewhere, as indicated.

.2 Install on cold water supply to nearest frequently used plumbing fixture, in concealed space, to approval of Consultant.

.3 Install soft copper or plastic tubing to floor drain and as indicated.

3.7 PERFORMANCE VERIFICATION:

.1 General:

.1 In accordance with Section 23 08 01 – Performance Verification Mechanical Piping Systems.

.2 PV procedures:

.1 Vacuum breakers, backflow preventers: operation under all conditions.

END OF SECTION 22 42 01

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 11 55 General Instructions

.2 Section 23 05 00 Common Work Results – Mechanical

.3 Section 23 05 29 Hangers & Support for Piping & Equipment

.4 Section 23 08 02 Cleaning and Start-up of Mechanical Piping Systems

.5 This Section applies to all related work under Divisions 22 and 23.

1.2 REFERENCES

.1 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.181-1999, Ready-Mixed Organic Zinc-Rich Coating.

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 01 50 – General Instructions.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal packaging material for recycling in accordance with Waste Management Plan.

.4 Divert unused metal materials from landfill to metal recycling facility approved by Departmental Representative.

Part 2 Products

2.1 NOT USED

.1 Not Used

Part 3 Execution

3.1 CONNECTIONS TO EQUIPMENT

.1 In accordance with manufacturer's instructions unless otherwise indicated.

.2 Use valves and either unions or flanges for isolation and ease of maintenance and assembly.

3.2 CLEARANCES

.1 Provide clearance around systems, equipment and components for observation of operation, inspection, servicing, maintenance and as recommended by manufacturer.

.2 Provide space for disassembly, removal of equipment and components as recommended by manufacturer or as indicated (whichever is greater) without interrupting operation of other system, equipment, or components.

3.3 PIPEWORK INSTALLATION

.1 Protect openings against entry of foreign material.

.2 Install to isolate equipment and allow removal without interrupting operation of other equipment or systems.

.3 Assemble piping using fittings manufactured to ANSI standards.

.4 Install exposed piping, equipment, rectangular cleanouts and similar items parallel or perpendicular to building lines.

.5 Install concealed pipework to minimize furring space, maximize headroom, conserve space.

.6 Valves:

- .1 Install in accessible locations.
- .2 Remove interior parts before soldering.
- .3 Install with stems above horizontal position unless otherwise indicated.
- .4 Valves accessible for maintenance without removing adjacent piping.
- .5 Install globe valves in bypass around control valves.
- .6 Use chain operators on valves NPS 2-1/2 and larger where installed more than 2,400mm above floor in Mechanical Rooms.

.7 Install dielectric coupling between dissimilar metals.

.8 Install in accordance with Section 23 05 29 – Hanger & Support for Piping & Equipment.

3.4 SLEEVES

.1 General: Install where pipes pass through masonry, concrete structures, fire rated assemblies (where steel sleeves are part of the listed assemblies), and elsewhere as indicated.

.2 Material: Schedule 40 black steel pipe.

.3 Construction: Foundation walls and where sleeves extend above finished floors to have annular fins continuously welded on at mid-point.

.4 Sizes: 6 mm minimum clearance between sleeve and un-insulated pipe or between sleeve and insulation.

.5 Installation:

- .1 Concrete, masonry walls, concrete floors on grade: Terminate flush with finished surface.
- .2 Other floors: Terminate 25mm above finished floor.

.6 Sealing:

- .1 Foundation walls and below grade floors: Fire retardant, waterproof non-hardening mastic.
- .2 Elsewhere: Provide space for firestopping. Maintain fire rating integrity.
- .3 Sleeves installed for future use: Fill with lime plaster or other easily removable filler.
- .4 Ensure no contact between copper pipe or tube and sleeve.

3.5 ESCUTCHEONS

.1 Install on pipes passing through walls, partitions, floors, and ceilings in finished areas.

.2 Construction: One piece type with set screws. Chrome or nickel plated brass or type 304 stainless steel.

.3 Sizes: Outside diameter to cover opening or sleeve. Inside diameter to fit around pipe.

3.6 CLEANING OF PIPING SYSTEMS

.1 Before start-up, clean interior of piping systems in accordance with requirements of Section 23 08 02 - Cleaning and Start-up of Mechanical Piping Systems.

.2 Preparatory to acceptance, clean and refurbish equipment and leave in operating condition, including replacement of filters in piping systems.

3.7 PRESSURE TESTING OF EQUIPMENT AND PIPEWORK

.1 Advise Departmental Representative 48 hours minimum prior to performance of pressure tests.

.2 Pipework: Test as specified in relevant sections.

.3 Maintain specified test pressure without loss for 24 hours minimum unless specified for longer period of time.

.4 Prior to tests, isolate equipment and other parts which are not designed to withstand test pressure or media.

.5 Pay costs for repairs or replacement, retesting, and making good. Departmental Representative to determine whether repair or replacement is appropriate.

.6 Conceal work only after approval and certification of tests by Departmental Representative.

END OF SECTION 23 05 05

Part 1 General

1.1 SUMMARY

.1 Section includes:

- .1 Heat tracing cables for pipes and tanks including controls and installation.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

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

1.3 REFERENCES

.1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

- .1 Safety Data Sheets (SDS)

1.4 SUBMITTALS

.1 Product Data:

- .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 – Submittals Procedures. Include product characteristics, performance criteria, and limitations.
  - .1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Safety Data Sheets (SDS) in accordance with Section 01 33 00 – Submittal Procedures.

.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.

1.5 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.

1.6 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 reuse and 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 A: Parallel zone system, 2 conductor stranded copper bus wires covered with FEPTEFLON or fluoropolymer inner insulation. Resistance heating cable connected to bus wires. Resistance heating cable connection to alternate bus wires covered with teflon tape and overall FEP protective jacket. Heating capacity: as indicated in W/m. For use with 120 V power supply.

.2 Type B: Copper alloy conductor with X-link polyethylene insulation copper ground braid, PVC protective jacket, cold leads factory spliced and as indicated. Heating capacity: as indicated in W/m. For use with 120 V power supply.

.3 Type C: Mineral insulated copper conductor with stainless steel sheath and HDPE jacket factory spliced and hermetically sealed cold leads and as indicated. Heating capacity: as indicated in W/m. For use with 120 V power supply.

.4 Type D: Self-limiting heating cable with copper ground wire, thermoplastic rubber primary and overall jackets. Heating capacity: as indicated in W/m. For use with 120 V power supply.

2.2 CONTROLS

.1 Thermostat: remote bulb type, to Section 23 09 33 - Electric and Electronic Control Systems for HVAC. Rating as indicated.

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 Type A heating cables in accordance with manufacturer's instructions. Coordinate installation with pipe insulation application.

.2 Install Type B, C, D heating cables in accordance with manufacturer's instructions. Distribute and fasten cable evenly on pipe or tank using pipe strap or tape at maximum spacing 0.5 m. Ensure that heating cables do not touch or cross each other at any point. Run only cold leads in conduit and ensure sensing bulb does not touch cable. Ground shield to building ground. Coordinate cable installation with insulation application. Loop additional cable at fittings, valves, and flanges.

.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 – 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 the 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.

3.5 COMMISSIONING

.1 Perform tests in accordance with Section 26 05 00 – Common Work Results – Electrical and Section 01 91 13 – General Commissioning (Cx) Requirements.

.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.

END OF SECTION 23 05 33

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 11 55 General Instruction

.2 Section 23 05 00 Common Work Results – Mechanical

1.2 REFERENCES

.1 National Building Code of Canada (NBC)

1.3 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 01 50 – General Instructions.

.2 Provide vibration isolation and seismic control systems shop drawings complete with performance and product data. Shop drawings shall demonstrate compliance with the National Building Code and shall bear the seal of a Professional Engineer.

.3 Provide detailed drawings of all seismic restraint systems for piping and equipment.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 11 55 – General Instructions.

.2 Divert unused metal and wiring materials from landfill to metal recycling facility approved by Departmental Representative.

.3 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.4 Dispose of packaging material in appropriate on-site bin for recycling in accordance with site waste management program.

Part 2 Products

2.1 VIBRATION ISOLATION SYSTEM – GENERAL

.1 Performance of vibration isolation systems shall be designed by manufacturer specializing in vibration isolation materials and devices.

.2 Size and shape of bases type shall be coordinated with submitted equipment.

.3 Products shall of the same manufacturer unless otherwise noted.

2.2 ELASTOMERIC PADS

.1 Type EP1 - neoprene waffle or ribbed; 9 mm [3/8”] minimum thick; 50 durometer; maximum loading 350 kPa [50 psi].

.2 Type EP2 - rubber waffle or ribbed; 9 mm [3/8”] minimum thick; 30 durometer natural rubber; maximum loading 415 kPa [60 psi].

.3 Type EP3 - neoprene-steel-neoprene; 9 mm [3/8”] minimum thick neoprene bonded to 1.71 mm [16 gauge] steel plate; 50 durometer neoprene, waffle or ribbed; holes sleeved with isolation washers; maximum loading 350 kPa [50 psi].

.4 Type EP4 - rubber-steel-rubber; 9 mm [3/8”] minimum thick rubber bonded to 1.71 mm [16 gauge] steel plate; 30 durometer natural rubber, waffle or ribbed; holes sleeved with isolation washers; maximum loading 415 kPa [60 psi].

2.3 HANGERS

.1 Colour coded springs, rust resistant, painted box type hangers. Arrange to permit hanger box or rod to move through a 30° arc without metal to metal contact.

.2 Type H1 - neoprene - in-shear, molded with rod isolation bushing which passes through hanger box.

.3 Type H2 - stable spring, elastomeric washer, cup with molded isolation bushing which passes through hanger box.

.4 Type H3 - stable spring, elastomeric element, cup with molded isolation bushing which passes through hanger box.

.5 Type H4 - stable spring, elastomeric element with pre-compression washer and nut with deflection indicator.

2.4 ACOUSTIC BARRIERS FOR ANCHORS AND GUIDES

.1 Acoustic barriers: between pipe and support, consisting of 25 mm [1”] minimum thick neoprene isolation material.

2.5 FLEXIBLE PIPE CONNECTORS

.1 Inner corrugated hose: stainless steel.

.2 Outer braid: Braided wire mesh stainless steel outer jacket.

.3 Type of end connection: threaded for 50mm [2”] or smaller; flange for 65mm [2-1/2”] or larger.

.4 Operating conditions:

- .1 Working pressure: 1379 kPa [200 psi].
- .2 Working temperature: 4540 °C [850 °F].

2.6 SEISMIC CONTROL MEASURES

.1 General:

- .1 Design anchorage and attachment methods for all systems and/or equipment as specified herein.
- .2 Seismic control systems to work in all directions.
- .3 Fasteners and attachment points to resist same maximum load as seismic restraint.
- .4 Drilled or power driven anchors and fasteners not permitted.
- .5 No equipment, equipment supports or mounts to fail before failure of structure.
- .6 Supports of cast iron or threaded pipe not permitted.
- .7 Seismic control measures not to interfere with integrity of firestopping.
- .8 For equipment mounted on housekeeping pad, specify the minimum distance between anchor bolt and edge of housekeeping pad.

.2 Static equipment:

- .1 Anchor equipment to equipment supports. Anchor equipment supports to structure.
- .2 Seismic restraints:

.1 Cushioning action to be gentle and steady.

.2 Shall never reach metal-like stiffness.

.3 Vibration isolated equipment:

.1 Seismic control measures not to jeopardize noise and vibration isolation systems. Provide 6 to 9mm clearance during normal operation of equipment and systems between seismic restraint and equipment.

.2 Provide seismic restraints in addition to vibration isolation system to resist complete isolator unloading.

.4 Fire protection piping systems:

.1 Provide seismic restraints for all piping in accordance to the NFPA 13 2016:

.1 Provide coupling requirements as listed in NFPA 13 2016.

.2 Provide approved seismic separation assembly where sprinkler piping regardless of size, crosses building seismic separation joints above ground level.

.3 Provide clearance around all piping extending through walls, floors, platforms and foundations, including drains, fire department connections and other auxiliary piping.

.4 Provide sway bracing to withstand forces in tension and compression. Tension only bracing systems are permitted for use where listed for this service and where installed in accordance with their listing limitations, including installations instructions.

.5 Provide sway bracing to resist both lateral and longitudinal horizontal seismic load and to prevent vertical motion resulting from seismic loads.

.6 To be compatible with requirements for anchoring and guiding of piping systems. Verify all seismic restraints method and locations with Departmental Representative and Heritage Consultant prior to installations.

.7 All branch piping in the Superstructure shall be supported by rods less than 150mm (6") long measured between the top of the pipe and the point of attachment to the building structure.

.5 Bracing methods:

.1 Approved by Departmental Representative and Heritage Consultant.

.2 Structural angles or channels.

.3 Cable restraint system incorporating grommets, shackles and other hardware to ensure alignment of restraints and to avoid bending of cables at connection points. Incorporate neoprene into cable connections to reduce shock loads.

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 Seismic control measures to meet requirements of NBC.

.2 Install vibration isolation equipment in accordance with manufacturer's instructions and adjust mountings to level equipment.

.3 Ensure piping and electrical connections to isolated equipment do not reduce system flexibility and that piping and conduit passage through walls and floors do not transmit vibrations.

.4 Where isolation is bolted to floor use vibration isolation rubber washers.

.5 Block and shim level bases so that piping connections can be made to rigid system at operating level, before isolator adjustment is made. Ensure that there is no physical contact between isolated equipment and building structure.

.6 Coordinate with Heritage personnel for locations and methods of installation.

3.3 FIELD QUALITY CONTROL

.1 Provide the services of the Professional Engineer(s) who designed the restraint systems for "Field Review" of the installed components, and submit the following to the Departmental Representative:

- .1 Assurance commitment letter, signed and sealed; provided at the commencement of the project.
- .2 Signed and sealed shop drawings of seismic restraints for equipment and piping provided prior to installation.
- .3 Typewritten inspection reports provided during the construction period.
- .4 Schedule C-B, signed and sealed; provided after performing "Field Review".

END OF SECTION 23 05 48

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 01 50 General Instructions

.2 Section 01 35 33 Health and Safety Requirements

.3 Section 23 05 00 Common Work Results – Mechanical

.4 This Section applies to all related work under Divisions 21, 22 and 23.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International):

- .1 CAN/CSA B149.1, Natural Gas and Propane Installation Code.

.2 Canadian General Standards Board (CGSB)

- .1 CAN/CGSB-1.60, Interior Alkyd Gloss Enamel.
- .2 CAN/CGSB-24.3, Identification of Piping Systems.

.3 National Fire Protection Association (NFPA)

- .1 NFPA 13, Standard for the Installation of Sprinkler Systems.

1.3 QUALITY ASSURANCE

.1 Quality assurance submittals: submit following in accordance with Section 01 11 55 – General Instructions.

.2 Health and Safety:

- .1 Do construction occupational health and safety in accordance with Section 01 35 33 - Health and Safety Requirements.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Packing, shipping, handling and unloading:

- .1 Deliver, store and handle in accordance with Section 01 11 55 – General Instructions.
- .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Waste Management and Disposal:

- .1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 11 55 – General Instructions.
- .2 Dispose of unused paint and coating material at official hazardous material collections site approved by Departmental Representative.
- .3 Do not dispose of unused paint and coating material into sewer system, into streams, lakes, onto ground or in locations where it will pose health or environmental hazard.

Part 2 Products

2.1 MANUFACTURER'S EQUIPMENT NAMEPLATES

.1 Metal or plastic laminate nameplate mechanically fastened to each piece of equipment by manufacturer.

.2 Lettering and numbers raised or recessed.

.3 Information to include, as appropriate:

- .1 Equipment: manufacturer's name, model, size, serial number, capacity.
- .2 Motor: voltage, Hz, phase, power factor, duty, frame size.

2.2 SYSTEM NAMEPLATES

.1 Colours:

- .1 Hazardous: red letters, white background.
- .2 Elsewhere: black letters, white background (except where required otherwise by applicable codes).

.2 Construction:

- .1 3 mm thick laminated plastic, matte finish, with square corners, letters accurately aligned and machine engraved into core.

.3 Sizes:

- .1 Conform to following table:

	Sizes (mm)	No. of Lines	Height of Letters (mm)
1	10 x 50	1	3
2	13 x 75	1	5
3	11 x 75	2	3
4	20 x 100	1	8
5	20 x 100	2	5
6	20 x 200	1	8
7	25 x 125	1	12
8	25 x 125	2	8
9	35 x 200	1	20

- .2 Use maximum of 25 letters/numbers per line.

.4 Identification for PWGSC Preventive Maintenance Support System (PMSS):

- .1 Use arrangement of Main identifier, Source identifier, Destination identifier.
- .2 Equipment in Mechanical Room:
  - .1 Main identifier: Size #9.
  - .2 Source and Destination identifiers: Size #6.
  - .3 Terminal cabinets, control panels: Size #5.
- .3 Equipment elsewhere: Sizes as appropriate.

2.3 PIPING SYSTEMS GOVERNED BY CODES

.1 Identification:

.1 Sprinklers: to NFPA 13.

2.4 IDENTIFICATION OF PIPING SYSTEMS

.1 Identify contents by background colour marking, pictogram (as necessary), legend; direction of flow by arrows. To CAN/CGSB 24.3 except where specified otherwise.

.2 Pictograms:

.1 Where required: Workplace Hazardous Materials Information System (WHMIS) regulations.

.3 Legend:

.1 Block capitals to sizes and colours listed in CAN/CGSB 24.3.

.4 Arrows showing direction of flow:

.1 Outside diameter of pipe or insulation less than 75 mm: 100 mm long x 50 mm high.

.2 Outside diameter of pipe or insulation 75 mm and greater: 150 mm long x 50 mm high.

.3 Use double-headed arrows where flow is reversible.

.5 Extent of background colour marking:

.1 To full circumference of pipe or insulation.

.2 Length to accommodate pictogram, full length of legend and arrows.

.6 Materials for background colour marking, legend, arrows:

.1 Pipes and tubing 20 mm and smaller: waterproof and heat-resistant pressure sensitive plastic marker tags.

.2 Other pipes: pressure sensitive [plastic-coated cloth] [vinyl] with protective overcoating, waterproof contact adhesive undercoating, suitable for ambient of 100% RH and continuous operating temperature of 150 degrees C and intermittent temperature of 200 degrees C.

.7 Colours and Legends:

.1 Where not listed, obtain direction from Departmental Representative.

.2 Colours for legends, arrows: to following table:

Background colour:	**Legend, arrows:**
Yellow	BLACK
Green	WHITE
Red	WHITE

.3 Background colour marking and legends for piping systems:

Contents	Background Colour Marking	Legend
Sanitary	Green	SAN
Plumbing vent	Green	SAN.VENT
Fire protection water	Red	FIREPROT.WTR
Sprinklers	Red	SPRINKLERS

2.5 CONTROLS COMPONENTS IDENTIFICATION

.1 Identify all systems, equipment, components, controls, sensors with system nameplates specified in this section.

.2 Inscriptions to include function and (where appropriate) fail-safe position.

2.6 LANGUAGE

.1 Identification in English.

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 TIMING

.1 Provide identification only after painting specified has been completed.

3.3 INSTALLATION

.1 Perform work in accordance with CAN/CGSB-24.3 except as specified otherwise.

.2 Provide CSA registration plates as required by respective agency.

.3 Identify systems, equipment to conform to PWGSC PMSS.

3.4 NAMEPLATES

.1 Locations:

- .1 In conspicuous location to facilitate easy reading and identification from operating floor.

.2 Standoffs:

- .1 Provide for nameplates on hot and/or insulated surfaces.

.3 Protection:

- .1 Do not paint, insulate or cover.

3.5 LOCATION OF IDENTIFICATION ON PIPING SYSTEMS

.1 On long straight runs in open areas in boiler rooms, equipment rooms, galleries, tunnels: at not more than 17 m intervals and more frequently if required to ensure that at least one is visible from any one viewpoint in operating areas and walking aisles.

.2 Adjacent to each change in direction.

.3 At least once in each small room through which piping or ductwork passes.

.4 On both sides of visual obstruction or where run is difficult to follow.

.5 On both sides of separations such as walls, floors, partitions.

.6 Where system is installed in pipe chases, ceiling spaces, galleries, confined spaces, at entry and exit points, and at access openings.

.7 At beginning and end points of each run and at each piece of equipment in run.

.8 At point immediately upstream of major manually operated or automatically controlled valves. Where this is not possible, place identification as close as possible, preferably on upstream side.

.9 Identification easily and accurately readable from usual operating areas and from access points.

.1 Position of identification approximately at right angles to most convenient line of sight, considering operating positions, lighting conditions, risk of physical damage or injury and reduced visibility over time due to dust and dirt.

3.6 VALVES, CONTROLLERS

.1 Valves and operating controllers, except at plumbing fixtures, radiation, or where in plain sight of equipment they serve: Secure tags with non-ferrous chains or closed "S" hooks.

.2 Install one copy of flow diagrams, valve schedules mounted in frame behind non-glare glass where directed by Departmental Representative. Provide one copy (reduced in size if required) in each operating and maintenance manual.

.3 Number valves in each system consecutively.

3.7 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 23 05 53

Part 1 General

1.1 RELATED SECTIONS

.1	Section 01 01 50	General Instructions
.2	Section 01 35 33	Health and Safety Requirements
.3	Section 07 92 00	Joint Sealing.
.4	Section 23 05 00	Common Work Results - Mechanical
.5	Section 23 05 05	Installation of Pipe Work.
.6	Section 23 05 29	Hangers and Supports for Piping and Equipment
.7	Section 23 05 53	Mechanical Identification.
.8	Section 23 07 16	Thermal Insulation for Equipment.

1.2 REFERENCES

.1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)

- .1 ANSI/ASHRAE/IESNA 90.1-2013; Energy Standard for Buildings Except Low-Rise Residential Buildings.

.2 American Society for Testing and Materials International, (ASTM)

- .1 ASTM B209M-10, Specification for Aluminum and Aluminum Alloy Sheet and Plate (Metric).
- .2 ASTM C335/C335M-10e1, Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.
- .3 ASTM C411-11, Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
- .4 ASTM C449-07(2013), Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.
- .5 ASTM C547-12, Standard Specification for Mineral Fiber Pipe Insulation.
- .6 ASTM C553-13, Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
- .7 ASTM C612-14, Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
- .8 ASTM C795-08(2013), Standard Specification for Thermal Insulation for Use with Austenitic Stainless Steel.
- .9 ASTM C921-10, Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.

.3 Canadian General Standards Board (CGSB)

- .1 CGSB 51-GP-52Ma-1989, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.

.4 Thermal Insulation Association of Canada (TIAC):

- .1 Mechanical Insulation Best Practice Guide, 2013.

.5 South Coast Air Quality Management District (SCAQMD), California State

.1 SCAQMD Rule 1168-A2005, Adhesive and Sealant Applications.

.6 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC-S102-07, Surface Burning Characteristics of Building Materials and Assemblies.

.2 CAN/ULC-S701-11, Standard for Thermal Insulation Polyotrene, Boards and Pipe Covering.

.7 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Safety Data Sheets (SDS).

1.3 SUBMITTALS

.1 Submittals: in accordance with Section 01 01 50 – General Instructions.

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 01 50 – General Instructions. Include product characteristics, performance criteria, and limitations.

.1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Safety Data Sheets (SDS) in accordance with Section 01 01 50 – General Instructions.

.3 Shop Drawings:

.1 Submit shop drawings in accordance with Section 01 01 50 – General Instructions.

.4 Quality assurance submittals: submit following in accordance with Section 01 01 50 – General Instructions.

.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.2 Instructions: submit manufacturer's installation instructions.

1.4 QUALITY ASSURANCE

.1 Qualifications:

.1 Installer: Qualified to standards of TIAC.

.2 Health and Safety:

.1 Do construction occupational health and safety in accordance with Section 01 35 33 - 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 01 50 – General Instructions.

.2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.3 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.2 Storage and Protection:

.1 Protect from weather, construction traffic.

.2 Protect against damage.

.3 Store at temperatures and conditions required by manufacturer.

.3 Waste Management and Disposal:

.1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 01 50 – General Instructions.

.2 Place excess or unused insulation and insulation accessory materials in designated containers.

.3 Divert unused metal materials from landfill to metal recycling facility approved by Departmental Representative.

.4 Dispose of unused adhesive material at official hazardous material collections site approved by Departmental Representative.

Part 2 - Products

2.1 FIRE AND SMOKE RATING

.1 In accordance with CAN/ULC-S102:

.1 Maximum flame spread rating: 25.

.2 Maximum smoke developed rating: 50.

2.2 INSULATION

.1 Mineral fibre as specified herein includes glass fibre, rock wool, slag wool.

.2 Thermal conductivity ("k" factor) not to exceed specified values at 24°C mean temperature when tested in accordance with ASTM C335.

.3 TIAC Code A-1: Rigid molded mineral fibre without factory applied vapour retarder jacket.

.1 Mineral fibre: to CAN/CGSB-51.9 / ASTM C547.

.2 Maximum "k" factor: to CAN/CGSB-51.9.

.4 TIAC Code A-2: Rigid molded calcium silicate without factory applied vapour retarder jacket.

.1 Calcium silicate: to CAN/CGSB-51.2 / ASTM C533.

.2 Maximum "k" factor: to CAN/CGSB-51.2.

.5 TIAC Code A-3: Rigid molded mineral fibre with factory applied vapour retarder jacket.

.1 Mineral fibre: to CAN/CGSB-51.9 / ASTM C547.

.2 Jacket: to CGSB 51-GP-52Ma.

.3 Maximum "k" factor: to CAN/CGSB-51.9 / ASTM C547.

.6 TIAC Code C-2: Mineral fibre blanket faced with factory applied vapour retarder jacket (as scheduled in PART 3 of this section).

.1 Mineral fibre: to CAN/ULC-S702 / ASTM C553.

.2 Jacket: to CGSB 51-GP-52Ma.

.3 Maximum "k" factor: to CAN/ULC-S702 / ASTM C553.

.6 TIAC Code A-6: Flexible unicellular tubular elastomer.

.1 Insulation: flexible closed-cell elastomer to ASTM C534.

.2 Jacket: to CGSB 51-GP-52Ma. Required for outdoor application.

.3 Maximum "k" factor: 0.27.

.4 Vapour transmission: 1.34 perm-mm.

.5 To be certified by manufacturer to be free of potential stress corrosion cracking corrodants.

.7 To be formaldehyde free, low VOC; resists mold and mildew.

.8 Evidence shall be provided to the Departmental Representative on the site of ULC listings of all products being used. Duct insulation adhesives and coatings shall be non-toxic as defined by WCB Regulations.

2.3 INSULATION SECUREMENT

.1 Tape: Self-adhesive, aluminum, reinforced, 50mm wide minimum.

.2 Contact adhesive: Quick setting.

.1 Maximum VOC limit 80 g/L to SCAQMD Rule 1168.

.3 Canvas adhesive: Washable.

.1 Maximum VOC limit 250 g/L to SCAQMD Rule 1168.

.4 Tie wire: 1.5mm diameter stainless steel.

.5 Bands: Stainless steel, 19mm wide, 0.5mm thick.

2.4 CEMENT

.1 Thermal insulating and finishing cement:

.1 To CAN/CGSB-51.12.

.2 Hydraulic setting or Air drying on mineral wool, to ASTM C 449.

2.5 VAPOUR RETARDER LAP ADHESIVE

.1 Water based, fire retardant type, compatible with insulation.

2.6 INDOOR VAPOUR RETARDER FINISH

.1 Vinyl emulsion type acrylic, compatible with insulation.

2.7 OUTDOOR VAPOUR RETARDER FINISH

.1 Vinyl emulsion type acrylic, compatible with insulation.

.2 Reinforcing fabric: Fibrous glass, untreated 305 g/m.

.1 Polyvinyl Chloride (PVC):

.1 One-piece moulded type and sheet to CGSB 51-GP-53M with pre-formed shapes as required.

.2 Colours: White.

.3 Minimum service temperatures: 20°C.

.4 Maximum service temperature: 65°C.

.5 Moisture vapour transmission: 0.02 perm.

.6 Fastenings:

.1 Use solvent weld adhesive compatible with insulation to seal laps and joints.

.2 Tacks.

.3 Pressure sensitive vinyl tape of matching colour.

.2 Canvas:

.1 220 and 120 gm/m cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C 921.

.2 Lagging adhesive: Compatible with insulation.

.1 Maximum VOC limit 250 g/L to SCAQMD Rule 1168.

.3 Aluminum:

.1 To ASTM B 209 with and without moisture barrier as scheduled in PART 3 of this section.

.2 Thickness: 0.50 mm sheet.

.3 Finish: Stucco embossed.

.4 Jacket banding and mechanical seals: 19 mm wide, 0.5 mm thick stainless steel.

2.9 WEATHERPROOF CAULKING FOR JACKETS INSTALLED OUTDOORS

.1 Caulking to: Section 07 92 00 - Joint Sealing.

Part 3 - Execution

3.1 PRE-INSTALLATION REQUIREMENT

.1 Pressure testing of piping systems and adjacent equipment to be complete, witnessed and certified.

.2 Surfaces to be clean, dry, free from foreign material.

3.2 INSTALLATION

.1 Install in accordance with TIAC National Standards.

.2 Apply materials in accordance with manufacturer's instructions and this specification.

.3 Use two layers with staggered joints when required nominal wall thickness exceeds 75mm.

.4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.

.1 Hangers, supports to be outside vapour retarder jacket.

.5 Supports, hangers:

.1 Apply high compressive strength insulation, suitable for service, at oversized pipe supports, saddles and shoes. See Section 23 05 29 – Hangers and Supports for Piping and Equipment.

.6 Seal vapor barrier penetrations with vapor barrier adhesive.

3.3 REMOVABLE, PRE-FABRICATED, INSULATION AND ENCLOSURES

.1 Application: At expansion joints, valves, primary flow measuring elements flanges and unions at equipment.

.2 Design: To permit movement of expansion joint and to permit periodic removal and replacement without damage to adjacent insulation.

.3 Insulation:

.1 Insulation, fastenings and finishes: same as system.

.2 Jacket: high temperature fabric for indoor applications and aluminum for outdoor applications.

3.4 INSTALLATION OF ELASTOMERIC INSULATION

.1 Insulation to remain dry at all times. Overlaps to manufacturer's instructions. Ensure tight joints.

.2 Provide vapour retarder as recommended by manufacturer.

3.5 PIPING INSULATION SCHEDULES

.1 Includes valves, valve bonnets, strainers, flanges and fittings unless otherwise specified.

.2 TIAC Code: A-1.

.1 Securements: SS Bands at 300mm on centre.

.2 Seals: lap seal adhesive, lagging adhesive.

.3 Installation: TIAC Code 1501-H.

.3 TIAC Code: A-2.

.1 Securements: SS Bands at 300mm on centre.

.2 Seals: lap seal adhesive, lagging adhesive.

.3 Installation: TIAC Code 1501-H.

.4 Direct contact with pipe and hanger is not acceptable. Install hanger outside of sheet metal protection shield covering an insert section of high density calcium silicate insulation.

.4 TIAC Code: A-3.

.1 Securements: SS Bands at 300mm on centre.

.2 Seals: VR lap seal adhesive, VR lagging adhesive.

.3 Installation: TIAC Code: 1501-C.

.5 TIAC Code: A-6.

.1 Seals: lap seal adhesive, lagging adhesive.

.2 Installation: TIAC Code: 1501-CA; per manufacturer's recommendation.

.6 TIAC Code: C-2 with vapour retarder jacket.

.1 Insulation securements: SS Bands at 300mm on centre.

.2 Seals: lap seal adhesive, lagging adhesive.

.3 Installation: TIAC Code: 1501-C.

.7 Thickness of insulation to be as listed in following table.

.1 Run-outs to individual units and equipment not exceeding 4000mm long.

.2 Do not insulate exposed run-outs to plumbing fixtures, chrome plated piping, valves, fittings.

Application	Temp °C	TIAC Code	Run out	To NPS1	1 ¼-2	2 ½-4	5-6	8 & over
Fire Protection		A-3	25	25	25	25	25	25

.7 Finishes:

.1 Exposed indoors: PVC jacket.

.2 Exposed in mechanical rooms: PVC jacket.

.3 Concealed, indoors: canvas on valves, fittings. No further finish.

.4 Use vapour retarder jacket on TIAC code A-3 insulation compatible with insulation.

.5 Outdoors: Water-proof Aluminium, or SS jacket.

.6 Finish attachments: SS screws or bands, at 150 mm oc. Seals: wing or closed.

.7 Installation: To appropriate TIAC code CPF/1 through CPF/5.

3.6 CLEANING

.1 Proceed in accordance with Section 01 01 50 – General Instructions.

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION 23 07 19

PART 1 – GENERAL

1. Summary

1. The purpose of this section is to specify the electrical contractor's responsibilities in the commissioning process.

2. An independent firm (CES Engineering Ltd) specializing in building systems commissioning has been retained by the Owner to act as the project Commissioning Authority (CA). This firm will be responsible to manage and administrate the commissioning process on this project.

3. The list of commissioned equipment and systems is found in Section 01 91 13 Commissioning – General Requirements. Commissioning requires the participation of contractor to ensure that all systems are operating in a manner consistent with the Contract Documents. The general commissioning requirements and coordination are detailed in the same section.

4. Contractors shall be familiar with all parts of Section 01 91 13 Commissioning – General Requirements, 01 91 41 Commissioning – Training, and the Commissioning Plan issued by the CA and shall execute all commissioning responsibilities assigned to them in the Contract Documents.

2. Responsibilities

1. General

    1. The responsibilities of the Project Manager, General Contractor, Architect, Mechanical and Electrical Consultants/Engineers (A/E), and Commissioning Authority in the commissioning process are provided in Section 01 91 13 Commissioning General Requirements.

    2. Include the cost of commissioning in the contract price as identified in section 01 91 13.

2. Electrical Sub-Contract Trade(s): The commissioning responsibilities applicable to the electrical contractor are as follows (all references apply to commissioned equipment only):

    1. Construction and Acceptance Phases:
        1. Test and commission the system listed in 01 91 13 and Part 3 of this specification.
        2. Include the cost of participating in the commissioning process as outlined in the specifications in the total contract price.
        3. All parties involved must be cognizant of industry-standard safety procedures. This document does not contain any procedures including specific safety procedures. It is recognized that an overwhelming majority of the tests and inspections

recommended in these specifications are potentially hazardous. Individuals performing these tests shall be qualified and capable of conducting the tests in a safe manner and with complete knowledge of the hazards involved.

4. In each purchase order or subcontract written, include requirements for submittal data, O&M data and training.
5. Attend a commissioning scoping meeting and other necessary meetings scheduled by the CA to facilitate the Cx process.
6. Contractors shall provide normal cut sheets and shop drawing submittals to the CA of commissioned equipment.
7. Provide additional requested documentation, prior to normal O&M manual submittals, to the CA for development of start-up and functional testing procedures:
    1. Typically this will include detailed manufacturer installation and start-up, operating, troubleshooting and maintenance procedures, full details of any owner-contracted tests, full factory testing reports, if any, and full warranty information, including all responsibilities of the Owner to keep the warranty in force clearly identified. In addition, the installation and checkout materials that are actually shipped inside the equipment and the actual field checkout sheet forms to be used by the factory or field technicians shall be submitted to the Commissioning Authority.
    2. The Commissioning Authority may request further documentation necessary for the commissioning process.
    3. This data request may be made prior to normal submittals.
8. Provide a copy of the O&M manuals submittals of commissioned equipment, through normal channels, to the CA for review and approval.
9. Contractors shall assist (along with the design consultants) in clarifying the operation and control of commissioned equipment in areas where the specifications, control drawings or equipment documentation is not sufficient for writing detailed testing procedures.
10. Develop and submit a test plan using manufacturer's start-up procedures and the prefunctional checklists from the CA (or similar) for all commissioned equipment. Submit to CA for review and approval prior to start of inspection and testing. Refer to Section 01 91 13 and this section for further details on start-up plan preparation.
11. Provide assistance to the CA in preparing the specific functional performance test procedures as specified in Section 01 91 13 and in this section. Subs shall review test procedures to ensure feasibility, safety and equipment protection and provide necessary written alarm limits to be used during the tests.
12. Provide notification to the CA prior to the commencement of any electrical commissioning activity.
13. Perform and document inspection and testing for electrical equipment and systems according to the agreed upon test plan, and using the using manufacturer's start-up procedures and the prefunctional checklists from the CA for all commissioned equipment.
14. During the startup and initial checkout process for mechanical equipment, coordinate work with the other divisions as required to execute and document the electrical-related portions of the pre-functional checklists for mechanical equipment.
15. Perform and clearly document all completed inspections and testing activities, including notification of any deficiencies, providing a copy to the CA prior to the start of functional testing phase.
16. Address current A/E punch list items before the start of functional testing.

17. Provide skilled technicians to execute starting of equipment and to execute the functional performance tests. Ensure that they are available and present during the agreed upon schedules and for sufficient duration to complete the necessary tests, adjustments and problem-solving.
18. Perform functional performance testing, witnessed by the CA, for specified equipment in Section 01 91 13 and in this section. Assist the CA in interpreting the inspection and testing data, as necessary.
19. Correct deficiencies (differences between specified and observed performance) as interpreted by the CA, GC and A/E and retest the equipment.
20. Prepare O&M manuals according to the Contract Documents, including clarifying and updating the original sequences of operation to as-built conditions.
21. During construction, maintain as-built red-line drawings for all drawings and final CAD as-builts for contractor-generated coordination drawings. Update after completion of commissioning (excluding deferred testing).
22. Provide training of the Owner's operating personnel as specified.
23. Coordinate with equipment manufacturers to determine specific requirements to maintain the validity of the warranty.

PART 2 – PRODUCTS

1. Test Equipment

1. Contractor shall provide all test equipment necessary to fulfill the testing requirements of this section.

2. The equipment to be provided shall include, but is not limited to:
   1. Electrical measurements: ohmmeter, voltmeter, ammeter and wattmeter;
   2. Any other equipment specified by the manufacturer to perform required testing and verification.

3. Suitability of Test Equipment
   1. All test equipment shall meet the calibration requirements below and be in good mechanical and electrical condition.
   2. Accuracy of metering in test equipment shall be appropriate for the test being performed.

4. Test Instrument Calibration
   1. The electrical contractor / designated commissioning agent shall have a calibration program which assures that all applicable test instruments are maintained within rated accuracy for each test instrument calibrated.
   2. The firm providing calibration service shall maintain up-to-date instrument calibration instructions and procedures for each test instrument calibrated.
   3. The accuracy shall be directly traceable to the National Institute of Standards and Technology (NIST).
   4. Instruments shall be calibrated in accordance with the following frequency schedule:
   1. Field instruments: Analog and digital, 12 months maximum.
   2. Laboratory instruments: 12 months maximum.

3. Leased specialty equipment: 12 months maximum.
5. Dated calibration labels shall be visible on all test equipment.
6. Records, which show date and results of instruments calibrated or tested, must be kept up-to-date.

5. Refer to 01 91 13, Part 2 – Products for additional requirements.

PART 3 – EXECUTION

1. Submittals

1. Contractor shall provide submittal documentation relative to commissioning as required in Part 1 of this section, 01 91 13 Commissioning - General Requirements, and the Commissioning Plan.

2. Generally, the following shop drawing submittals are required as related to the commissioning process:
   1. All new LV Distribution Equipment
   2. Automatic Transfer Switches & Sequence of Operation
   3. Panelboards
   4. Motor Control Centres (MCC)
   5. Wiring Devices

3. Additional technical submittals shall be provided as requested at the initial commissioning meetings and dependent on the technical scope of the project.

4. The shop drawings are reviewed by the CA for commissioning purposes only and this process is separate to the Engineer's review.

5. The Transfer Scheme (or ATS) submittal shall include a sequence of operation showing the starting sequence of transfer switches on loss of power and resumption.

6. The Fire Alarm System submittal shall contain a system operation matrix which shall include sequence of operation for the fire alarm system and the cause/effect of all systems interfaced with the fire alarm system.

2. Pre-Start Up

1. Carry out all Factory Acceptance Tests and off-site pre-commissioning as directed by the technical specifications of Division 26.

3. Start-up, Pre-functional Checklists and Initial Checkout

1. General

1. The sub-contract trades shall follow the start-up and initial checkout procedures listed in this section, in 01 91 13 and in Division 26.
2. The following system start-up procedures are presented as a minimum standard of acceptance to validate the commissioning of the identified systems. Requirements listed in the electrical consultant's specification sections may differ from the requirements listed below. The most onerous requirements shall be carried by the contractor in all cases.
3. Submit all test results in typed format (not handwritten).

2. Distribution Cables
    1. Check cables are properly installed, terminated and tightened to the correct torque values.
    2. Check and record cable sizes, types and method of installation.
    3. Check and confirm the installed cable sizes are of adequate rating, taking into consideration the type of cable, the method of installation, the correction factors and any other requirements.
    4. Grounding test to ensure the equipment, the conduit and the cable armour / sheath, if applicable, are properly grounded.
    5. Prior to energizing any portion of the electrical system perform insulation resistance test on all new feeders. Test to include phase to phase and phase to ground using appropriate DC test level for voltage level of equipment. Result to conform to the Canadian Electrical Code, to the satisfaction of the Local Inspection Authority having jurisdiction, and to the Engineer.

3. Transformers
    1. Check and record nameplate data.
    2. Check and report the transformer enclosure is suitable for the environment in which it is installed.
    3. Check and record sizes and types of primary and secondary protection devices, conductor sizes and types.
    4. Check cables are properly installed, terminated and tightened to the correct torque values.
    5. Megger the primary and secondary windings.
    6. Measure the primary and secondary winding resistances.
    7. Measure turns ratio, capacitance and dissipation factor.
    8. Grounding test to ensure transformer is properly grounded.

4. Distribution Panelboards and Branch Circuit Panelboards
    1. Check and record nameplate data.
    2. Check and report the panel enclosure is suitable for the environment in which it is installed.
    3. Check cables are properly installed, terminated and tightened to the correct torque values.
    4. Check and test to verify the panelboard directory is correct for all new circuits.
    5. Include the directory in the test records. The directory shall contain the size of each breaker, equipment served, cable type and size.
    6. Check and test the voltage drop is within the specified limit from the service entrance switchboard to the distribution panels and branch panelboards.
    7. Grounding test to ensure panelboards are properly grounded.
    8. Measure voltage and load current on each phase. Submit test reports to Consultant. When required, re-arrange branch circuits as directed by the Consultants for proper load balancing.

4. Functional Performance Testing

1. General
   1. Refer to Section 01 91 13 for a list of systems to be commissioned and to Division 26 technical specifications for a description of the process and for specific details on the required functional performance tests.
   2. Division 26 is responsible for all installation, inspections and testing required to complete systems and sub-systems to ensure that they are fully functional, meeting the design objectives of the Contract Documents. The commissioning procedures and Functional Testing requirements listed under this section do not relieve or lessen this responsibility or shift that responsibility partially to the Commissioning Authority or Owner
   3. Functional testing is intended to begin upon completion of the start- up stage. Functional testing may proceed prior to the completion of systems, or sub-systems at the discretion of the CA and Contractor.
   4. The functional performance testing phase shall not commence until the Start-Up activities have been completed to the satisfaction of the CA. Beginning functional testing prior to completion of start-up does not relieve the Contractor from fully completing the system, including all pre-functional checklists as soon as possible

2. Emergency Lighting and Exit Signs
   1. Perform operational test to verify operation of the emergency lighting system, including devices powered by building emergency distribution.

3. Fire Alarm System
   1. Manufacturer shall carry out following tests:
      1. Perform system verifications and tests according to CAN/ULC-S537.
      2. Check and verify all system operations shown in the matrix.
      3. Perform system integration test to verify proper fire alarm system operation, and the proper operations of all systems interfaced with the fire alarm system.
      4. Submit verification reports and system operation verification reports.
   2. Perform operational test to verify:
      1. FA system monitoring Fire Protection System flow and supervisory valves
      2. Sample device checks for smoke detectors, pull stations, etc.

5. Testing Documentation, Non-Conformance, and Approvals

1. Refer to Section 01 91 13 for specific details on non-conformance issues relating to pre-functional checklists and tests.

2. Refer to Section 01 91 13 for issues relating to functional performance tests.

6. Operation and Maintenance (O&M) Manuals and Systems Manuals

1. Contractor shall compile and prepare documentation for all equipment and systems covered in the Division 26 sections of the Performance Specification documents.

2. Contractor shall deliver O&M documents according to Section 01 91 13 Commissioning General Requirements and other applicable sections of the Performance Specification documents.

3. The CA shall receive a copy of the O&M manuals for review

4. Where required the contractor shall provide the following information to the CA to assist in compilation of the Systems Manual. The CA is responsible for production of the Systems Manual. Information to be provided by the contractor includes:
    1. Approved equipment submittals including Sequence of Operation.
    2. Contractor & Supplier listing with contact information.
    3. Copy of all permits and certificates.
    4. All data generated during the commissioning process, including start-up reports, evaluation checklists and completed test certificates and reports.
    5. List of all incomplete/ deferred testing.
    6. Manufacturer's recommended preventive maintenance instructions.

5. Review of the commissioning related sections of the O&M manuals shall be made by the A/E and by the CA. Refer to Section 01 91 13 for details.

7. Training of Owner Personnel

1. Demonstration and training shall not proceed until the following tasks and deliverables have been completed and reviewed/approved by the CA:
    1. Functional Performance Testing Completed, including Issues Log summarizing status/remaining issues. Systems verified to be operating to design intent.
    2. O&M Manuals have been reviewed, approved, and final version submitted to the owner
    3. Record Drawings completed and submitted to the owner. In the absence of final Record Drawings, a full colour, full size scanned copy of the as-builts may be provided by the contractor in both hard and digital copy.

2. Detail information regarding contents, duration and instructors for any particular system is included in Section 01 91 41: Commissioning –Training.

8. Deferred and Seasonal Testing

1. Refer to Section 01 91 13, Part 3.13 for general requirements of deferred testing.

2. Voltage Checks
    1. Make voltage checks throughout the project after the project has been in operation for 30 days, and at this time, if directed by the Consultant, adjust transformers tap settings. Readings taken shall be logged, tabulated and any adjustments made to

building system shall be suitably incorporated in the Operating & Maintenance Manuals.

3. The Contractor shall allow for at least 2 separate 4 hour visits to the site for general trouble shooting and overseeing the operation and maintenance of all systems and equipment during the first full year warranty period following the final Commissioning and Substantial Performance Certificate being issued.
    1. These site meetings are over and above normal trouble and warranty call backs.
    2. These site visits shall be coordinated with post-occupancy review performed by the design professionals and Commissioning Authority.
    3. The purpose of these site visits is to investigate and troubleshoot the system operations and any problems and to ensure that all systems and equipment are being properly operated and maintained.

9. Written Work Products

1. Contractor's written work products will consist of the startup and initial checkout plan and functional testing described in this section and Section 01 91 13 Commissioning – General Requirements and the completed startup, initial checkout and pre-functional, and functional checklists.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 11 55 – General Instructions.

.1 Note in particular clauses 1.3.5 and 1.3.6 as they refer to the heritage issues related to work in the building.

.2 All specification sections prefix-numbered 26

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.1-15, Canadian Electrical Code, Part 1 (23rd Edition), Safety Standard for Electrical Installations.

.2 Every reference to a CAN/ULC or CSA standard in all sections of the specification shall be a reference to the latest published edition at the time of tender.

1.3 DESIGN REQUIREMENTS

.1 Operating voltages: to CAN3-C235. Latest published edition.

.2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard.

.1 Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

1.4 SUBMITTALS

.1 Submittals: in accordance with Section 01 11 55 – General Instructions.

.2 Submit copy of electrical permit for the project to Departmental Representative prior to commencement of work. Departmental Representative will provide drawings required by Electrical Inspection Department at no cost.

.1 Pay associated fees.

.2 Notify Departmental Representative of changes required by Electrical Inspection Department prior to making changes.

.3 Furnish certificate of acceptance from Electrical Inspection Department upon completion of the work.

.3 Shop drawings:

.1 Submit shop drawings and product data.

.2 Indicate details of construction, dimensions, capacities, weights and electrical performance characteristics of equipment or material.

.3 Where applicable, include wiring, single line and schematic diagrams.

.4 Include wiring drawings or diagrams showing interconnection with work of other Sections.

.5 Submit 6 copies of shop drawings and product data to the Departmental Representative.

.4 Provide operation and maintenance data for incorporation into operation and maintenance manual specified in Section 01 11 55 – General Instructions.
Include in operations and maintenance data:

.1 Details of design elements, construction features, component function and maintenance requirements, to permit effective start-up, operation, maintenance, repair, modification, extension and expansion of any portion or feature of installation.

.2 Technical data, product data, supplemented by bulletins, component illustrations, exploded views, technical descriptions of items, and parts list. Advertising or sales literature not acceptable.

.3 Wiring and schematic diagrams.

.4 Names and addresses of local suppliers for items included in maintenance manuals.

.5 Copy of reviewed shop drawings.

.5 Quality Control: in accordance with Section 01 11 55 – General Instructions.

.1 Provide CSA certified equipment and material.

.2 Submit test results of installed electrical systems.

.3 Permits and fees: in accordance with General Conditions of contract.

.4 Submit to Departmental Representative certificate of acceptance from authority having jurisdiction upon completion of Work.

.6 Record Drawings

.1 Provide record drawings of the installation as specified in Section 01 11 55 – General Instructions.

1.5 QUALITY ASSURANCE

.1 Quality Assurance: in accordance with Section 01 11 55 – General Instructions.

.2 Qualifications: electrical Work to be carried out by qualified personnel in accordance with the requirement of authorities having jurisdiction.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Material Delivery Schedule: provide Departmental Representative with schedule within 2 weeks after award of Contract.

.2 Construction/Demolition Waste Management and Disposal: where applicable separate waste materials for recycling in accordance with Section 01 11 55 – General Instructions.

1.7 SYSTEM STARTUP

.1 Instruct Departmental Representative and operating personnel in operation, care and maintenance of systems, system equipment and components.

.2 Where applicable and as further specified, arrange and pay for services of manufacturer's factory service Departmental Representative to supervise start-up of installation, check, adjust, balance and calibrate components and instruct operating personnel.

.3 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with aspects of its care and operation.

1.8 OPERATING INSTRUCTIONS

.1 Provide for each system and principal item of equipment as specified in technical sections for use by operation and maintenance personnel.

.2 Operating instructions to include following:

.1 Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.

.2 Start up, proper adjustment, operating, lubrication, and shutdown procedures.

.3 Safety precautions.

.4 Procedures to be followed in event of equipment failure.

.5 Other items of instruction as recommended by manufacturer of each system or item of equipment.

Part 2 Products

2.1 MATERIALS AND EQUIPMENT

.1 Provide material and equipment in accordance with Section 01 11 55 – General Instructions.

.2 Material and equipment to be CSA certified.

.3 Factory assemble control panels and component assemblies.

2.2 WIRING TERMINATIONS

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

2.3 EQUIPMENT IDENTIFICATION

.1 Identify electrical equipment with nameplates and labels as follows:

.1 Nameplates: lamicoid plastic engraving sheet, black face, white core, lettering accurately aligned and engraved into core attached with Loctite 414 adhesive. No pre-gummed labels are acceptable.

.2 Sizes as follows:

NAMEPLATE SIZES

Size 1	10 x 50 mm	1 line	3 mm high letters
Size 2	12 x 70 mm	1 line	5 mm high letters
Size 3	12 x 70 mm	2 lines	3 mm high letters
Size 4	20 x 90 mm	1 line	8 mm high letters
Size 5	20 x 90 mm	2 lines	5 mm high letters
Size 6	25 x 100 mm	1 line	12 mm high letters
Size 7	25 x 100 mm	2 lines	6 mm high letters

.2 Labels: plastic labels with 4mm high letters unless specified otherwise.

.3 Wording on nameplates and labels to be approved by Departmental Representative prior to manufacture.

.4 Allow for minimum of twenty-five (25) letters per nameplate and label.

.5 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.

.6 Disconnects, starters and contactors: indicate equipment being controlled and voltage.

.7 Terminal cabinets and pull boxes: indicate system and voltage.

2.4 WIRING IDENTIFICATION

.1 Identify wiring with permanent indelible identifying markings, either numbered or coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.

.2 Maintain phase sequence and colour coding throughout.

.3 Colour coding: to CSA C22.1 - 2015

2.5 FINISHES

.1 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.

.2 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

Part 3 Execution

3.1 INSTALLATION

.1 Do complete installation in accordance with CSA C22.1 - 2015, BC Amendments, Directives and Bulletins except where specified otherwise.

.2 Do not cut, bore, or otherwise damage treated wood unless approved in writing. If cutting any treated wood is approved, treat all field cuts and damage in accordance with CSA O80

– Series 15 with a minimum of two coats of field preservative treatment as identified in the standard.

3.2 NAMEPLATES AND LABELS

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

3.3 FIRESTOPPING

.1 Where cables or conduits pass through floors and fire rated walls, pack space full with a ULC approved firestopping system.

.2 Fire stopping is specified in Section 07 84 00 – Fire Stopping.

3.4 LOCATION OF OUTLETS

.1 Locate outlets in accordance with Section 26 05 32 - Outlet Boxes, Conduit Boxes and Fittings.

.2 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000mm, and information is given before installation.

3.5 FIELD QUALITY CONTROL

.1 Carry out tests in presence of Departmental Representative or his representative. Submit written test results for review.

.2 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.

3.6 CLEANING

.1 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.

END OF SECTION

Part 1 General

Part 2 Products

Part 3 Execution

3.1 FIXING, HANGING

.1 All wiring shall be fixed to or hung from building structure and shall not be fixed to or hung from building services, i.e., ducts, pipes, electrical conduits, sprinkler pipes, etc.

3.2 CONCEALMENT

.1 Wiring, in general, shall be concealed where possible. Wiring may be concealed by running on tops of beams to make it invisible from below, in hollow walls and partitions and above ceilings.

3.3 SURFACE WIRING IN FINISHED AREAS

.1 Finished areas of the building are all areas except the mechanical rooms and similar service rooms.

.2 Any wiring proposed to be run exposed in finished areas of the buildings shall not be installed until all means of possible concealment have been investigated with the Departmental Representative. Such surface wiring shall be approved by the Departmental Representative as shall the routing. Where exposed, wiring shall be installed in corners of walls/roof joins or joins of structural and architectural components with intent to minimize impact of the visual aesthetic.

.3 Surface wiring in finished areas shall be enclosed in EMT unless otherwise indicated. Junction, pull and outlet boxes for surface wiring shall be concealed from view, where possible.

3.4 USE OF EMT CONDUIT

.1 For concealed wiring:

.1 Wiring shall be installed in EMT.

.2 Except as otherwise indicated or specified, all systems inside buildings shall be wired in EMT including lighting, power, receptacles, fire alarm, and other systems including low voltage systems.

.2 For exposed wiring:

.1 Exposed-to-view wiring inside buildings shall be in EMT or conduit and wire.

3.5 USE OF RIGID PVC CONDUIT

.1 Use rigid pvc conduit with stainless steel straps and hardware where wiring is installed under or outside the building, to protect the wiring from the proximity of the marine environment.

3.6 **USE OF FLEXIBLE CONDUIT OR AC (BX) CABLE**

.1 AC (BX) cable or flexible conduit may be used where wiring is concealed and is installed above dropped plaster ceilings or on the tops of structure to make it unable to be viewed.

.2 Where flexible conduit is used, provide ground bond wire in conduit.

.3 Flexible conduit or AC (BX) cable where used shall be installed on the square parallel to building lines and be straight and taut between fixing points. Provide in excess of code-required fixing points as necessary to maintain AC (BX) cable taut and straight between fixing points.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for wire and box connectors.

1.2 RELATED SECTIONS

.1 Section 01 11 55 – General Instructions

.2 Section 26 05 21 – Wires and Cables (0-1000V)

.3 Section 26 05 00 – Common Work Results – For Electrical

1.3 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.2No.65, Wire Connectors. Latest published version.

Part 2 Products

2.1 MATERIALS

.1 Pressure type wire connectors to: CSA C22.2No.65, with current carrying parts of copper or copper alloy sized to fit copper conductors as required.

.2 Fixture type splicing connectors to: CSA C22.2No.65, with current carrying parts of copper or copper alloy sized to fit copper conductors 10 AWG or less.

.3 Clamps or connectors as required to: CAN/CSA-C22.2No.18.

Part 3 Execution

3.1 INSTALLATION

.1 Remove insulation carefully from ends of conductors and:

.1 Install mechanical pressure type connectors and tighten screws or secure with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CSA C22.2No.65.

.2 Install fixture type connectors and tighten. Replace insulating cap.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 11 55 – General Instructions

.2 Section 26 05 20 - Wire and Box Connectors - 0 - 1000 V.

.3 Section 26 05 00 – Common Work Results – For Electrical

1.2 REFERENCES

.1 CSA C22.2 No .0.3, Test Methods for Electrical Wires and Cables. Latest published edition.

1.3 PRODUCT DATA

.1 Submit product data in accordance with Section 01 11 55 – General Instructions.

Part 2 Products

2.1 BUILDING WIRES

.1 Conductors: Minimum size: 12 AWG.

.2 Copper conductors: size as indicated, with 600V insulation of chemically cross-linked thermosetting polyethylene material rated RW90. Note: THHN not acceptable.

.3 As armoured cable in accordance with Section 26 05 10.

2.2 ARMOURED CABLES

.1 Conductors: Minimum size: 12 AWG.

.2 Type: AC 90

.3 Armour: Interlocking

Part 3 Execution

3.1 INSTALLATION OF BUILDING WIRES

.1 Install wiring as follows:

.1 In conduit systems in accordance with Section 26 05 34.

.2 As cable systems in accordance with Section 26 05 10.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 11 55 – General Instructions

.2 Section 26 05 00 – Common Work Results for Electrical

.3 Section 26 05 31 –Junction, Pull Boxes and Cabinets

.4 Section 26 05 32 – Outlet Boxes, Conduit Boxes and Fittings

.5 Section 26 05 34 – Conduits, Conduit Fastenings and Conduit Fittings

.6 Section 26 05 37 – Wireways and Auxiliary Gutters

.7 Section 26 12 17 – Dry Type Transformers Up To 600V Primary

.8 Section 26 31 02 – Fire Alarm System

.9 Section 26 52 01 – Inverter Unit for Emergency Lighting

.10 Section 26 52 02 – Unit equipment for Emergency Lighting

Part 2 Products

2.1 SUPPORT CHANNELS

.1 U shape, size 41 x 41 mm, 2.5 mm thick, surface mounted or suspended.

.2 Stainless steel U shape, size 41 x 41 mm, 2.5 mm thick, surface mounted or suspended where used under or outside buildings.

Part 3 Execution

3.1 INSTALLATION

.1 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.

.2 Fasten exposed conduit or cables to building construction or support system using straps.

- .1 One-hole 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.
- .4 Use stainless steel components outdoors or under buildings.

.3 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.

.4 Do not use wire lashing or perforated strap to support or secure raceways or cables.

.5 Do not use supports or equipment installed for other trades for conduit or cable support.

.6 Install fastenings and supports as required for each type of wired equipment, cables and conduits, and in accordance with manufacturer's installation recommendations.

.7 Provide seismic restraint of electrical components including:

.1 Light fixtures installed under this contract

.2 Transformers installed under this contract as well as existing units indicated on the drawings.

.3 Standby generator installation

.8 All hangers, supports and brackets shall be provided and be installed to be consistent with the requirements of Table 4.1.8.18 of Section 4 of the National Building Code 2015.

.9 Following installation of all equipment and fixings, retain the services of a Structural Engineer registered with APEGBC to provide a structural review of the fixings of devices forming part of the electrical installation. Provide, as a result of this review, a signed and sealed report indicating the installation complies with the requirements of the National Building Code 2015 pertaining to seismic restraint. The importance factor for earthquake loads and effects shall be “normal”.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 11 55 – General Instructions

.2 Section 26 05 00 – Common Work Results – For Electrical

Part 2 Products

2.1 JUNCTION AND PULL BOXES

.1 Welded steel or aluminum construction with screw-on flat covers for surface mounting.

Part 3 Execution

3.1 JUNCTION AND PULL BOXES INSTALLATION

.1 Install pull boxes in inconspicuous but accessible locations.

.2 Install pull boxes so as not to exceed 30m of conduit run between pull boxes.

3.2 IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results - Electrical.

.2 Install size 2 identification labels indicating system name, voltage and phase.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 CSA C22.1-2015, Canadian Electrical Code, 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 Blank cover plates for boxes without wiring devices.

2.2 SHEET STEEL OUTLET BOXES

.1 Electro-galvanized steel single and multi gang flush device boxes for flush installation, minimum size 76 x 50 x 38 mm. 102 mm square outlet boxes when more than one conduit enters one side with extension and plaster rings as required.

.2 Electro-galvanized steel utility boxes for outlets connected to surface-mounted EMT conduit, minimum size 102 x 54 x 48 mm.

2.3 CONDUIT BOXES

.1 Cast FS or FD aluminum or feraloy boxes with factory-threaded hubs and mounting feet for surface wiring of components and devices.

.2 Surface wiremold boxes. Boxes without knockouts.

2.4 FITTINGS - GENERAL

.1 Bushing and connectors with nylon insulated throats.

.2 Knock-out fillers to prevent entry of debris.

Part 3 Execution

3.1 INSTALLATION

.1 Support boxes independently of connecting conduits.

.2 Use FS or FD boxes or wiremold boxes for surface mounted outlets and junction boxes.

.3 Provide correct size of openings in boxes for conduit connections. Reducing washers are not allowed.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 11 55 – General Instructions

.2 Section 26 05 00 – Common Work Results – For Electrical

1.2 REFERENCES

.1 Canadian Standards Association

.1 CSA C22.2 No. 56, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit. Latest published edition.

.2 CSA C22.2 No. 83, Electrical Metallic Tubing. Latest published edition.

.3 CSA C22.2 No. 211.2, Rigid PVC (Unplasticized) Conduit. Latest published edition.

1.3 SUBMITTALS

.1 Provide submittals in accordance with Section 01 11 55 – General Instructions.

Part 2 Products

2.1 CONDUITS

.1 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with steel fittings.

.2 Flexible metal conduit: to CSA C22.2 No. 56, steel or aluminum liquid-tight flexible metal.

.3 Rigid PVC

2.2 CONDUIT FASTENINGS

.1 One hole steel straps to secure surface conduits 50 mm and smaller, except as otherwise noted.

.2 Use stainless steel components outside or under buildings.

2.3 CONDUIT FITTINGS

.1 Fittings: to CAN/CSA C22.2 No. 18, manufactured for use with conduit specified.

.1 Coating: same as conduit.

.2 Material: Steel (Cast fittings are not acceptable).

.2 Factory "ells" where 90 degrees bends for 21 mm and larger conduits.

2.4 FISH CORD

.1 Polypropylene.

Part 3 Execution

3.1 INSTALLATION

.1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.

.2 Conceal conduits where possible except in mechanical and electrical service rooms.

.3 Surface mount conduits in mechanical and electrical rooms, unfinished areas and elsewhere as noted on the drawings.

.4 Use electrical metallic tubing EMT except as otherwise indicated.

.5 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp or wet locations.

.6 Minimum conduit size: 21mm.

.7 Bend conduit cold:

.1 Replace conduit if kinked or flattened more than 1/10th of its original diameter.

.8 Mechanically bend steel conduit over 19 mm diameter.

3.2 SURFACE CONDUITS

.1 Run parallel or perpendicular to building lines.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 11 55 – General Instructions.

.2 Section 31 23 33.01 – Excavating, Trenching and Backfilling.

1.2 REFERENCES

.1 Canadian Standards Association (CSA)

.1 CSA C22.2 No. 211.2 – Rigid PVC (Unplasticized) Conduit. (Latest published document).

.2 CSA C22.2 No. 211.1, Rigid Types EBI and DB2/ES2 PVC Conduit. (Latest published document).

1.3 SUBMITTALS

.1 Make submittals in accordance with Section 01 11 55 – General Instructions

.2 Submit WHMIS MSDS - Material Safety Data Sheets acceptable to Labour Canada and Health and Welfare Canada for solvent cement. Indicate VOC content.

Part 2 Products

2.1 PVC DUCTS/CONDUITS AND FITTINGS

.1 Rigid PVC duct: to CSA C22.2 No. 211.1.

.2 Rigid PVC conduit: to CSA C22.2 No. 211.2.

.3 Rigid PVC bends, couplings, reducers, bell end fittings, plugs, caps, adaptors same product material as duct, to make complete installation.

.4 Rigid PVC 90^{o} and 45^{o} bends.

.5 Rigid PVC 5^{o} angle couplings.

2.2 SOLVENT WELD COMPOUND

.1 Solvent cement for PVC joints.

2.3 CABLE PULLING EQUIPMENT

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

Part 3 Execution

3.1 INSTALLATION

.1 Install duct or conduit in accordance with manufacturer's instructions. Use duct for 53mm dia ducts and larger. Use rigid PVC conduit for direct burial in sizes below 53mm.

.2 Clean inside of ducts and conduits before laying.

.3 Ensure full, even support throughout duct and conduit length.

.4 Provide sand bed and cover on ducts and conduits in trench as indicated

.5 During construction, cap ends of ducts and conduits to prevent entrance of foreign materials.

.6 Pull through each duct a wooden mandrel not less than 300 mm long and of diameter 6 mm less than internal diameter of duct and conduit, followed by stiff bristle brush to remove sand, earth and other foreign matter. Pull stiff bristle brush through each duct immediately before pulling-in cables.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and components for dry type transformers up to 600 V primary, equipment identification and transformer installation.

1.2 RELATED SECTIONS

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

1.3 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CAN/CSA-C22.2 No.47-13, Air-Cooled Transformers (Dry Type).

.2 CSA C9-17, Dry-Type Transformers.

.3 CAN/CSA C802.2-12 (R2017), Minimum Efficiency Values for Dry-Type Transformers

1.4 PRODUCT DATA

.1 Submit product data in accordance with Section 01 01 50 – General Instructions

Part 2 Products

2.1 TRANSFORMERS

.1 Use transformers of one manufacturer throughout project and in accordance with CAN/CSA-C22.2No.47, CSA-C9 as appropriate.

.2 Design 1:

.1 Type: ANN with copper windings. Two winding type.

.2 3 phase, 60Hz, kVA input and output voltages as indicated on drawings.

.3 Voltage taps: 2 - 2.5% FCAN, 2.- 2.5% FCBN.

.4 Insulation: Class 220C, 150 degrees C temperature rise.

.5 Basic Impulse Level (BIL): 10kV

.6 Average sound level: standard

.7 Impedance at 17 degrees C: standard

.8 Enclosure: Suitable for installation in sprinklered room.

.9 Mounting: floor or wall as indicated.

.10 Finish: in accordance with Section 26 05 00 - Common Work Results – Electrical

.11 Minimum efficiency values to requirements of CAN/CSA 802.2-12 (R2017)

Part 3 Execution

3.1 INSTALLATION

.1 Mount transformers as indicated.

.2 Ensure minimum CE code required clearance around transformer for ventilation.

.3 Install transformers in level upright position.

.4 Remove shipping supports only after transformer is installed and just before putting into service.

.5 Loosen isolation pad bolts until no compression is visible.

.6 Make primary and secondary connections in accordance with wiring diagram.

.7 Energize transformers after installation is complete.

.8 Provide fixing of transformers to satisfy requirements of National Building Code 2015 for seismic compliance per Division B Part 4.

3.2 PRE – COMMISSIONING

.1 With transformer energized but not in service, check voltage level applicable at each tap setting to verify satisfactory performance. Record values.

.2 Set transformer on tap settings that suit the available voltage at the location so that the load voltage is nominal maximum 5% below 120/208V when under load.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

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

1.2 REFERENCES

.1 Canadian Standards Association

.1 CSA C22.2 No.29, Panelboards and enclosed Panelboards. Latest published edition.

1.3 SHOP DRAWINGS

.1 Submit shop drawings.

.2 Drawings to include electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.

Part 2 Products

2.1 PANELBOARDS

.1 Panelboards: to CSA C22.2No.29 and product of one manufacturer.

.1 In addition to CSA requirements manufacturer's nameplate must show fault current that panel including breakers has been built to withstand.

.2 250 V panelboards: bus and breakers rated for 10,000 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 For lighting and receptacle panelboards trim with flush locking door and concealed front bolts and hinges.

.9 Trim and door finish: baked grey enamel.

.10 Multi-way ground bar bonded to panel steel.

.11 Suitable for installation in a sprinklered room.

2.2 BREAKERS

.1 Breakers with thermal and magnetic tripping in panelboards except as indicated otherwise.

.2 Lock-on devices on breakers for: Heat trace circuits.

2.3 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results - Electrical.

.2 Nameplate for each panelboard size 4 engraved.

.3 Complete circuit directory with typewritten legend showing location and load of each circuit.

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.

.3 Mount panelboards to height specified in Section 26 05 00 - Common Work Results - Electrical.

.4 Connect loads to circuits.

.5 Connect neutral conductors to common neutral bus.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 11 55 – General Instructions

.2 Section 26 05 00 - Common Work Results - Electrical.

1.2 REFERENCES

.1 Canadian Standards Association – latest editions of the following

- .1 CSA-C22.2 No.42, General Use Receptacles, Attachment Plugs and Similar Wiring Devices.
- .2 CSA-C22.2 No.42.1, Cover Plates for Flush-Mounted Wiring Devices.
- .3 CSA-C22.2 No.55, Special Use Switches.
- .4 CSA-C22.2 No.111, General-Use Snap Switches.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 01 11 55 – General Instructions.

Part 2 Products

2.1 SWITCHES

.1 20 A, 120 V, single pole, double pole, three-way, four-way switches to: CSA-C22.2 No.55 and CSA-C22.2 No.111.

.2 Manually-operated general purpose ac switches with following features:

- .1 Terminal holes approved for No. 10 AWG wire.
- .2 Silver alloy contacts.
- .3 Urea or melamine moulding for parts subject to carbon tracking.
- .4 Suitable for back and side wiring.
- .5 Ivory toggle.

.3 Toggle operated fully rated for tungsten filament and fluorescent lamps, and up to 80% of rated capacity of motor loads.

.4 Switches of one manufacturer throughout project.

.5 Acceptable materials: Arrow Hart 1900 series, Bryant 4900 series, Hubbell 1200 series, P&S 20 AC series.

2.2 RECEPTACLES

.1 Duplex receptacles, CSA type 5-15 R or 5-20 R, 125 V, 15 or 20 A, U ground, to: CSA-C22.2 No.42 with following features:

.1 Urea moulded housing, ivory in colour.

.2 Suitable for No. 10 AWG for back and side wiring.

.3 Break-off links for use as split receptacles.

.4 Eight back wired entrances, four side wiring screws.

.5 Triple wipe contacts and rivetted grounding contacts.

.2 Other receptacles with ampacity and voltage as indicated.

.3 Receptacles of one manufacturer throughout project.

.4 Acceptable materials: Arrow Hart No. 6262, Bryant No. 5262, Hubbell No. 5262, P&S No. 5262.

2.3 SPECIAL WIRING DEVICES

.1 Special wiring devices:

.1 Pilot lights as indicated, with neon type 0.04 W, 125 V lamp or led lamp and red plastic jewel or lens, flush type.

2.4 COVER PLATES

.1 Cover plates for wiring devices to: CSA-C22.2 No.42.1.

.2 Cover plates from one manufacturer throughout project.

.3 Sheet steel utility box cover for wiring devices installed in surface-mounted utility boxes.

.4 Stainless steel, vertically brushed, cover plates, for wiring devices mounted in flush-mounted outlet box.

.5 Cast cover plates for wiring devices mounted in surface-mounted FS or FD type conduit boxes.

.6 Weatherproof double lift spring-loaded cast aluminum cover plates, complete with gaskets for duplex receptacles as indicated inside the building and for those exposed to the weather.

Part 3 Execution

3.1 INSTALLATION

.1 Switches:

.1 Install single throw switches with handle in "UP" position when switch closed.

.2 Install switches in gang type outlet box when more than one switch is required in one location.

.3 Mount toggle switches at height in accordance with Section 26 05 00 - Common Work Results - Electrical.

.4 Mark the circuit number in black indelible ink on the body of each switch in a location visible when the coverplate is removed, but not visible with the coverplate installed.

.2 Receptacles:

.1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.

.2 Mount receptacles at height in accordance with Section 26 05 01 - Common Work Results - Electrical.

.3 Where split receptacle has one portion switched, mount vertically and switch upper portion.

.4 Mark the circuit number in black indelible ink on the body of each receptacle in a location visible when the coverplate is removed, but not visible with the coverplate installed.

.3 Cover plates:

.1 Protect stainless steel cover plate finish with paper or plastic film until painting and other work is finished.

.2 Install suitable common cover plates where wiring devices are grouped.

.3 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.

.4 Provide a label on every switch and receptacle cover plate indicating circuit number.

.1 Label: Produced by electronic label maker. 5mm high (min) upper case **black letters** on **clear tape**, 12mm, laminated tape, or equivalent.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 11 55 – General Instructions

.2 Section 26 05 00 - Common Work Results - Electrical.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International).

.1 CAN/CSA C22.2 No.4, Enclosed and Dead Front Switches. Latest published edition.

1.3 SUBMITTALS

.1 Submit product data in accordance with Section 01 11 55 – General Instructions.

Part 2 Products

2.1 DISCONNECT SWITCHES

.1 Fusible or non-fusible, horsepower rated disconnect switch in CSA Enclosure type to suit the application. Enclosure suitable for installation in a sprinklered room for indoor mounting, weatherproof type for outdoor mounting.

.2 Provision for padlocking in on-off switch position by three locks.

.3 Mechanically interlocked door to prevent opening when handle in ON position.

.4 Fuses: size as indicated, HRC J-type.

.5 Fuseholders: to CSA C22.2 No.39, relocatable and suitable without adaptors, for type and size of fuse indicated.

.6 Quick-make, quick-break action.

.7 ON-OFF switch position indication on switch enclosure cover.

2.2 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results - Electrical.

.2 Indicate name of load controlled on size 4 nameplate.

Part 3 Execution

3.1 INSTALLATION

.1 Install disconnect switches complete with fuses as applicable or indicated.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 11 55 – General Instructions

.2 Section 26 05 00 - Common Work Results - Electrical.

1.2 REFERENCES

.1 International Electrotechnical Commission (IEC)

.1 IEC 60947-4-1, Part 4-1 plus applicable amendments: Contactors and motor-starters.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with Section 01 11 55 – General Instructions.

.2 Indicate:

.1 Mounting method and dimensions.
.2 Starter size and type.
.3 Layout of identified internal and front panel components.
.4 Enclosure types.
.5 Wiring diagram for each type of starter.
.6 Interconnection diagrams.

1.4 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance data for motor starters for incorporation into manual specified in Section 01 11 55 – General Instructions.

.2 Include operation and maintenance data for each type and style of starter.

Part 2 Products

2.1 MATERIALS

.1 Starters: to IEC 60947-4-1.

.2 Starters to have enclosures suitable for installation in sprinklered rooms.

2.2 MANUAL MOTOR STARTERS

.1 Single or three phase manual motor starters of size, type, rating, and enclosure type as indicated, with components as follows:

.1 Switching mechanism, quick make and break.

.2 One overload heater for single phase, 3 for 3-phase, manual reset, trip indicating handle.

.2 Accessories:

.1 Toggle switch: labelled to indicate purpose.

.2 Indicating light: green LED type.

.3 Locking tab to permit padlocking in "ON" or "OFF" position.

2.3 FULL VOLTAGE MAGNETIC STARTERS

.1 Magnetic and combination magnetic starters of size, type, rating and enclosure type as indicated with components as follows:

.1 Contactor solenoid operated, rapid action type.

.2 Motor overload protective device in each phase, manually reset from outside enclosure.

.3 Wiring and schematic diagram inside starter enclosure in visible location.

.4 Identify each wire and terminal for external connections, within starter, with permanent number marking identical to diagram.

.2 Accessories:

.1 Pushbuttons and/or Selector switches: standard, heavy duty, oil tight labelled as indicated.

.2 Indicating lights: LED type and color as indicated.

.3 2-N/O and 2-N/C spare auxiliary contacts unless otherwise indicated.

2.4 REDUCED VOLTAGE STARTERS

.1 Reduced voltage starters shall be as follows:

.1 Electronic soft start type

.2 3-phase controlled

.3 Built in motor overload protection in each phase, manually reset from outside enclosure.

.4 Horsepower rating one NEMA motor rating size larger than the motor to be controlled. For example, for a 7.5hp motor the starter shall be sized for 10hp.

.5 Integrated bypass contacts in the main power circuit

.6 Input programming capability and readout

.7 Associated wiring and schematic diagram.

.8 Identify each wire and terminal for external connections, within starter, with permanent number marking identical to diagram.

.2 Accessories:

.1 Indicating lights: LED type.

.2 2-N/O and 2-N/C spare auxiliary contacts unless otherwise indicated.

2.5 CONTROL TRANSFORMER

.1 Single phase, dry type, control transformer with primary voltage as indicated and 120 V secondary, complete with secondary fuse, installed in with starter as indicated.

.2 Size control transformer for control circuit load plus 20% spare capacity.

2.6 FINISHES

.1 Apply finishes to enclosure in accordance with Section 26 05 00 - Common Work Results - Electrical.

2.7 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results - Electrical.

.2 Manual starter designation label, white plate, black letters, size 1, engraved to indicate purpose.

.3 Magnetic starter designation label, white plate, black letters, size 1 engraved to indicate purpose.

Part 3 Execution

3.1 INSTALLATION

.1 Install starters, connect power and control as indicated.

.2 Ensure correct fuses and overload devices elements installed.

.3 Set the soft starter to the following values: Start ramp time 5 secs, Ramp time for stop 0 secs, initial voltage 30%, current inrush max 350%.

3.2 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results - Electrical and manufacturer's instructions.

.2 Operate switches, starters to verify correct functioning.

.3 Perform starting and stopping sequences of starters and control relays.

.4 Check that sequence controls, interlocking with other separate related starters, equipment, control devices, operate as indicated.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 11 55 – General Instructions

.2 Section 26 05 00 - Common Work Results - Electrical.

.3 Section 26 05 21 – Wires and Cables (0-1000V)

.4 Section 26 05 34 – Conduits, Fastenings and Conduit Fittings.

1.2 REFERENCES

.1 Government of Canada

.1 NBC, National Building Code of Canada – 2015

.2 Latest editions of Underwriter's Laboratories of Canada (ULC) publications:

.1 CAN/ULC-S524-2014-AMD1 Installation of Fire Alarm Systems.
.2 ULC-S525, Audible Signal Appliances for Fire Alarm.
.3 CAN/ULC-S526, Visual Signal Appliances, Fire Alarm.
.4 CAN/ULC-S527, Control Units.
.5 CAN/ULC-S528, Manual Pull Stations.
.6 CAN/ULC-S529, Smoke Detectors.
.7 CAN/ULC-S537-13, Verification of Fire Alarm Systems.

1.3 SYSTEM OVERVIEW

.1 The existing fire alarm system on site is a Simplex non-addressable system. The new fire alarm system is to be an addressable system. No components of the existing fire alarm system shall be re-used for the new system.

.2 Existing wiring shall not be re-used but is to be replaced with new wiring as the existing wiring has deteriorated because of the local marine environment. Some of the existing wiring is in conduit, which conduit may be re-used for new wiring. Some of the existing system is wired in red-jacketed fire alarm cable and some is wired in armoured fire alarm cable.

The work of this contract shall result in <u>all the new fire alarm wiring</u> being installed in <u>new conduit or existing conduit.</u>

1.4 SYSTEM DESCRIPTION

.1 Fully supervised, microprocessor-based, fire alarm system, utilizing digital techniques for data control and digital, and multiplexing techniques for data transmission.

.2 System to carry out fire alarm and protection functions; including receiving alarm signals; initiating single-stage alarm; supervising components and wiring; actuating annunciators and auxiliary functions; initiating trouble signals and signalling to monitoring agency.

.3 Zoned, non-coded single stage.

.4 Modular in design to allow for future expansion.

.5 Operation of system shall not require personnel with special computer skills.

.6 System to include:

.1 Central Control Unit in separate enclosure with power supply, stand-by batteries, central processor with microprocessor and logic interface, main system memory, input-output interfaces for alarm receiving, annunciation/display, and program control/signalling.

.2 Power supplies.

.3 Initiating/input circuits.

.4 Output circuits.

.5 Auxiliary circuits.

.6 Wiring.

.7 Manual and automatic initiating devices.

.8 Audible and visual signalling devices.

.9 End-of-line resistors.

.10 Remote annunciators

.11 Ancillary devices.

.12 On board software package allowing preparation of reports as well as computer, monitor and printer to allow creation of the reports.

.13 Output relays for signaling ULC S561 conditions required for a sprinklered building, which include fire alarm, fire trouble, sprinkler alarm, sprinkler supervisory.

1.5 REQUIREMENTS OF REGULATORY AGENCIES

.1 System components: listed by ULC and comply with applicable provisions of National Building Code, and meet requirements of local authority having jurisdiction.

1.6 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 11 55 – General Instructions.

.2 Include:

.1 Detail assembly and internal wiring diagrams for control units.

.2 Overall system wiring diagram identifying control equipment initiating zones, signaling circuits; identifying terminations, terminal numbers, conductors and raceways.

.3 Details for devices.

.4 Details and performance specifications for control, annunciation and peripherals.

.5 Step-by-step operating sequence.

1.7 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance data for fire alarm system for incorporation into manuals specified in Section 01 11 55 – General Instructions.

.2 Include:

.1 Instructions for complete fire alarm system to permit effective operation and maintenance.

.2 Technical data - illustrated parts lists with parts catalogue numbers.

.3 Copy of approved shop drawings with corrections completed and marks removed except review stamps.

.4 List of recommended spare parts for system.

.5 Provide an operators condensed and simplified list of instruction on how to react to the various alarm and trouble conditions to be expected. The list shall be on one 216mm by 279mm sheet only. Departmental Representative shall review the operating instructions prior to distribution.

1.8 EXTRA MATERIALS

.1 Provide maintenance materials in accordance with Section 01 01 50 - General Instructions.

.2 Include:

.1 3 spare glass rods for manual pull stations.

.2 One manual fire alarm station.

.3 One of each type of smoke detector used.

Part 2 Products

2.1 MATERIALS

.1 Equipment and devices: ULC listed and labelled and supplied by single manufacturer.

.2 Power supply: to CAN/ULC-S524.

.3 Audible signal devices: to ULC-S525.

.4 Visual signal devices: to CAN/ULC-S526.

.5 Control unit: to CAN/ULC-S527.

.6 Manual alarm stations: to CAN/ULC-S528.

.7 Smoke detectors: to CAN/ULC-S529.

2.2 SYSTEM OPERATION: SIGNALS ONLY

.1 Actuation of any alarm initiating device to:

.1 Cause electronic latch to lock-in alarm state at central control unit.

.2 Indicate zone of alarm at central control unit and at remote annunciators.

.3 Cause audible and visual signal devices throughout building to operate in general alarm mode.

.4 Transmit signal to off site monitoring station via the existing monitoring system that is on site.

.2 Acknowledging alarm: indicated at central control unit.

.3 Possible to silence signals by "alarm silence" switch at central control unit, after 60 s period of operation.

.4 Subsequent alarm, received after previous alarm has been silenced, to re-activate signals.

.5 Actuation of any supervisory device to:

.1 Cause electronic latch to lock-in supervisory state at central control unit.

.2 Indicate respective supervisory zone at central control unit and remote annunciators.

.3 Cause audible signal at control unit and at remote annunciators to sound.

.4 Activate common supervisory sequence.

.5 Signal to the monitoring panel, which in turn will signal the condition off site to the monitoring station.

.6 Resetting alarm or supervisory device not to return system indications/functions back to normal until control unit is reset.

.7 Trouble on system to:

.1 Indicate circuit in trouble at central control unit.

.2 Activate "system trouble" indication, buzzer and common trouble sequence. Acknowledging trouble condition at either control unit or remote annunciators to silence audible indication; visual indication to remain until trouble is cleared and system is back to normal.

.8 Troubles on system: suppressed during course of alarm.

.9 Trouble condition on any circuit in system not to initiate alarm conditions.

2.3 CONTROL PANEL

.1 Central control unit (CCU).

.1 Addressable type.

.2 Minimum two line LCD type display.

.3 System to provide for priority reporting levels, with fire alarm points assigned highest priority, supervisory and monitoring lower priority, and third priority for troubles. Possible to assign control priorities to control points in system to guarantee operation or allow emergency override as required.

.4 Integral power supply, battery charger and standby batteries.

.5 Basic life safety software: retained in non volatile Erasable Programmable Read-Only-Memory (EPROM). Extra memory chips: easily field-installed.

Random-Access-Memory (RAM) chips in panel to facilitate password-protected field editing of simple software functions (e.g. zone labels, priorities) and changing of system operation software.

.6 Circuitry to continuously monitor communications and data processing cycles of microprocessor. Upon failure, audible and visual trouble indication to activate.

.7 Equipped with software routines to provide Event-Initiated-Programs (EIP); change in status of one or more monitor points, may be programmed to operate any or all of system's control points.

.8 Software and hardware to maintain time of day, day of week, day of month, month and year.

.9 Software to operate variable sensitivity addressable smoke detectors and annunciate their status and sensitivity settings at control panel.

.2 Manufacturer: Chubb Edwards, Simplex, Mircom, Notifier other approved.

2.4 POWER SUPPLIES

.1 120 V, 60 Hz as primary source of power for system.

.2 Voltage regulated, current limited system power.

.3 Primary power failure or power loss (less than 102 V) will activate common trouble sequence.

.4 Interface with battery charger and battery to provide uninterruptible transfer of power to standby source during primary power failure or loss.

.5 During normal operating conditions fault in battery charging circuit, short or open in battery leads to activate common trouble sequence and standby power trouble indicator.

.6 Standby batteries: sealed, maintenance free. Capacity of standby battery system shall be to NBC 2015 requirements for a low-rise building of occupancy type A2.

.7 Continuous supervision of wiring for external initiating and alarm circuits to be maintained during power failure.

2.5 WIRING - DCL

.1 Data communication link (DCL) wiring from the panel to field initiating devices shall be a type A link. The DCLA wiring is similar to a class A fire alarm circuit which returns to the panel. The wiring that returns to the panel shall follow a different route and not be in the same conduit per requirements of CAN/ULC-S524-2014-AMD1. Isolator modules shall be installed in readily accessible locations in the DCLA wiring on each side of a fire separation at the entry to and exit from the space that has the fire separation.

2.6 INITIATING/ INPUT CIRCUITS

.1 Receiving circuits for alarm initiating devices such as manual pull stations, smoke detectors, and water flow switches, wired to central control unit.

.2 Alarm receiving circuits (active and spare): compatible with smoke detectors and open contact devices.

.3 Receiving circuits for supervisory, N/O devices. Devices: wired to central control unit.

2.7 ALARM OUTPUT CIRCUITS

.1 Alarm output circuit: connected to signals, wired in class B configuration to central control unit.

.1 Signal circuits' operation to follow system programming; capable of sounding bells in alarm conditions. Alarm shall be the ISO 8201 temporal pattern. Each signal circuit: rated at 2 A, 24 VDC; fuse-protected from overcurrent. Minimum 6 circuits.

.2 Visual signal circuits. Minimum 4 circuits.

.3 Manual alarm silence, automatic alarm silence and alarm silence inhibit to be provided by system's common control.

2.8 AUXILIARY CIRCUITS

.1 Auxiliary contacts for control functions and for alarm and supervisory monitoring functions. Minimum 3 sets of contacts for fire alarm, sprinkler operation and supervisory condition monitoring.

.2 Alarm and or supervisory trouble on system to cause operation of programmed auxiliary output circuits.

.3 Upon resetting system, auxiliary contacts to return to normal or to operate as pre-programmed.

.4 Auxiliary circuits: rated at 2 A, 24 Vdc or 30 Vac, fuse-protected.

.5 Auxiliary circuits shall control remote relays to provide shutdown functions that are required on alarm as indicated.

2.9 WIRING

.1 Twisted copper conductors: rated 300 V, listed by CSA as suitable for fire alarm duty.

.2 To initiating circuits: 18 AWG minimum, and in accordance with manufacturer's requirements.

.3 To signal circuits: 16 AWG minimum, and in accordance with manufacturer's requirements.

.4 To control circuits: 14 AWG minimum, and in accordance with manufacturer's requirements.

.5 To annunciators: In accordance with manufacturer’s requirements.

.6 All FAS type wiring to meet requirements of CEC table 19 and section 32 of CEC.

2.10 MANUAL ALARM STATIONS

.1 Addressable Manual alarm stations: pull lever, wall mounted semi-flush type, bilingual signage. On board electronics for communication with control unit.

2.11 AUTOMATIC ALARM INITIATING DEVICES

.1 Smoke detector: photo-electric type.

.2 Addressable variable-sensitivity smoke detectors.

.1 Photo-electric type for ceiling mounted device, ionization type for air duct detectors.

.2 Electronics to communicate detector's status to addressable module.

.3 Sensitivity settings: Settings, determined and operated by control panel. No shifting in detector sensitivity due to atmospheric conditions (dust, dirt) within certain parameters.

.4 Ability to annunciate minimum of 2 levels of detector contamination automatically with trouble condition at control panel.

2.12 AUDIBLE SIGNAL DEVICES

.1 Bells: 250mm diameter, 24 V dc, Minimum 85db @ 3m.

2.13 VISUAL ALARM SIGNAL DEVICES

.1 Strobe type: flashing, red, 24 V dc.

.2 Designed for surface mounting on ceilings or walls.

2.14 END-OF-LINE DEVICES

.1 End-of-line devices to control supervisory current in signalling circuits, sized to ensure correct supervisory current for each circuit. Open, short or ground fault in any circuit will alter supervisory current in that circuit, producing audible and visible alarm at main control panel and remotely at annunciator.

2.15 REMOTE INDOOR ANNUNCIATOR (IN HEATED SPACE)

.1 Surface mounted with LCD display.

.2 Surface mounted back box.

2.16 REMOTE INDOOR ANNUNCIATOR (IN UNHEATED SPACE)

.1 Fire Alarm Annunciator required features

.1 Scaled floor plan for main floor, mezzanine and substructure.

.2 Indication of sprinkler zones by colour. Pastel shades shall be used, no dark shades.

.3 LED to light for each pull station in alarm. LEDs shall be located on the floor plan at each pull station location.

.4 One LED for each sprinkler zone. Sprinkler zone LEDs maybe clustered together in the annunciator provided they reference the particular sprinkler zone.

.5 One common LED for sprinkler trouble condition. (Details will be provided by the LCD readout.

.6 One common LED for fire alarm trouble.

.7 One common LED for power on

.8 LED test switch.

.9 LCD readout type annunciator at top.

.10 YOU ARE HERE indication and north arrow.

.11 Generator run and generator trouble indicating lights.

.1 The generator run light shall cause a local audible and visible signal but shall not transmit the condition to the monitoring station.

.2 Generator trouble shall cause a common fire alarm system trouble, which shall be transmitted to the monitoring station.

.12 All components shall be housed in a custom colored factory finished brown-shade sheet-metal enclosure of maximum dimensions 108mm deep by 660mm wide by 965mm high. Exact RAL color for custom painting of the enclosure and door trim will be advised at the time of shop drawing submission.

.1 The enclosure shall have a hinged door with glass panel and key lock. Trim shall be custom brown color as for back-box enclosure.

.13 Enclosure is located in an unheated space and shall contain a small heater thermostatically controlled to maintain a minimum operating temperature that suits the enclosed electronics.

2.17 HEAT TRACE CONTROL PANEL AND MONITOR

.1 Suitable for control of heat trace cables.

.2 Capable of monitoring for loss of power, ground fault.

.3 Contacts for monitoring by the fire alarm panel.

.4 Refer to drawing E-3 for added detail and installation pre-commissioning requirements.

2.18 SPRINKLER ALARM AND SUPERVISORY DEVICES

.1 The sprinkler contractor will install alarm and supervisory switches on the sprinkler system. To allow connection of these devices to the fire alarm system provide the necessary addressable modules for connection to the sprinkler system.

2.19 AS-BUILT RISER DIAGRAM

.1 Fire alarm system riser diagram: in glazed frame minimum size 600 x 600 mm.

2.20 PRINTER, KEYBOARD, MONITOR, MOUSE

.1 Provide remote printer, keyboard, monitor and mouse for report function only. (No graphics)

.1 Provide KVM extenders to suit operation of components in location indicated.

.2 Locate devices on existing table in the room indicated.

Part 3 Execution

3.1 INSTALLATION

.1 Install systems in accordance with CAN/ULC-S524-2014-AMD1.

.2 Install all wiring in EMT in accordance with Section 26 05 34 – Conduits, Conduit Fastenings and Conduit Fittings.

.3 Install control unit and connect to ac power supply, dc standby power.

.4 Install manual alarm stations and connect to alarm circuit wiring.

.5 Locate and install detectors and connect to alarm circuit wiring. Do not mount detectors within 1 m of air outlets. Maintain at least 600 mm radius clear space on ceiling, below and around detectors.

.6 Connect alarm circuits to main control panel. Fire alarm system wiring shall be permanently labeled at each end of every conductor using numbered ferrules. Wiring shall be continuous from panel to device. Where splices are required, they shall be within accessible junction boxes on labeled rail-mounted terminal blocks. Labeling schedule shall be typed, laminated in plastic and stuck to inside of junction box.

.7 Install bells and visual signal devices and connect to signalling circuits.

.8 Connect signalling circuits to main control panel.

.9 Install end-of-line devices at end of signalling circuits.

.10 Install remote annunciator panel and connect to annunciator circuit wiring.

.11 Install remote relay units to control fan shut down.

.12 Wiring splices are not permitted except at device locations. To preclude deterioration because of the marine environment all splices shall be made using crimp connections with hot or cold shrink pvc sleeves installed over the splice.

.13 Provide necessary raceways, cable and wiring to make interconnections to terminal boxes, annunciator equipment and control unit, as required by equipment manufacturer.

.14 Ensure that wiring is free of opens, shorts or grounds, before system testing and handing over.

.15 Identify circuits and other related wiring at central control unit, annunciators, and terminal boxes.

.16 Wire to sprinkler system and other systems for supervisory function as indicated on the drawings and as follows:

.1 To the alarm switch on each zoned area of the sprinkler system to provide separate alarm indication for each area.

.2 To the zone valve tamper switches to provide trouble or supervisory indication. Where the tamper switches are located within the same room they may be on the one supervisory zone. Where zone valve tamper switches are in different rooms there shall be a supervisory indication for the valves in each room.

.3 System low pressure condition shall be monitored as a separate indication for each wet or dry sprinkler systems.

.4 There will be an excess pressure pump for the sprinkler system. Wire to the excess pressure pump as necessary via the pressure switch arrangement for automatic pump-up of system.

.5 To heat trace monitoring and control panels as indicated on drawing E3.

.1 Electrical contractor shall coordinate with the mechanical contractor regarding installation of heat trace. Electrical contractor shall install the heat trace monitoring panels and thermostat sensor to allow testing prior to insulation.

3.2 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results - Electrical and CAN/ULC-S537-14.

.2 Tests, inspection and verification shall be performed by a specialist contractor other than the installation contractor. Provide the name of the test, inspection and verification contractor (for example – fire alarm equipment manufacturer) within 5 days after contract award.

.1 Verification of the fire alarm system is to be witness tested. Inform the Departmental Representative when verification is to be performed; minimum 7 days notice is required.

.3 Fire alarm system:

.1 Test each device and alarm circuit to ensure manual stations, smoke detectors sprinkler system transmit alarm to control panel.

.1 Test of smoke detectors shall confirm that each smoke detector sensitivity value is within its rated operating range, using the manufacturer's recommended test equipment or other means. Include initial sensitivity value for each smoke detector in verification report.

.2 Check annunciator panel to ensure zones are shown correctly.

.3 Simulate grounds and breaks on alarm and signalling circuits to ensure proper operation of systems.

.4 Addressable circuits system style DCLA:

.1 Test each conductor on all DCLA addressable links for capability of providing 3 or more subsequent alarm signals on each side of single open-circuit fault condition imposed near midmost point of each link. Operate Acknowledge/Silence switch after reception of each of the 3 signals. Correct imposed fault after completion of each series of tests.

.2 Test each conductor on all DCLA addressable links for capability of providing 3 or more subsequent alarm signals during ground-fault

condition imposed near midmost point of each link. Operate Acknowledge/Silence switch after reception of each of the 3 signals. Correct imposed fault after completion of each series of tests.

.5 Verification Certificate. Provide copies of the completed verification certificate to the Departmental Representative prior to the request for an interim inspection.

.1 Verification documentation shall include provision of the complete Appendix C of CAN/ULC S537-13 and shall include audibility sound level test values for each room. State the lowest recorded sound level test value for each room.

.6 Provide final PROM program of any re-burn done for the system incorporating program changes made during construction.

3.3 FIRE ALARM SYSTEM PRE-COMMISSIONING

.1 Verification of the fire alarm system is to be witness tested. Inform the Departmental Representative when verification is to be performed; minimum 7 days notice is required.

.2 Pre-commissioning shall be conducted at night. Make allowance as necessary.

.1 Pre-commissioning shall be conducted after installation of the ULC S561 monitoring system installation.

.2 Pre-commissioning shall be conducted by the contractor in the presence of the Departmental Representative or their authorized representative.

.3 Exact night for pre-commissioning shall be as mutually agreed with the Departmental Representative.

.3 Following successful verification perform the following tests.

.1 At a random location activate a pull station into alarm.

.1 Confirm all strobe flashings are synchronized.

.2 Confirm all bells sound and that none are faulty. A faulty bell is one that does not provide full sound output compared to adjacent devices. (Such bells shall be replaced.)

.3 Confirm the readout on the LCD annunciator.

.4 Confirm that the correct device is indicated at the active graphic annunciator.

.5 Confirm an alarm signal is sent to the fire alarm monitoring station.

.6 Acknowledge the system.

.7 Silence the system.

.8 Activate a second pull station prior to resetting the first pull station. Confirm the fire alarm condition, bells ringing, etc. is re-established.

.9 Silence the system.

.10 Reset both pull stations.

.11 Reset the fire alarm panel.

.2 Repeat item 3.3.3.1 above for all pull stations. Ensure items 3.3.3.1.3, 3.3.3.1.4, 3.3.3.1.5 above occur. Then acknowledge, silence and reset.

.3 Create a fire alarm trouble condition by creating an open circuit somewhere on the system.

.1 Confirm the panels and annunciators indicate a trouble condition

.2 Silence the trouble.

.3 Remove the trouble.

.4 Ensure the trouble disappears from the panel but that the record is retained in the system memory. Demonstrate.

.5 Ensure the trouble condition was transmitted to the monitoring station.

.4 Create a sprinkler system alarm. (Simulation acceptable by shorting a flow switch.) Ensure items 3.3.3.1.3, 3.3.3.1.4, 3.3.3.1.5 above occur. (Confirm the signal sent to the monitoring station is a sprinkler alarm.) Then acknowledge, silence and reset.

.1 Repeat the test for all sprinkler flow switches.

.5 Create a sprinkler system supervisory condition by operating a sprinkler shut-off valve to cause the tamper switch to register.

.1 Confirm the panel and annunciators indicate a supervisory condition.

.2 Silence the supervisory audible indication.

.3 Remove the supervisory condition.

.4 Ensure the supervisory condition remains at the panel until the system is acknowledged and reset but that the record is retained in the system memory. Demonstrate.

.5 Ensure the trouble condition was transmitted to the monitoring station.

.6 Repeat the test for all sprinkler system supervisory conditions that are capable of being created by devices having monitored switches.

.6 Electrical contractor shall be in attendance at sprinkler system commissioning and shall operate the fire alarm panel. Inform the Departmental Representative in conjunction with the mechanical contractor when sprinkler system commissioning is to be performed; minimum 7 days notice is required so that the sprinkler system commissioning maybe witnessed.

.1 The electrical contractor shall note all operations at the fire alarm panel and ensure operation matches the previously simulated operating condition performed during pre-commissioning.

.2 It is expected that sprinkler system commissioning will not occur at the same time as fire alarm system commissioning. Allow for extra time at site as may be necessary during sprinkler system commissioning. It is to be noted that sprinkler commissioning may be done one zone at a time and that each zone may be commissioned at a different time from any other zone

.7 Test sprinkler system heat trace monitoring system. Establish various trouble conditions such as open circuit, loss of AC power. Confirm the conditions are registered by the fire alarm system. System operation should be similar to sprinkler system supervisory conditions.

.8 Prove correct operation of low temperature sensing thermostats in valve rooms by setting thermostat at a simulated temperature.

3.4 DEMONSTRATION AND TRAINING

.1 Provide on-site lecture and demonstration by fire alarm equipment manufacturer to train operational personnel in use and maintenance of fire alarm system.

.1 Training shall not be part of verification. It shall be conducted independently on a separate day. Training shall be performed by the fire alarm system's field representative who shall be familiar with software operation, bypassing components etc.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 11 55 - General Instructions

.2 Section 26 05 21 - Wires and Cables (0-1000 V).

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

1.2 REFERENCES

.1 Canadian Standards Association

.1 Latest published edition of CSA C22.2 No.141 -15, Emergency Lighting Equipment.

1.3 SUBMITTALS

.1 Submit product data in accordance with Section 01 11 55 - General Instructions.

.2 Data to indicate system components, mounting method, source of power and special attachments.

Part 2 Products

2.1 EQUIPMENT

.1 Emergency lighting equipment: to CSA C22.2 No.141. Inverter unit providing pure sine wave output. Unit shall have cUL listing and label.

.2 Supply voltage: 120 V, ac suitable for Led lighting type remote lighting heads.

.3 Output voltage: 120 V, ac with fused output connections.

.4 Operating time: **30 min**. Minimum unit capacity 1440 watts.

.5 Battery: sealed, maintenance free, valve regulated lead-acid type with a 10-year life expectancy and a 9 year pro-rata warranty.

.6 Charger: solid state, Variable-rate, voltage/current regulated, inverse temperature compensated, short circuit protected with regulated output.

.7 Solid state transfer circuit transferring in 1 sec or less and providing 100% power output immediately upon such transfer.

.8 Low voltage disconnect: solid state, modular, operates at 80% battery output voltage.

.9 Signal lights: solid state, for 'AC Power ON' and 'High Charge'.

.10 Lamp heads: remote, 345 degrees horizontal and 180 degrees vertical adjustment. Lamp type:

.1 120V, minimum 4 watt MR-16 style LED for all areas. Performance shall allow lighting heads to provide building code required levels of lighting when spaced nominal 15 meters from each other and aimed towards each other at nominal 2.7meters above floor level.

.2 Lighting head and j-box canopy trim colour shall be black.

.11 Cabinet: suitable for direct mounting to wall and c/w knockouts for conduit. Removable or hinged front panel for easy access to batteries.

.12 Finish: Factory standard.

.13 Auxiliary equipment:

.1 Lamp disconnect switch.

.2 Test switch.

.3 AC input and output terminal blocks inside cabinet.

.4 Seismic fixing accommodation.

.5 Cord and plug connection for AC.

.6 RFI suppressors as appropriate.

.7 Audible self diagnostics

.14 Other: remote heads: ceiling or wall, surface heads mounted on adjustable swivel.

2.2 RELAY UNITS

.1 Relay units to activate all emergency heads connected to inverter, if any of the indicated lighting circuits fail.

2.3 WIRING OF REMOTE HEADS

.1 Conduit: type EMT, in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings where installed in ceiling spaces or walls.

.2 AC (BX) cable where it can be concealed from view.

.3 Conductors: RW90 type in accordance with Section 26 05 21 - Wires and Cables (0-1000 V), sized as minimum #12 AWG for AC wiring.

Part 3 Execution

3.1 INSTALLATION

.1 Install inverter equipment for emergency lighting. Fix to floor to suit seismic fixing requirements.

.2 Install remote mounted fixtures as indicated.

.3 Wire AC and inverter unit connections to exit signs. Use minimum #12 AWG conductor size for AC wiring. Conductor size larger than #12AWG shall be as required by voltage drop which shall not exceed 5% on any wiring run. Organize wiring so there are home runs from various areas. Do not wire the remote lighting head system as one long linear circuit from the inverter, where voltage drop will be an issue.

.4 Direct heads to best light exit paths. Perform work at night with lighting in the building off. Following aiming by the contractor the contractor shall arrange with the Departmental Representative for site review to be conducted where adjustments to lighting aiming may be requested to be made by the Departmental Representative as the review is conducted.

.5 With lighting in the building off, perform work at night and measure lighting level from the emergency lighting. Refer to note 36 on drawing E4.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 26 05 21 - Wires and Cables (0-1000 V).

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

1.2 REFERENCES

.1 Canadian Standards Association

.1 Latest published edition of CSA C22.2 No.141, Unit Equipment for Emergency Lighting.

1.3 SUBMITTALS

.1 Submit product data in accordance with Section 01 11 55 - General Instructions.

.2 Data to indicate system components, mounting method, source of power and special attachments.

Part 2 Products

2.1 EQUIPMENT

.1 Emergency lighting equipment: to CSA C22.2 No.141.

.2 Supply voltage: 120 V, ac.

.3 Output voltage: 12 V dc.

.4 Operating time: 30 **min**.

.5 Battery: sealed, maintenance free, 10 year life expectancy.

.6 Charger: solid state, multi-rate, voltage/current regulated, inverse temperature compensated, short circuit protected with regulated output of plus or minus 0.01V for plus or minus 10% input variations.

.7 Solid state transfer circuit.

.8 Low voltage disconnect: solid state, modular, operates at 80% battery output voltage.

.9 Signal lights: solid state, for 'AC Power ON' and 'High Charge'.

□

.10 Lamp heads: integral on unit and/or remote, 345 degrees horizontal and 180 degrees vertical adjustment. Lamp type:

.1 12V, 4 Watt LED for all areas.

.11 Cabinet: suitable for direct mounting to wall and c/w knockouts for conduit. Removable or hinged front panel for easy access to batteries.

.12 Finish: Factory standard.

.13 Auxiliary equipment:

.1 Lamp disconnect switch.
.2 Test switch.
.3 AC input and DC output terminal blocks inside cabinet.
.4 Seismic fixing accommodation.
.5 Cord and plug connection for AC.
.6 RFI suppressors.

.14 Other remote heads: ceiling or wall, surface heads mounted on adjustable swivel.

2.2 WIRING OF REMOTE HEADS

.1 Conduit: type EMT, in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings where installed in ceiling spaces or walls.

.2 Conductors: RW90 type in accordance with Section 26 05 21 - Wires and Cables (0-1000 V), sized as #12 AWG for AC wiring and #10 AWG for DC wiring.

Part 3 Execution

3.1 INSTALLATION

.1 Install unit equipment for emergency lighting. Fix to wall to suit seismic fixing requirements.

.2 Install unit equipment and remote mounted fixtures as indicated.

.3 Wire AC and DC connections to exit signs. Use #12 AWG conductor size for AC and #10 AWG for DC wiring.

□

.4 Cut and re-cap cord to remove surplus.

.5 Direct heads as indicated.

END OF SECTION

□

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 11 55 - General Instructions.

.2 Section 26 05 21 - Wires and Cables (0-1000 V).

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

1.2 REFERENCES

.1 Canadian Standards Association

.1 Latest published edition of CSA C22.2 No.141, Inverter Unit for Emergency Lighting.

.2 Latest published edition of CAN/CSA C860, Performance of Internally-Lighted Exit Signs.

1.3 SUBMITTALS

.1 Provide submittals in accordance with Section 01 11 55 - General Instructions.

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

Part 2 Products

2.1 STANDARD UNITS

.1 Exit lights: to CSA C22.2 No.141 and CSA C860.

.2 Housing: white coloured cold rolled steel minimum 1.0 mm thick, or white extruded aluminum housing.

.3 Face and back plates: die formed cold rolled steel or extruded aluminum.

.4 LED type suitable for connection to 120V AC

.5 Pictogram sign to requirements of CSA 22.2 No 141-10 and 2015 National Building Code in terms of colour, size and graphical content.

2.2 DESIGN

.1 Universal mounting.

.2 Single or double face with face plate to remain captive for relamping.

.3 Arrows: Front, back in directions as indicated.

Part 3 Execution

3.1 INSTALLATION

.1 Install exit lights in locations indicated.

.2 Connect fixtures to exit light AC circuits.

.3 Connect fixtures to emergency lighting inverter AC output circuits with min. #12 AWG conductors.

.4 Ensure that exit light circuit breaker is locked in on position.

END OF SECTION

PART 1 GENERAL

1.1 RELATED SECTIONS

.1 Section 01 11 55 – General Instructions.

.2 Section 01 35 43 - Environmental Procedures.

1.2 REFERENCES

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

- .1 ASTM C117, Standard Test Method for Material Finer Than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.
- .2 ASTM C136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
- .3 ASTM D422, Standard Test Method for Particle-Size Analysis of Soils.
- .4 ASTM D698, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3) (600 kN-m/m^3).
- .5 ASTM D1557, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3) (2,700 kN-m/m^3).
- .6 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 CA/CGSB-8.2, Sieves, Testing, Woven Wire, Metric

.3 Canadian Standards Association (CSA)

- .1 CAN/CSA-A3000, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
  - .1 CSA-A3001, Cementitious Materials for Use in Concrete.
- .2 CSA-A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/ Methods of Test and Standard Practices for Concrete.

1.3 DEFINITIONS

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

.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 Unsuitable materials:

.1 Weak and compressible materials under excavated areas.

.2 Frost susceptible materials under excavated areas.

.3 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 D422 and ASTM C136: Sieve sizes to CAN/CGSB-8.1.

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

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

1.4 SUBMITTALS

.1 Inform Departmental Representative at least 2 weeks prior to commencing work, of proposed source of fill materials submit certified grain size analysis for review, if requested by Departmental Representative.

1.5 QUALITY ASSURANCE

.1 Submit design and supporting data for review at least 2 weeks prior to commencing work.

.2 Design and supporting data submitted to bear stamp and signature of qualified professional engineer registered or licensed in the province of British Columbia.

.3 Keep design and supporting data on site.

.4 Engage services of qualified professional engineer who is registered or licensed in Province of British Columbia to design and inspect cofferdams, shoring, bracing and underpinning required for work.

1.6 EXISTING CONDITIONS

.1 Buried services:

.1 Before commencing work 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 commencing excavation work, notify Canada or applicable authorities having jurisdiction, establish location and state of use of buried utilities and structures. Contractor to clearly mark such locations to prevent disturbance during work.

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

.7 Maintain and protect from damage, water, sewer, gas, electric, telephone and other utilities and structures encountered as indicated.

.8 Where utility lines or structures exist in area of excavation, obtain direction of Departmental Representative before removing or re-routing.

.9 Record location of maintained, re-routed and abandoned underground lines.

.10 Confirm locations of recent excavations adjacent to area of excavation.

.2 Existing buildings and surface features:

.1 Utilize PSPC 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 to approval of Departmental Representative.

.3 Where required for excavation, cut roots or branches as approved by Departmental Representative.

.3 Existing Dike

.1 Locate and confirm the dike from City of Richmond documentation, to be provided by Departmental Representative.

.2 Contractor shall develop a Dike Maintenance Act (DMA) application package complete with a design brief sealed by Contractor's professional engineer. Submit to Deputy Inspector of Dikes (Alexandre Salvaille – alexandre.salvaille@gov.bc.ca) for approval. After approval, submit to City of Richmond prior to conducting any dike work.

.4 Contaminated Soil

.1 Work at site may involve contact with contaminants as identified at the site during excavation activities and/or upon receipt of laboratory analytical results. As such, revise and update Health and Safety Plan as required, and re-submit to Departmental Representative.

PART 2 PRODUCTS

2.1 MATERIALS

.1 Backfill Type 2 and Type 4 fill: properties to match City of Richmond drawing no. Mb-98 (Typical Cross Section River Dike Upgrade) and the following requirements:

.1 Crushed, pit run or screened stone, gravel or sand.

.2 Gradations to be within limits specified when tested to ASTM C136 and ASTM C117. US Standard Sieve sizes and types shown to match City of Richmond types:

.3 Type 2 is a relatively impervious fill.

US Standard Sieve Size	%Passing Type2	Type2A	Type4
3”	-	-	-
2”	-	-	-
1 ½”	-	-	-
1”	-	-	-
3/4”	100	-	100
1/2”	-	-	75-100
3/8”	-	100	60-90
#4	80-100	80-100	40-70
#8	-	-	27-55
#16	-	-	16-42
#30	-	-	8-30
#40	25-90	25-90	-
#50	-	-	5-20
#100	18-50	18-50	-
#200	15-30	15-30	2-8

PART 3 EXECUTION

3.1 SITE PREPARATIONS

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

3.2 PREPARATION/PROTECTION

.1 Notify Civil and other consultants designated by Canada at least 5 days in advance to be present during excavation works.

.2 Archaeological consultants must be present during excavation activities to view excavation of material for archaeological purposes. Any physical sampling shall be done at contractor’s off-site storage facility.

.3 Contaminated soils consultant must be present during excavation activities to identify and characterize soils requiring segregation by the construction contractor including monitoring of the construction contractor’s work to carry out segregation. Any physical sampling shall be done at contractor’s off-site storage facility.

.4 Protect existing features in accordance with Section 01 56 00 - Temporary Barriers and Enclosures and requirements of the construction contract.

.5 Keep excavations clean, free of loose soil. Work outside of the dike in such a manner that water ingress does not destroy the integrity of the excavations.

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

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

.8 Identify a grid system for the excavation area to be labelled on soil bags. Refer to Section 3.4.1.

3.3 STRIPPING OF TOPSOIL

.1 Stripping of topsoil is not required.

3.4 STOCKPILING, EXCAVATED MATERIAL TRANSPORT AND DISPOSAL

.1 Stockpiling of excavated material will not be permitted on site. Excavated materials shall be placed into one-tonne soil bags at the excavation area, labelled by grid-area and immediately removed from site and stored at an off-site stockpile area provided by the contractor. Soil bags shall be impermeable to water and soil and closed to prevent ingress or egress of water or soil during transport and storage. Sampling by consultants shall take place at off-site stockpile area..

.2 Protect fill materials from contamination.

.3 Material characterization additional to information provided in the contract required by transport or Disposal Facility is the responsibility of the Contractor.

.4 Contractor to assume ownership of and be responsible for excavated material once it is loaded on a vehicle for transport. Sediment or excess water in soil must not be allowed to flow out of vehicle during transport.

.5 Manifest and correlate weights of all material transported from site, documenting estimated weight at removal from site, movement, transfer stations, interim storage and treatment, and weight of material at final disposal facility. Submit all manifests, as instructed by the Departmental Representative.

3.5 SHORING, BRACING AND UNDERPINNING

.1 Maintain sides and slopes of excavations in safe condition by appropriate methods and in accordance with Section 20.81 – Occupational Health and Safety Regulation for the Province of British Columbia.

.2 Construct temporary works to depths, heights and locations as indicated or approved by Departmental Representative.

.3 During backfill operation:

.1 Unless otherwise indicated or as 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 an elevation at least 500 mm above toe of sheeting.

.4 When sheeting is required to remain in place, cut off tops at elevations as indicated.

3.6 DEWATERING

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

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

.3 Avoid excavation below groundwater table if quick condition is likely to occur. 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 and in manner not detrimental to public and private property, or any portion of work completed or under construction.

.6 Provide flocculation tanks, settling basins, or other treatment facilities to remove suspended solids or other materials before discharging to storm sewers, water courses or drainage areas.

3.7 EXCAVATION

.1 Excavate to lines, grades, elevations and dimensions as indicated by Departmental Representative.

.2 Remove concrete, masonry, paving, walks, demolished foundations and rubble and other obstructions encountered during excavation in accordance with Section 02 41 13 - Selective Site Demolition.

.3 Excavation must not interfere with bearing capacity of adjacent foundations.

.4 Do not disturb soil within branch spread of trees or shrubs that are to remain. If excavating through roots, excavate by hand and cut roots with sharp axe or saw.

.5 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.

.6 Keep excavated materials a safe distance away from edge of trench as directed by Departmental Representative.

.7 Restrict vehicle operations directly adjacent to open trenches.

.8 Dispose of surplus and unsuitable excavated material off site.

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

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

.11 Notify Departmental Representative when bottom of excavation is reached.

.12 Obtain Departmental Representative approval of completed excavation.

.13 Remove unsuitable material from trench bottom to extent and depth as directed by Departmental Representative.

.14 Correct unauthorized over-excavation as follows:

.1 Fill under bearing surfaces and footings with concrete specified for footings.

.2 Fill under other areas with Type 1 fill compacted to not less than 95% of corrected maximum dry density.

.15 Hand trim, make firm and remove loose material and debris from excavations. Where material at bottom of excavation is disturbed, compact foundation soil to density at least equal to undisturbed soil. Clean out rock seams and fill with concrete mortar or grout to approval of Departmental Representative.

3.8 SAMPLING

.1 All excavations below 40cm in depth require archaeology consultant (appointed by PSPC and Departmental Representative) to observe.

.2 Provide assistance for collection of confirmation samples as requested by Contaminated Soil Consultant and instructed to the Departmental Representative.

.3 The Contaminated Soil Consultant may occasionally request sampling from the excavator bucket for field screening purposes and the estimated excavator time typically required is 30 minutes per shift.

.4 Contaminated material onsite classification will be based on available in-situ characterization or ex-situ characterization as instructed by Departmental Representative.

.5 Soil samples will be collected from the stockpiled material for laboratory analysis. Based on previous investigations in the vicinity of the excavation area, it is suspected the concentrations of the potential constituents of concern to be less than industrial waste quality (IL+).

.6 Archaeological and environmental soil sampling is expected to be conducted on grid-area labelled, bagged soil at contractor's off-site storage facility.

3.9 FILL TYPES AND COMPACTION

.1 Use fill of types as indicated or specified below. Compaction densities are percentages of maximum densities obtained from ASTM D698 corrected maximum dry density.

.1 Under concrete slabs: provide 150 mm compacted thickness base course of Type 1 fill to underside of slab. Compact base course to 100%.

.2 To correct over excavation in trenches: use Type 1 fill to underside of bedding compacted to 95%.

3.10 BEDDING AND SURROUND OF UNDERGROUND SERVICES

.1 Place and compact granular material for bedding and surround of underground services as indicated on drawings.

.2 Place bedding and surround material in unfrozen condition.

3.11 BACKFILLING

.1 Vibratory compaction equipment: approved by Departmental Representative.

.2 Do not proceed with backfilling operations until Departmental Representative has inspected and approved installations.

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

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

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

.6 Backfill around installations.

- .1 Place bedding and surround material as specified elsewhere.
- .2 Do not backfill around or over cast-in-place concrete within 48 hours after placing of concrete.
- .3 Place layers simultaneously on both sides of installed work to equalize loading. Difference not to exceed 600 mm.
- .4 Permit concrete thrust blocks to cure for minimum 14 days or until it has sufficient strength to withstand earth and compaction pressure or as recommended by concrete supplier, and approval obtained from Departmental Representative.

3.12 RESTORATION

.1 Upon completion of work, remove waste materials and debris, trim slopes, and correct defects as directed by Departmental Representative.

.2 Replace topsoil as indicated by Departmental Representative.

.3 Reinstate lawns to elevation which existed before excavation.

.4 Reinstate, asphalt, concrete pavement, and sidewalks distributed by excavation to thickness, structure, and elevation which existed before excavation.

.5 Clean and reinstate areas affected by work as directed by Departmental Representative.

.6 Use temporary plating to support traffic loads over unshrinkable fill for initial 24 h.

3.13 EXCAVATED MATERIAL DISPOSAL

.1 Dispose excavated material at disposal facility provided by Contractor and accepted by Departmental Representative.

.2 Disposal facility must:

.1 Be designed, constructed and operated to prevent any pollution from being caused by the facility outside the area of the facility from waste placed in or on land within the facility.

.2 Hold a valid and subsisting permit, certificate, approval, or any other form of authorization issued by a province or territory for the disposal of soil or other material that is waste quality.

.3 Comply with applicable municipal zoning, bylaws, and other applicable requirements.

.4 Dispose material as soon as leaving site or as required by Contract unless otherwise accepted by Departmental Representative.

.5 Material sent to a disposal facility must be permanently stored at that facility.

.6 If proposed disposal facility is not acceptable to Departmental Representative, provide an alternate Disposal Facility that is acceptable.

.7 Submit Certificates of Disposal for all material disposed off-site.

END OF SECTION

PART 1 GENERAL

1.1 Scope of Work

.1 Chain link gate in existing fence.

1.2 Reference Standards

.1 CAN/CSA-G164-M92, Hot Dip Galvanizing of Irregularly Shaped Articles.

.2 CAN/CGSB-138.1-M80, Fence, Chain Link, Fabric.

.3 CAN/CGSB-138.2-M80, Fence, Chain Link, Framework, Zinc-Coat, Steel.

.4 CAN/CGSB-138.3-M80, Fence, Chain Link – Installation.

.5 CAN/CGSB-138.4-M82, Fence, Chain Link, Gates.

.6 CAN/CGSB-1.181-92, Ready-Mixed Organic Zinc-Rich Coating.

.7 ASTM A 121-86, Specification for Zinc-Coated (Galvanized) Steel Barbed Wire.

.8 CAN/CSA-A23.1-M2000, Concrete Materials and Methods of Concrete Construction.

1.3 Related Work

.1 Section 03 30 00 Cast-in-Place Concrete

1.4 Submittals

.1 Submit shop drawings and product data in accordance with Section 01 33 00 Submittal Procedures.

.2 Drawings to indicate: line posts spacing, location and construction details of swing gates, manufacturer's standard and custom gate hardware, class and style of chain link fences and gates and enclosure anchorage and bracing systems specified in this Section.

PART 2 PRODUCTS

2.1 Materials

.1 Concrete mix designed to produce 20 MPa minimum compressive strength at 28 days and containing 20mm maximum size, 5mm minimum size coarse aggregate, with water/cement ratio to CAN/CSA-S23.1-M94 Table 7 for Class F-2 exposure and 60mm slump at time and point of deposit. Air entrainment to CAN/CSA-A23.1-M94, Table 8.

.2 Chain-link fence fabric: to CAN/CGSB-138.1-M80.

- .1 Electro-galvanized steel 50 x 50mm, 9GA.
- .2 Height of wire: as indicated on drawings.
- .3 Top and bottom selvage to have a twisted finish.

.3 Posts and rails: to CAN/CGSB-138.2-M80+Amdt-June-82, ASTM F1043, Schedule 40 electro-galvanized steel pipe (275 g/m^2) in the following sizes, except as noted otherwise:

- .1 Line posts: 64mm O.D.
- .2 Gate, straining and corner posts: 76mm O.D.
- .3 Rails (brace, strain and top rail) 44 mm O.D.

.4 Bottom tension wire: single strand, spiraled or crimped, galvanized steel wire, 4.8mm diameter.

.5 Tie wire fasteners: single strand, galvanized steel wire conforming to requirements of fence fabric, 3mm diameter.

.6 Tension bar: 5 x 19mm minimum galvanized steel.

.7 Tension bar bands: 3 x 19mm minimum galvanized steel.

.8 Zinc pigmented paint: to CGSB 1-GP-181-M1977.

.9 Fittings and hardware: cast aluminum alloy, galvanized steel or malleable or ductile cast iron. Post caps to provide waterproof fit, to fasten securely over posts and to carry top rail.

.10 Stainless steel sheet: to ASTM A167, cold rolled, annealed and pickled, Type 430, minimum hardness of Rockwell 37 (30N), mill finish.

.11 ASTM A526M-90 Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Commercial Quality (brackets, lock cases, etc.).

.12 Galvanized steel wire: to ASTM 121.

2.2 Gates

.1 Swing Gate frames: to ASTM A53-84 or schedule 40 galvanized steel pipe, minimum 44mm outside diameter pipe, for outside frame and minimum 41mm outside diameter for interior bracing.

.2 Fabricate swing gates to ASTM F900 to width as indicated x height to match fence with electronically welded joints and Galvacon finished at welds. Fasten fence fabric on outside of gate with twisted selvage at top.

.3 Provided non-corrosive hasps for User's padlocks.

2.3 Finishes

.1 Galvanizing:

.1 For chain link fabric: to CAN/CGSB-138.1-M80, ASTM A392.

.2 For posts, rails: 550 g/m² minimum to ASTM A90-81.

.3 For gate framework: 275 g/m² minimum to ASTM A90-81.

.4 For other fittings: to CSA G164-M1981, ASTM A123.

PART 3 EXECUTION

3.1 Installation of Swing Gates

.1 Install gates in locations as indicated.

.2 Set gate bottom approximately 50mm above ground (or floor slab) surface for swing gates.

.3 Install gate hardware as scheduled. Adjust swing gates for correct function.

3.2 Existing Fencing

.1 Re-use owner's existing chain link fencing where indicated. Make good where damaged.

3.3 Touch Up

.1 Repair damaged galvanized surfaces. Clean damaged surfaces with wire brush removing loose and cracked coatings. Apply two coats of approved zinc pigmented (Galvacon) paint to damaged areas.

3.4 Cleaning

.1 Clean areas disturbed by operations. Dispose of surplus material and repair damaged surfaces as direct by Departmental Representative.

.2 Dispose of surplus fencing material.

END OF SECTION

APPENDIX A

Public Works and Government Services Canada | Travaux publics et Services gouvernementaux Canada

GULF of GEORGIA CANNERY PRELIMINARY HAZARD ASSESSMENT FORM

Project Number:	R076121.001
Location:	Gulf of Georgia Cannery, Steveston B.C.
Date:	JUNE 28, 2018
Name of Departmental Representative:	Tom Dunphy / Stephane Clavel
Name of Client:	PARKS CANADA
Name of Client Project Co-ordinator	MATTHIAS ZECHER PH: (250) 654 - 4084

Site Specific Orientation Provided at Project Location ☐ **Yes**

Notice of Project Required ☐ **Yes**

NOTE:
PWGSC REQUIRES A Notice of Project FOR ALL CONSTRUCTION WORK RELATED ACTIVITIES

NOTE:
OHS law is made up of many municipal, provincial, and federal acts, regulations, bylaws and codes. There are also many other pieces of legislation in British Columbia that impose OHS obligations.

Important Notice: This hazard assessment has been prepared by PSPC for its own project planning process, and to inform the service provider of actual and potential hazards that may be encountered in performance of the work. PSPC does not warrant the completeness or adequacy of this hazard assessment for the project and the paramount responsibility for project hazard assessment rests with the service provider.

TYPES OF HAZARDS TO CONSIDER	Potential Risk for:				COMMENTS
Examples: Chemical, Biological, Natural, Physical, and Ergonomic Listed below are common construction related hazards. Your project may include pre-existing hazards that are not listed. Contact the Regional Construction Safety Coordinator for assistance should this issue arise.	**PWGSC, OGD's, or tenants**		**General Public or other contractors**		Note: When thinking about this pre-construction hazard assessment, remember a **hazard** is anything that may cause harm, such as chemicals, electricity, working from heights, etc; the **risk** is the chance, high or low, that somebody could be harmed by these and other hazards, together with an indication of how serious the harm could be.
	Yes	**No**	**Yes**	**No**	

Typical Construction Hazards					
Concealed/Buried Services (electrical, gas, water, sewer etc)	yes				
Slip Hazards or Unsound Footing	yes				
Working at Heights	yes				For both substructure and interior work
Working Over or Around Water	yes				For scope pertaining to substructure
Heavy overhead lifting operations, mobile cranes etc.	yes				

Canada

Marine and/or Vehicular Traffic (site vehicles, public vehicles, etc.	yes				
Fire and Explosion Hazards	yes				
High Noise Levels	yes				
Excavations	yes				
Blasting		no			
Construction Equipment	yes				
Pedestrian Traffic (site personnel, tenants, visitors, public)	yes				
Multiple Employer Worksite	yes				Example: Contractor working in an occupied Federal Employee space.

Electrical Hazards					**Comments**
Contact With Overhead Wires	yes				
Live Electrical Systems or Equipment	yes				
Other:					
Physical Hazards					
Equipment Slippage Due To Slopes/Ground Conditions		no			
Earthquake	yes				
Tsunami	yes				
Avalanche		no			
Forest Fires		no			
Fire and Explosion Hazards	yes				
Working in Isolation	yes				
Working Alone	yes				
Violence in the Workplace	yes				
High Noise Levels	yes				
Inclement weather	yes				
High Pressure Systems		no			
Other:					
Hazardous Work Environments					
Confined Spaces / Restricted Spaces PSPC employees do not enter confined space.	TBD				If available, provide the contractor with the existing confined space assessment(s) for information only. Contractor must perform their own confined space assessment as per provincial regulations.
Suspended / Mobile Work Platforms	yes				
Other:					
Biological Hazards					
Mould Proliferations		no			
Accumulation of Bird or Bat Guano		no			
Bacteria / Legionella in Cooling Towers / Process Water		no			
Rodent / Insect Infestation		no			
Poisonous Plants		no			
Sharp or Potentially Infectious Objects in Wastes	yes				

Wildlife	yes				
Chemical Hazards					
Asbestos Materials on Site	yes				If "yes" a pre-project asbestos survey report is required. Provide Contractor with ELF Form 16 "Contractor Notification and Acknowledgement"
Designated Substance Present		no			If "yes" a pre-project designated substance survey report is required.
Chemicals Used in work		no			
Lead in paint	yes				If "yes" a pre-project lead survey report is required.
Mercury in Thermostats or Switches	TBD				If "yes" a pre-project mercury survey report is required.
Application of Chemicals or Pesticides		no			
PCB Liquids in Electrical Equipment		no			
Radioactive Materials in Equipment		no			
Other:	yes				Existing creosote
Contaminated Sites Hazards					
Hazardous Waste		no			
Hydrocarbons		no			
Metals		no			
Other:					

Security Hazards					**Comments**
Risk of Assault	yes				
Other:					
Other Hazards					

Other Compliance and Permit Requirements[1]	**YES**	**NO**	**Notes / Comments**[2]
Is a Building Permit required?			
Is an Electrical permit required?			
Is a Plumbing Permit required?			
Is a Sewage Permit required?			
Is a Dumping Permit required?			
Is a Hot Work Permit required?			
Is a Permit to Work required?			Mandatory for ALL AFD managed work sites.
Is a Confined Space Entry Permit required?	**yes**		Mandatory
Is a Confined Space Entry Log required	**yes**		Mandatory for all Confined Spaces
Discharge Approval for treated water required			

Notes:

(1) Does not relieve Service Provider from complying with all applicable federal, provincial, and municipal laws and regulations.

(2) TBD means To Be Determined by Service Provider.

Service Provider Acknowledgement: We confirm receipt and review of this Pre-Project Hazard Assessment and acknowledge our responsibility for conducting our own assessment of project hazards, and taking all necessary protective measures (which may exceed those cited herein) for performance of the work.			
Service Provider Name			
Signatory for Service Provider		**Date Signed**	
RETURN EXECUTED DOCUMENT TO PSPC DEPARTMENTAL REPRESENTATIVE PRIOR TO ANY WORK COMMENCING			

APPENDIX B

Hazardous Building Materials Assessment

Gulf of Georgia Cannery,
Richmond BC

Prepared for:
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Prepared by:
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Project No.: 123220330

March 24, 2016

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Executive Summary

Stantec Consulting Ltd. (Stantec) was retained by Public Works and Government Services Canada (PWGSC) on behalf of Parks Canada to conduct hazardous building materials assessments within the following six buildings and structures (subject buildings) that are all located throughout the Gulf of Georgia Cannery site in Richmond, BC:

- Cannery
- Watchman's Shed
- Tank Farm
- Administrative Building
- Lead Foundry
- Oil Drum Storage.

The purpose of the assessment was to check for potential hazardous building materials that may require special attention in accordance with the requirements of the *Canada Labour Code, Part II* (Canada Labour Code), the current version of British Columbia's *Occupational Health & Safety Regulation* (BC Reg. 296/97), as well as the *Parks Canada Asbestos Management Guide* (January 2014) and the Parks Canada Asbestos Management Standard (January 2014).

The hazardous building materials considered included asbestos-containing materials (ACMs), lead-containing materials including lead-containing paints (LCPs), polychlorinated biphenyls (PCBs), mercury-containing items, ozone-depleting substances (ODSs), mould or moisture affected building materials, and silica.

Based on Stantec's visual assessment and on the laboratory analyses performed on samples collected, hazardous building materials were identified within the subject buildings.

A summary of our findings and recommendations is presented below. It should be noted that this summary is subject to the same restrictions and limitations as presented in Section 3.0 (Assessment Limitations) and Section 6.0 (Closure). The information provided is to be read in conjunction with the remainder of this report.

NOTE: Where particular hazardous building materials are not listed in the following table, they were not identified in that particular building.

Summary of Identified Hazardous Building Materials	
Building Name	**Identified Hazardous Building Materials**
Cannery	**Asbestos** The following ACMs were identified through this assessment and through previous reports. • Previously identified exterior cement panel in the following locations: – At the front entrance of the East Wing(exterior) – On the east wall of the building (exterior) – On the south wall of the Dryer Shed (exterior) – On the west wall of the Dryer Shed at the roof (exterior). • Mechanical gasket, artifact serial #: KX.91.43.227 (Similar large mechanical gaskets were observed in the Vitamin Oil Shed) • Mechanical gasket, artifact serial #: KX.92.32.92 • Mechanical gasket on artifact serial #: KX.92.32.8 (observed to be in poor condition) • Mechanical gasket on artifact serial #: KX.92.32.8 • O-ring, artifact serial #: KX.93.5.373 • Oven heat shield on artifact serial #: KX.91.42.108 (observed to be in poor condition) • Cement panel behind GE transformer boxes throughout • Grey roof panel on the Dryer Shed • Tan fibrous liner on the wood plank in Tank Room #3 of the Vitamin Oil Shed (observed to be in poor condition) • Tan/Black fibrous liner around perimeter hatch on the "HRT" boiler (observed to be in poor condition) • Dark brown mechanical gasket on the small tank in the northeast corner of the Boiler Room • White insulation on mechanical pipe straights ("Aircell") by the north west exit (observed to be in poor condition) • Blue pipe sealant on sprinkler piping throughout the Main Building • Silver mechanical gaskets on the presses in the Reduction Annex. Unless otherwise noted above, the materials that were accessible and observed, were noted to be in good condition.

Summary of Identified Hazardous Building Materials	
Cannery (Cont'd)	**Lead** The following LCPs were identified through the previous assessments: • Green coloured paint on interior walls and window frames of the Evaporator and Separator Rooms (observed to be in poor condition) • Yellow coloured paint on interior walls and window frames of the Evaporator and Separator Rooms • White coloured paint on interior walls and ceilings of the Vitamin Oil Shed • White coloured paint on exterior walls of the Vitamin Oil Shed • Burgundy coloured paint on exterior trim throughout the Cannery • Cream coloured paint on the Cannery building ceiling and west wall (observed to be in poor condition) • Silver coloured paint on upper interior walls of Ice House • White coloured paint on lower interior walls of Ice House • White coloured paint on the North exterior wall • White coloured paint on the West exterior wall The following LCPs were identified as part of the current assessment: • Lime green coloured paint on the chute of the Dryer Shed/Grinding and Sacking Room • Silver coloured paint on the dryers in the Dryer Shed is lead-containing • Silver coloured paint on the oil tanks of the Vitamin Oil Shed • Black coloured paint on the oil tanks of the Vitamin Oil Shed • Grey coloured paint on the east interior wall of the Boiler Room • Grey coloured paint on the staircase of the Boiler Room • Black coloured paint on the Tea Kettle Boiler of the Boiler Room • Green coloured paint on the Patterson Boiler of the Boiler Room • Grey coloured paint on the interior walls of the West Staff Room in the East Wing • Teal coloured paint on the interior walls of the West Staff Room in the East Wing • White coloured paint on the walls of the East Wing office • Cream coloured paint on the interior walls of the loft level in the East Wing • Cream coloured paint on interior walls of the upper level Ice House • Red coloured paint on switch boxes on the upper level of the Ice House (observed to be in poor condition) • Black coloured paint on interior walls of the upper level Ice House • coloured White coloured paint on the interior wood columns throughout • Teal coloured paint on the door of the Plant Office • Silver coloured paint on the walls of the loft level Electrical Room • White coloured paint on the window trims of the Plant Office • White coloured paint on wood panel walls throughout • Blue coloured paint on the door of the loft level Electrical Room • Teal coloured paint on the chute in the Reduction Annex • Green coloured paint on the Evaporator • Yellow coloured paint on the Evaporator • Silver coloured paint on the Evaporator • Dark green coloured paint on the stairs of the Evaporator room • Silver coloured paint on the press. These materials were observed to be in good condition unless noted otherwise above. Lead is expected to be present in lead-acid batteries used in emergency lighting, older electrical wiring materials and sheathing, solder used on domestic water lines, solder used in bell fittings for cast iron pipes, solder used in electrical equipment, ceramic tile glaze and vent and pipe flashings.
Cannery (Cont'd)	**PCBs** Suspected PCB-containing electrical equipment was not observed.

Summary of Identified Hazardous Building Materials	
	PCBs may also be present in plastics, molded rubber parts, applied dried paints, coatings or sealants, caulking, adhesives, paper, sound-deadening materials, insulation, or felt and fabric products such as gaskets. According to the Previous Reports, the following paint applications tested showed relatively low concentrations of PCB (less than 50 mg/kg): • White coloured paint on the exterior north side of the Cannery – 2.2 mg/kg (Arcoclor-1248) • Burgundy coloured paint on the door to the Boiler Room of north side of the Cannery – 4.9 mg/kg (Arcoclor-1248) – A new coat of Red paint was observed in this location during the current assessment. However, unless paint was completely removed prior to repainting then this application should still be considered to contain PCBs. Further sampling of this paint application may be required to determine management and disposal options, in the future. **Mould and Moisture** Mould-impacted wood panel was confirmed to be present in the East Wing staff room in the back of lockers. **Mercury** Mercury may be present in paints and adhesives. **Ozone Depleting Substances** Two York HVAC Units at the North end of the loft level were identified by labels to be ODS-containing (R-22). **Silica** Silica is expected to be present in vinyl floor tiles, ceiling tiles, concrete, cement and masonry block and interior wall finishes observed in various locations.

Summary of Identified Hazardous Building Materials	
Watchman's Shed	**Asbestos** The following ACMs were identified as part of the current assessment: • Grey cement paneling on the lower east wall (poor condition). **Lead** The following LCPs were identified through the previous assessments: • Purple coloured paint on exterior trim paint, presumed to be present beneath a new coat of red paint, which was observed during the current assessment. Unless the previously-identified lead-containing purple paint was completely removed prior to repainting, then this application should still be considered an LCP. The following LCPs were identified as part of the current assessment: • Teal coloured paint on the interior walls • Green coloured paint on the floor These materials were observed to be in good condition. Lead is expected to be present in older electrical wiring materials and sheathing, solder used in electrical equipment and vent and pipe flashings. **PCBs** Suspected PCB-containing electrical equipment was not observed. PCBs may be present in plastics, molded rubber parts, applied dried paints, coatings or sealants, caulking, adhesives, paper, sound-deadening materials, insulation, or felt and fabric products such as gaskets. **Mercury** Mercury may be present in paints and adhesives. **Silica** Silica is expected to be present in concrete and cement observed in various locations.
Tank Farm	**Asbestos** The following ACMs were identified as part of the current assessment: • Grey mechanical gasket on flanges attached to the two large tanks in the Tank Farm (good condition). **Lead** The following LCPs were identified as part of the current assessment: • Red coloured paint on the pipes (observed to be in poor condition) • Grey coloured paint on the tank • Blue coloured paint on pump (observed to be in poor condition) These materials were observed to be in good condition unless noted otherwise above. Lead is expected to be present in solder used in bell fittings for cast iron pipes. **PCBs** Suspected PCB-containing electrical equipment was not observed. PCBs may be present in plastics, molded rubber parts, applied dried paints, coatings or sealants, caulking, adhesives, paper, sound-deadening materials, insulation, or felt and fabric products such as gaskets. **Mercury** Mercury may be present in paints and adhesives. **Silica** Silica is expected to be present in concrete and cement observed in various locations.

Summary of Identified Hazardous Building Materials	
Administrative Building	**Asbestos** The following ACMs were identified as part of the current assessment: • Grey electrical penetration putty on the upper east wall of the mechanical room • 12"x12" pink stone pattern floor tile and associated mastic in the mechanical/electrical room and the archive room. Unless otherwise noted above, the materials that were accessible and observed, were noted to be in good condition. **Lead** The following LCPs were identified as part of the current assessment: • Yellow coloured paint on the curb of the east side of the building • White coloured paint on the interior walls throughout. These materials were observed to be in good condition. Lead is expected to be present in lead-acid batteries used in emergency lighting, older electrical wiring materials and sheathing, solder used on domestic water lines, solder used in bell fittings for cast iron pipes, solder used in electrical equipment, ceramic tile glaze and vent and pipe flashings. **PCBs** The approximately thirty (30) fluorescent light fixtures were observed to have high-efficiency light tubes. The ballasts within such fixtures are not suspected to contain PCBs. PCBs may also be present in plastics, molded rubber parts, applied dried paints, coatings or sealants, caulking, adhesives, paper, sound-deadening materials, insulation, or felt and fabric products such as gaskets. **Mercury** Mercury vapour is likely to be present in the light tubes/bulbs in the approximately thirty (30) fluorescent light fixtures observed throughout. Mercury may be present in paints and adhesives. **Silica** Silica is expected to be present in concrete and cement observed in various locations.

Summary of Identified Hazardous Building Materials	
Lead Foundry	**Asbestos** The following ACMs were identified as part of the current assessment: • Grey heat shield hanging from wood column on the west side of the building (observed to be in poor condition. **Lead** The following LCPs were identified through the previous assessments: • Purple coloured paint on exterior trim, presumed to be present beneath a new coat of red paint, which was observed during the current assessment. Unless the previously-identified lead-containing purple paint was completely removed prior to repainting, then this application should still be considered an LCP. The following LCPs were identified as part of the current assessment: • White coloured paint on the interior walls. These materials were observed to be in good condition. Lead is expected to be present in older electrical wiring materials and sheathing, solder used in electrical equipment and vent and pipe flashings. **PCBs** Suspected PCB-containing electrical equipment was not observed. PCBs may be present in plastics, molded rubber parts, applied dried paints, coatings or sealants, caulking, adhesives, paper, sound-deadening materials, insulation, or felt and fabric products such as gaskets. **Mercury** Mercury may be present in paints and adhesives. **Silica** Silica is expected to be present in concrete and cement observed in various locations.

Summary of Identified Hazardous Building Materials	
Oil Drum Storage	**Lead** The following LCPs were identified through the previous assessments: • Yellow coloured paint on mechanical pipe on the north exterior • White coloured paint on exterior walls. The following LCPs were identified as part of the current assessment: • White coloured paint on the interior trim of the garage (good condition). Lead is expected to be present in older electrical wiring materials and sheathing, solder used in electrical equipment and vent and pipe flashings. **PCBs** The approximately nine (9) fluorescent light fixtures were observed to have high-efficiency light tubes. The ballasts within such fixtures are not suspected to contain PCBs. PCBs may be present in plastics, molded rubber parts, applied dried paints, coatings or sealants, caulking, adhesives, paper, sound-deadening materials, insulation, or felt and fabric products such as gaskets. **Mercury** Mercury vapour is likely to be present in the light tubes/bulbs in the approximately nine (9) fluorescent light fixtures observed throughout. Mercury may be present in paints and adhesives. **Silica** Silica is expected to be present in concrete and cement observed in various locations.

The statements made in this Executive Summary text are subject to the same limitations included in this report, and are to be read in conjunction with the remainder of this report.

1.0 INTRODUCTION

Stantec Consulting Ltd. (Stantec) was retained by Public Works and Government Services Canada (PWGSC) on behalf of Parks Canada to conduct hazardous building materials assessments within the buildings associated with the following National Park sites in British Columbia:

- Fort Langley National Historic Site in Langley, BC (24 buildings)
- Gulf of Georgia Cannery in Richmond, BC(5 buildings)
- Fort Rodd Hill National Historic Site in Victoria, BC (31 buildings)
- Gulf Islands National Park on Vancouver, Saturna, Prevost, Pender, Russell, Mayne and Tumbo Island, BC (45 buildings)
- Pacific Rim National Park in and between Tofino, Ucluelet and Port Renfrew, BC (39 buildings)

The general locations of the National Park sites are indicated on Drawing A1 in Appendix A.

This report presents the findings of assessment activities within the following six buildings and structures (subject buildings) that are all located throughout the Gulf of Georgia Cannery site in Richmond, BC:

- Cannery
- Watchman's Shed
- Tank Farm
- Administrative Building
- Lead Foundry
- Oil Drum Storage

The purpose of the assessment was to check for potential hazardous building materials that may require special attention in accordance with the requirements of the *Canada Labour Code, Part II* (Canada Labour Code), the current version of British Columbia's *Occupational Health & Safety Regulation* (BC Reg. 296/97) as well as the *Parks Canada Asbestos Management Guide* (January 2014) and the Parks Canada Asbestos Management Standard (January 2014).

The hazardous building materials considered included asbestos-containing materials (ACMs), lead-containing materials including lead-containing paints (LCPs), polychlorinated biphenyls (PCBs), mercury-containing items, ozone-depleting substances (ODSs), mould or moisture affected building materials, and silica.

The site work was conducted by Keith Irwin and Steve Chou of Stantec on July 13 and 14, 2015.

1.1 UNDERSTANDING OF THE PROJECT

Stantec understands that the subject buildings were constructed during time periods when hazardous building materials were commonly used in construction, and that information pertaining to the identity, location and approximate extent of hazardous building materials (if any) within the subject buildings is either not on-file or outdated. As such, and in accordance with the *Parks Canada Asbestos Management Guide* (January 2014), the *Parks Canada Asbestos Management Directive* (January 2014), the *Canada Labour Code* and *BC Reg. 296/97* pertaining to identifying hazards associated with hazardous building materials in the workplace, PWGSC commissioned this assessment on behalf of Parks Canada.

1.2 INFORMATION FROM PREVIOUS REPORTS

The following documentation was reviewed prior to undertaking the assessment:

- Stantec Report No. 123710616 entitled *Lead-Containing Paint and Limited Asbestos Sampling Gulf of Georgia Cannery Moncton Street, Richmond, BC*, dated March 26, 2013, prepared for PWGSC (2013 LCP Report).
- Stantec Report No. 123710616.300 entitled *Assessment of PCB and Lead Content in Paint Gulf of Georgia Cannery Moncton Street, Richmond, BC*, dated July 5, 2013, prepared for PWGSC (2013 LCP and PCB Report).
- Stantec Report No. 123220125 entitled *Assessment/Delineation of Remaining Lead-Containing Paint Exterior West Wall of the Gulf of Georgia Cannery Main Building 12138 Fourth Avenue, Richmond, BC*, dated January 5, 2015, prepared for PWGSC (2015 LCP Report).

Stantec reviewed the above-noted reports (further referred to collectively as the Previous Reports) outlined above for information purposes, and the information provided was considered in developing the current assessment and sampling plan.

Supplemental sampling of previously sampled materials was conducted in those instances where such sampling was required to bring the information into compliance with current regulations as they pertain to minimum sample numbers to appropriately characterize the sampled building materials.

Where previous sampling and analytical data indicated the presence of a hazardous building material (e.g., asbestos, lead), additional sampling was not conducted, and the material was considered to be hazardous.

2.0 SCOPE AND METHODOLOGY

Keith Irwin and Steve Chou of Stantec conducted visual assessments within the subject buildings on July 13 and 14, 2015. Site work was conducted in general compliance with the requirements of the Canada Labour Code, BC Reg. 296/97 and Stantec's Safe Work Practices (SWPs).

Mechanical systems, structures and finishes of the subject buildings were visually examined to determine the suspected presence of ACMs, lead including LCPs, PCBs, mercury, ODSs, mould, and silica. Where building materials were suspected but not confirmed to contain asbestos or lead (in paint) samples were collected for analysis to confirm or deny the presence of these hazardous materials. Based on analytical results, visually similar materials were referenced to specific analyzed samples to reduce the number of samples collected.

Additional background information and the methodology used for the determination of presence or absence of each specific hazardous material considered in this assessment are outlined in the following sections.

2.1 ASBESTOS

The common use of friable (materials which, when dry, can be easily crumbled or powdered by hand pressure) ACMs in construction generally ceased voluntarily in the mid-1970s but was only banned through legislation by the late 1980s. Friable asbestos was used in many building products, primarily high temperature insulations, spray-applied structural fireproofing, and a material known as vermiculite that was commonly used as block wall insulation and may be contaminated with asbestos fibres. Asbestos was also used in many non-friable manufactured products such as floor tiles, ceiling tiles, Transite cement products, and various other construction materials. Some cement products currently used in the construction of buildings may still contain asbestos.

The presence of asbestos in federal workplaces, and pertaining to federally regulated workers is governed by the *Canada Labour Code*. The presence of asbestos in the workplace in British Columbia pertaining to provincially regulated workers is governed by BC Reg. 296/97. As both federally regulated workers and provincially regulated workers (e.g., contractors) are expected to carry out work activities within the subject buildings, and as the provincial regulations are generally more prescriptive pertaining to asbestos (and generally include the requirements noted in the *Canada Labour Code*), this assessment was conducted to meet the requirements of *BC Reg. 296/97*.

According to the current version of *BC Reg. 296/97*, ACM means any material containing at least 0.5% asbestos, or vermiculite insulation with any asbestos.

Based on these criteria, a visual assessment of accessible areas was undertaken in order to check for the presence of materials suspected of containing asbestos. Locations to collect

discrete bulk asbestos samples of suspect building materials were identified. Samples of representative materials were then collected at these locations.

Multiple samples were collected from each "homogenous application" of observed suspected ACMs (materials suspected to contain asbestos that are uniform in material type, colour, texture application and estimated installation date) and submitted to EMSL Canada Inc. (EMSL) in Mississauga, Ontario for analysis of asbestos content using polarized light microscopy (PLM) with dispersion staining, in accordance with the United States Environmental Protection Agency (EPA) 600/R-93/116 method.

The number of samples to be collected for each homogenous application of a suspected ACM was based on accepted occupational hygiene standards and protocols, along with the assessor's experience and understanding of the consistency of that building material's application.

EMSL's analytical laboratory is accredited by the National Voluntary Laboratory Accreditation Program (NVLAP).

2.1.1 Sample Results Interpretation

When asbestos is detected in concentrations greater than 0.5% in one of the samples within a set that was collected to represent a "homogenous application" of a particular material (or detected in any concentration, in a set of samples collected for applications of vermiculite), the entire sample set and the entire application of that material was then considered to be an ACM.

In addition to the above, a "positive stop" option was used during the laboratory analysis of the building material samples submitted for asbestos analysis. The "positive stop" option is utilized by the laboratory when asbestos is detected at a concentration of greater than one percent in one of the samples within a set that was collected to represent a "homogenous application" of that material. At this point, further analysis of subsequent samples within the set is deemed to be unnecessary (as the entire set will be considered an ACM, per above), and the remainder of the samples within the set are not analyzed.

2.1.2 Potential Asbestos-Containing Vermiculite Insulation

As part of the assessment, Stantec assessed the subject buildings for areas where vermiculite insulation, a potential ACM, would likely be present. This included making note of and assessing attic spaces, floor cavities and masonry or brick walls, which are typical areas where vermiculite is found. Regarding this portion of the assessment, the following should be noted:

- Where masonry or brick walls were observed, destructive assessment (drilling) was not conducted to assess the cavity for the presence of vermiculite.

- Where non-vermiculite attic insulation (e.g., fiberglass) was observed, inspection for the presence of vermiculite under the other insulation was conducted only at the attic access point (not throughout the attic).

2.1.3 Asbestos Sampling Quality Assurance/Quality Control

Sampling activities pertaining to asbestos were conducted in accordance with Stantec's SWPs, which take into account current provincial regulations pertaining to such work (i.e., sampling procedures, required number of samples, and laboratory analytical procedures).

Representative bulk samples were collected of accessible suspect ACMs in sufficient quantities for laboratory analyses. Suspect ACM samples were sealed in polyethylene zip-lock bags labeled with the sample number, suspect material description, and sample location. As part of sampling procedures, sampling tools were cleaned between sample collection events to avoid the potential for cross-contamination of samples.

Sample bags were compiled in order and placed into a single container accompanied with a Chain of Custody form outlining the project information, date, building location, number of samples, and sample description. Samples were submitted to the analytical laboratory in a sealed container via courier.

2.2 LEAD

Lead may be used in its pure metallic form or combined chemically with other elements to form lead compounds. Metallic lead is used to make products such as electric storage batteries, ammunition, lead solder, radiation shields, pipes, and sheaths for electric cables. Metallic lead is sometimes combined with other metals such as copper, tin, and antimony as lead alloys for use in the manufacture of a variety of metal products. Lead is commonly found in buildings in the solder used on copper domestic pipes, in the caulking on bell fittings of cast iron drainage pipes and in electrical equipment.

The presence of lead-containing materials (other than paint) was assessed through visual means.

With respect to paint, the lead content of interior paint was limited to 0.5% by weight (equivalent to 5,000 mg/kg or ppm) in 1976 under the Federal *Hazardous Products Act,* which governs the import, export and distribution of hazardous products in Canada. In 2005, the *Hazardous Products Act* had reduced the criteria for surface coatings (including paint) to 600 mg/kg (600 ppm) to define them as "lead-containing". This criterion has since (2010) been reduced to 90 ppm.

However, with respect to potential lead exposures associated with disturbance to surfaces coated with lead-containing products, WorkSafeBC has compiled a manual titled *Lead-Containing Paint and Coatings: Preventing Exposure in the Construction Industry*, (Lead Guideline) which defines a "lead-containing surface coating material" and indicates that "…the improper removal of lead paint containing 600 mg/kg lead results in airborne lead

concentrations that exceed half of the exposure limit". As such, Stantec will reference this value (600 ppm) in defining paints as "lead-containing".

Based on this criterion, samples of suspected LCPs were collected from major paint applications, and were collected to substrate, where possible, in sufficient quantity to conduct analyses for total lead content. Samples collected were placed into separate, sealed, and labeled polyethylene bags, and submitted to EMSL for analyses of total lead content using Flame Atomic Absorption Spectrometry AAS (SW 846 3050B*/7000B).

EMSL's analytical laboratory is also accredited by the American Industrial Hygiene Association (AIHA) Environmental Lead Laboratory Approval Program.

2.3 POLYCHLORINATED BIPHENYLS

PCBs were used widely as coolants and lubricants in transformers, capacitors, and other electrical equipment. In fluorescent fixtures, PCBs were usually found within the small capacitors inside the ballast that controls the lamp. The Federal *Chlorobiphenyls Regulation, SOR/91-152*, prohibited the use of PCBs in electrical equipment manufactured after July 1, 1980.

The presence of PCB-containing equipment was assessed through visual means. With respect to fluorescent lamp ballasts, due to the risk of electrical shock associated with dismantling operating fixtures, fluorescent lamp ballasts were not removed to view identification numbers/information.

The total number of fluorescent lamp fixtures that may have ballasts that contain PCBs was approximated for each building assessed.

Suspected PCB-containing electrical equipment can be visually inspected and compared to the Environment Canada reference guide entitled *Identification of Lamp Ballasts Containing PCBs, Report EPS 2/CC/2*, dated August 1991 (PCB Guide).

2.4 MERCURY

Mercury is commonly found in buildings as mercury vapour lighting, thermostats/thermometers with mercury-containing glass ampoules, electrical switches and can also be found in minor amounts in fluorescent lamp tubes and vapour bulbs and may be present in stable forms in adhesives. Exposure to mercury in federal workplaces is governed by the *Canada Labour Code*, while provincially it is governed by *BC Reg. 296/97*.

The presence of mercury and mercury-containing equipment was assessed through visual means.

2.5 MOULD

Moist building materials may provide suitable conditions for mould growth, and the removal of building materials impacted by mould growth may require workers with specific training and experience using work procedures that have been developed to protect workers and work areas from exposure to elevated concentrations of airborne mould.

The presence of suspect visible mould was assessed through visual means and sampling. Material observed with dark-coloured staining and/or a textured and discoloured appearance is described as "suspect mould". Mould identified visually is defined as "suspect mould" unless it is confirmed as mould by laboratory analysis.

2.5.1 Mould Reference Guidelines

With respect to mould and/or moisture, the visual assessment procedures utilized during this project were based on the recommendations provided in the documents listed below:

- Standard Construction Document CCA 82 *Mould Guidelines for the Canadian Construction Industry*, Canadian Construction Association, 2004 (referred to as CCA 82)
- *Guidelines on Assessment and Remediation of Fungi in Indoor Environment*, New York City Department of Health, Bureau of Environmental and Occupational Disease Epidemiology, April 2000 (referred to as the NYC Guidelines)
- *Fungal Contamination in Public Buildings: Heath Effects and Investigation Methods*, Federal-Provincial Committee on Environmental and Occupational Health, 2004 (referred to as the Health Canada Guide)
- *Indoor Air Quality in Office Buildings: A Technical Guide*, report of the Federal-Provincial Advisory Committee on Environmental and Occupational Health, 1995 (referred to as the IAQ Guide)
- *Bioaerosols: Assessment and Control, American Conference of Governmental Industrial Hygienists* (ACGIH), 1999 (referred to as the ACGIH Report)

2.6 OZONE-DEPLETING SUBSTANCES

Chlorofluorocarbons (CFCs) and other ODSs are often found in refrigeration units associated with air-conditioning or other refrigeration equipment. In September 1987, 47 countries agreed to the Montreal Protocol on Substances that Deplete the Ozone Layer. ODSs are regulated in BC by the *British Columbia Waste Management Act—Ozone Depleting Substances and Other Halocarbons Regulation* (*BC Reg. 387/99* as amended by *BC Reg. 109/2002*) and the Federal *Halocarbon Regulations*, 2003 (FHR 2003).

2.7 SILICA

Silica, also referred to as free crystalline silica, is found in concrete, cement, mortar, ceramic wall and floor tiles, stucco finishes and acoustic ceiling tiles. Prolonged exposure to, and inhalation of

free crystalline silica, may result in respiratory disease known as silicosis, which is characterized by progressive fibrosis of the inner lung tissue and marked shortness of breath or impaired lung function.

Exposure to silica dust is governed by *BC Reg. 296/97* According to both legislative instruments; the time-weighted average exposure limit for airborne silica dust is 0.025 mg/m³.

The presence of silica was assessed through visual means.

3.0 ASSESSMENT LIMITATIONS

In preparation of this report, Stantec used professional judgment based on experience. The work was conducted in accordance with generally accepted professional standards. Stantec relied on information gathered during the site investigation and laboratory analytical reports.

This report reflects the observations made within accessed areas of the subject buildings and the results of analyses performed on specific materials sampled during the assessment. Analytical results reflect the sampled materials at the specific sample locations.

Sampling was conducted pertaining to suspected ACMs and suspected LCPs only. The assessment for the presence of other hazardous building materials was visual in nature, and was conducted pertaining to readily visible surfaces within accessible spaces only. Concealed spaces were inspected via existing access panels, where present. Interior and exterior finishes, solid ceilings, walls, flooring and structural elements were not removed to access concealed areas.

The following areas were not accessed, for the reasons indicated:

- Sloped roof portions (lack of safe access)
- Vitamin Oil Shed Tank Room #2 (key not available).

As such, limited comments, if any, will be provided regarding the presence, quantity or condition of hazardous building materials within the above-noted areas.

In addition to the above, and due to limitations on the agreed to scope of work for this project as well as physical limitations in accessing concealed areas and limitations associated with working in occupied/operational spaces, there are specific limitations to the information that can be provided to each hazardous building material considered in this assessment, as outlined in the following sub-sections.

3.1 ASBESTOS

Suspected ACMs that were not sampled include, but are not limited to, the following (where present, based on building construction or as otherwise noted):

- Roofing materials associated with buildings where the roof could not be accessed safely with the equipment present on-site
- Sub-grade materials
- Interior components of mechanical equipment (e.g., inner linings or gaskets in boilers)
- Interior components of heating, ventilation and air conditioning (HVAC) units
- Heat protection materials inside mechanical installations (e.g., gaskets) and light fixtures (e.g., paper backing in sealed incandescent fixtures)
- Flooring material concealed beneath ceramic tile, brickwork, hardwood flooring, and/or concealed beneath existing sub-floors
- Drywall and/or wall plaster and associated finish materials concealed behind new and/or additional walls or ceilings
- Woven tape inside duct connection joints or inner ducting insulation
- Materials within sealed/hard wall cavities, hard ceiling cavities or crawlspaces without appropriate access points
- Insulation materials inside fire doors
- Insulation materials in attic, ceiling or crawlspace areas beyond reasonable reach from safe access points
- Ceramic tile grout.

If encountered during renovation, demolition or other activities, any suspected ACMs not identified within this report should be presumed to contain asbestos and handled as such until otherwise proven, through analytical testing.

3.1.1 Cannery – Artifacts

A large collection of "artifacts" is present throughout the loft area of the main Cannery building. Many of these artifacts are mechanical components used during the operational era of the Cannery and as such, ACMs may be present in the collection. Various suspected ACM artifacts were sampled as directed by Parks Canada staff. This sampling was intended to provide information about the types of ACM materials which may be present within the collection but does not constitute a comprehensive assessment of all of the artifacts. Artifacts that are suspected to have ACM components and that were not sampled as part of this assessment should be presumed to contain asbestos until proven otherwise by analytical testing.

3.1.2 Cannery – Mechanical Equipment on Display

Mechanical equipment used during the operational era of the Cannery is also on display throughout the main Cannery building. This equipment was visually inspected and samples of readily accessible suspected ACMs were collected. Mechanical equipment was not dismantled in order to assess internal components for the presence of suspected ACMs. As such, if mechanical equipment is to be dismantled any suspected ACMs discovered during this process should be presumed to contain asbestos until proven otherwise by analytical testing.

3.2 LEAD

Assessment for the presence of lead or lead-containing materials was visual in nature, and was conducted pertaining to readily visible surfaces within accessible spaces of the subject buildings only. The presence of lead or lead-containing materials in inaccessible areas not assessed included, but was not limited to: ceiling spaces, wall cavities, crawlspaces, and buried materials.

With respect to paint, samples of suspected LCPs were collected within the subject buildings only from surfaces of major paint applications where visually different paint colours and/or types were identified. Although the surfaces where samples were collected may be covered with more than one coat of paint, the paint samples are described by the surface (visible) colour only.

Attempts were made to represent all layers of paint in the samples collected. As analytical results are referenced to the surface paint colour only, the lead content of all painted surfaces similar to that represented by the surface paint colour will be presumed to be the same, regardless of differing sub surface paints, if any.

3.3 POLYCHLORINATED BIPHENYLS

Due to height restrictions and the risk of electrical shock in handling operational light fixtures, the ballasts present in the fixtures observed within the subject buildings were not removed for comparison to the PCB Guide. The visible labels of ballasts in several fixtures were inspected for comparison to the PCB Guide.

Conclusions and recommendations regarding the presence of PCBs within the subject buildings are based on Stantec's limited observations in combination with information provided by staff regarding lighting renovations (where requested by Stantec based on observations) and is presented to provide guidance regarding the likelihood that PCB-containing equipment is or is not present within the subject buildings. The exact extent and/or number of fluorescent lamp ballasts containing PCBs, if any, within the subject buildings will not be commented on.

3.4 MERCURY

Visual assessment for the presence of mercury-containing equipment within the subject buildings was conducted in accessible areas only. The presence of mercury or mercury-containing equipment in inaccessible areas includes, but is not limited to: ceiling spaces, wall cavities, and crawlspaces, or as internal parts of HVAC mechanisms.

3.5 MOULD

Visual assessment for the presence of suspected visible mould and/or suitable conditions for mould growth (e.g., moist and/or water-stained building materials) were conducted in accessed portions of the subject buildings only. The assessment was not intrusive in nature and included visual assessment of exposed surfaces and closer inspection of known problem areas.

The conclusions made in this report provide description(s) of the potential source(s) of moisture within the subject buildings that may have led to suitable conditions for mould growth, only in those cases where potential source(s) of moisture were identified. These conclusions will not necessarily identify all sources of moisture leading to suitable conditions for mould growth within the subject buildings or within the impacted area(s).

This assessment does not constitute a building envelope/building systems assessment, which would include an intrusive investigation to assess the internal condition, potential moisture sources, and expected remaining service life of the various components and systems comprising the envelope of a building.

3.6 OZONE DEPLETING SUBSTANCES

Visual assessment for the presence of ODSs within the subject buildings was conducted in accessible areas only. The presence of ODS-containing equipment in inaccessible areas including, but not limited to, ceiling spaces, wall cavities and crawlspaces, was not assessed. In addition, portable equipment that may contain ODSs (refrigerators, drink coolers, etc.) was not considered as part of this assessment.

3.7 SILICA

Visual assessment for the presence of silica-containing materials within the subject building was conducted in accessible areas only. The presence of potential silica-containing materials in inaccessible areas including, but not limited to, ceiling spaces and wall cavities was not assessed.

4.0 FINDINGS

Floor plans showing bulk sample locations and locations of identified hazardous materials (where practical) are provided in Appendix A.

The results of the assessment for each of the considered hazardous materials are provided in the following sub-sections.

4.1 ASBESTOS

Building-by-building summary lists of the samples collected during this assessment including descriptions of the sample types, sampling locations and laboratory analytical results are provided in Tables B-1 through B-6 in Appendix B. Copies of the Laboratory Certificates of Analysis for asbestos samples analyzed are included in Appendix C.

Based on our observations of building construction (estimated vintage of interior finishes and uniformity of building material use) and on our interpretations of the analytical results of suspected ACM samples collected during this assessment as well as the information provided in

the Previous Reports, the materials presented in Tables D-1 though D-5 in Appendix D were identified as ACMs. This table also provides information regarding the asbestos content of the material, its condition, location and friability, as well as representative photographs of the material (where available).

4.1.1 Potential for Vermiculite Insulation

It should be noted that various walls of the subject buildings were comprised of masonry (concrete) blocks. Asbestos-contaminated vermiculite was historically used as insulating material in masonry block or brick walls, may be present. To assess for this potential ACM, destructive sampling is required, which was not conducted as part of this assessment. Although various holes, breaches and cracks were observed and no vermiculite was present, the presence of this potential ACM cannot be ruled out without destructive testing.

4.1.2 Materials with <0.5% Asbestos

It should be noted that various materials tested as part of this assessment were found to contain asbestos in trace concentrations (<0.25%) in some samples, as summarized below:

- Cannery
  - Roof material over staircase for Dryer Shed (< 0.25% chrysotile asbestos detected in two samples, no asbestos detected in the third sample)
  - Vent sealant on roof (< 0.25% chrysotile asbestos detected in one sample, no asbestos detected in the other two samples)
  - Insulation on the Tea Kettle boiler in the Boiler room (< 0.25% chrysotile asbestos detected in one sample, no asbestos detected in the other two samples)

As the number of samples collected for each of the above-noted homogenous applications would be considered sufficient to appropriately characterize that material based on published provincial standards (BC Asbestos Guide), the above-noted materials are not considered to be ACMs.

4.2 LEAD

Building-by-building summary lists of the samples collected during this assessment including descriptions of the sample types, sampling locations and laboratory analytical results are provided in Tables E-1 through E-6 in Appendix E. Copies of the Laboratory Certificates of Analysis for paint chip samples analyzed are included in Appendix F.

Based on our observations and on our interpretations of the analytical results of suspected LCP samples collected during this assessment as well as the information provided in the Previous Reports, the materials presented(on a building-by-building basis) in Tables G-1 through G-6 in Appendix G were identified as LCPs. This table also provides information regarding the lead content of the paint, its condition and location, as well as representative photographs of the paint (where available),

In addition to paint, lead is expected to be present in the following within the subject buildings:

- Lead-acid batteries used in emergency lighting
- Older electrical wiring materials and sheathing
- Solder used on domestic water lines
- Solder used in bell fittings for cast iron pipes
- Solder used in electrical equipment
- Ceramic tile glaze
- Vent and pipe flashings.

4.3 POLYCHLORINATED BIPHENYLS

The following observations were made pertaining to potential PCB-containing electrical equipment:

- Cannery, Tank Farm and Lead Foundry
  - No suspected PCB-containing electrical equipment or stored items were observed.
- Administrative Building
  - Approximately 30 fluorescent light fixtures with high-efficiency light tubes were observed. The ballasts within such fixtures are not suspected to contain PCBs.
- Oil Drum Storage
  - Approximately nine fluorescent light fixtures with have high-efficiency light tubes were observed. The ballasts within such fixtures are not suspected to contain PCBs.

PCBs may also be present in plastics, molded rubber parts, applied dried paints, coatings or sealants, caulking, adhesives, paper, sound-deadening materials, insulation, or felt and fabric products such as gaskets.

4.3.1 PCBs in Paint

Sampling and/or assessment for PCBs in paint was not within the scope of the current assessment.

According to the 2013 LCP and PCB Report, relatively low concentrations of PCB (less than 50 mg/kg) were detected in the following paints associated with the Cannery:

- White coloured paint on the exterior north wall of the Cannery – 2.2 mg/kg (Arcoclor-1248)
- Burgundy coloured paint on the door trim to the Boiler Room of north wall of the Cannery – 4.9 mg/kg (Arcoclor-1248).

During the current assessment, a new coat of red paint was observed on the materials that were previously observed to be coated with the above-noted burgundy paint. It should be noted that unless the old paint was completely removed prior to repainting, then this new red paint application should still be considered to contain PCBs. Further sampling of this paint application may be required to determine management and disposal options, in the future.

4.4 MOULD

The observations pertaining to mould and moisture that were made during this assessment are summarized in Table 4-1 below.

Table 4-1 Mould/Moisture Observations Summary
Gulf of Georgia Cannery, 12138 - 4 Avenue, Richmond, BC

Building and Area	Observation	Suspected Source of Moisture	Photo
Cannery East Wing staff room, in the back of the lockers	Confirmed mould-stained wood panel inside lockers (see below for analytical results)	Condensation	
Watchman's Shed Tank Farm Administrative Building Lead Foundry Oil Drum Storage	No suspected mould and/or moisture-impacted building materials observed	N/A	N/A

4.4.1 Surface Sampling – Cannery

Table 4-2, below, summarizes the locations and analytical results of the bulk surface samples collected from the Cannery during this assessment. A copy of the sample analytical report provided by Sporometrics is attached in Appendix H.

Table 4-2 Surface Sample Collection and Analysis Summary
Gulf of Georgia Cannery, 12138 - 4 Avenue, Richmond, BC

Sample No.	Sample Location	Microscopic Observation	Mould Growth Indicated?
EW-MS-01	Cannery – East Wing – staff room locker (west)	Hyphal fragments, pigmented	Yes

4.5 MERCURY

The following observations were made pertaining to potential mercury-containing items:

- Cannery, Watchman's Shed, Tank Farm and Lead Foundry
  - No suspected mercury-containing items were observed.
- Administrative Building
  - Mercury vapour is likely to be present in the light tubes within thirty (30) fluorescent light fixtures observed.
- Oil Drum Storage
  - Mercury vapour is likely to be present in the light tubes within nine (9) fluorescent light fixtures observed.

Mercury may also be present in paints and adhesives.

4.6 OZONE DEPLETING SUBSTANCES

The following equipment was identified by labels to be ODS-containing:

Building	Equipment	Location	Refrigerant
Cannery	York HVAC Units (2 units)	North end on the loft Level	R-22 (6 lbs. total)
Watchman's Shed Tank Farm Administrative Building Lead Foundry Oil Drum Storage	None observed	N/A	N/A

The locations of the confirmed ODS-containing equipment are indicated in the floor plan drawings provided in Appendix A.

4.7 SILICA

Silica is expected to be present in vinyl floor tiles, ceiling tiles, concrete, cement and masonry block and interior wall finishes observed in various locations throughout the subject buildings.

5.0 RECOMMENDATIONS

5.1 ASBESTOS

For buildings/structures with identified ACMs, Stantec recommends the following with regards to meeting the requirements of the *Canada Labour Code*, *BC Reg. 296/97*, the *Parks Canada Asbestos Management Guide* (January 2014) and the *Parks Canada Asbestos Management Standard* (January 2014) as they pertain to managing asbestos in the workplace and/or managing asbestos during renovation/demolition projects:

- Damaged ACMs should be removed and disposed of by an experienced asbestos abatement contractor, in accordance with the procedures and regulations outlined in *BC Reg. 296/97* and the *BC Asbestos Guide*. This would include the following:
  - Cannery
    - Remove and dispose of the mechanical gasket on artifact serial #: KX.92.32.8.
    - Remove and dispose of the oven heat shield on artifact serial #: KX.91.42.108.
    - Remove and dispose of approximately 5 square feet of tan fibrous liner on the wood plank in tank room #3 of the vitamin oil shed.
    - Remove and dispose of the tan fibrous liner around the perimeter of the hatch on the "HRT" boiler.
    - Remove and dispose of approximately 20 linear feet of white Aircell mechanical pipe insulation by the north west exit.
  - Watchman's Shed
    - Remove and dispose of approximately 8 square feet of grey cement paneling on the lower east wall.
  - Lead Foundry
    - Remove and dispose of approximately 1 square foot of grey heat shield hanging from wood column on the west side of the building.
- Identified ACMs in good condition can be managed in place in accordance with the requirements of the *Parks Canada Asbestos Management Guide* (January 2014) and the *Parks Canada Asbestos Management Standard* (January 2014).
- Asbestos-containing materials that may be impacted during renovations and/or demolition activities should be removed by an experienced asbestos abatement contractor, in accordance with the procedures and regulations outlined in *BC Reg. 296/97* and the *BC Asbestos Guide*, and prior to the renovation and/or demolition activities.
- Should a material suspected to contain asbestos fibres become uncovered during renovation and/or demolition activities, all work in the areas that may disturb the material should be stopped. Samples of the suspect material should be submitted for laboratory analysis to determine if asbestos fibres are present. Confirmed asbestos materials should be handled in accordance with applicable guidelines and regulations.
- Suspected ACMs deemed visually similar to the ACMs identified in this report (on a building-by-building basis) should be considered asbestos-containing and handled as such, unless proven otherwise, through analytical testing.

- Asbestos-containing cement pipe may be present below ground—caution should be used if excavation is required.
- If masonry block walls are to be impacted by renovation and/or demolition work, and these walls have not been checked for the presence of vermiculite insulation, intrusive assessments for vermiculite should be undertaken prior to renovation/or demolition work. If vermiculite insulation is suspected to be present, this material should be treated as an ACM until testing can show otherwise.
- Ensure asbestos containing waste is handled, stored, and disposed of in accordance with the requirements of the Federal Transportation of Dangerous Goods Regulation and the *British Columbia Hazardous Waste Regulation* (*BC Reg. 63/88*).

5.2 LEAD

Lead-containing paint observed in poor condition throughout should be cleaned-up and/or addressed to mitigate potential for additional deterioration and dispersal of lead-containing paint chips/dust. This would include the following:

- Cannery
  - Green coloured paint on interior walls and window frames of the Evaporator and Separator Rooms
  - Cream coloured paint on the Cannery building ceiling and west wall
  - Red coloured paint on switch boxes on the upper level of the Ice House.
- Tank Farm
  - Red coloured paint on the pipes
  - Blue coloured paint on pumps.

Consideration should be given to re-painting surfaces to mitigate the potential for additional deterioration and hazards associated with the lead-containing paint chips/dust that may be created. If re-painting is completed, appropriate precautions to protect workers and work areas from exposure to lead will be required during painting preparation activities.

If LCPs or other lead-containing equipment/materials within the subject buildings are to be disturbed and/or removed, ensure compliance with the following:

- The exposure protection requirements of the *BC Reg. 296/97*.
- The disposal requirements of the British Columbia Hazardous Waste Regulation (*BC Reg. 63/88*).
- The transportation requirements of the Federal *Transportation of Dangerous Goods Regulation*.

Corrective action or remedial work on paint applications containing any concentration of lead should be undertaken in a manner so as to avoid generating fine particulate matter or dust (i.e., avoid sanding). Airborne lead dust or fumes should not exceed the *BC Reg. 296/97* 8-hour Occupational Exposure Limit (OEL) of 0.05 milligram per cubic metre (mg/m^3) during the removal of paints and products containing any concentration of lead. The use of personal protective

equipment is recommended to reduce the potential for over-exposure to lead dust. This can be achieved by:

- Providing workers with protective clothing and PPE or devices as necessary to protect the worker against the hazards to which the worker may be exposed.
- Providing workers with adequate and training in the care and use of clothing, equipment or device before wearing or using it.
- Wetting the surface of the materials to prevent dust emissions.
- Providing workers with washing facilities with clean water, soap and individual towels to properly wash prior to exiting the work area.

To avoid the inhalation of lead, it is essential to have the following control methods in place:

- Engineering controls
- Work practices and hygiene practices
- Respirators and personal protective equipment
- Training.

The work tasks required and the ways in which lead-containing materials (including paints) will be impacted will determine the appropriate respirators, measures and procedures that should be followed to protect workers from lead exposure.

Lead-containing materials, including paints, can be managed in place, where in good condition.

5.3 POLYCHLORINATED BIPHENYLS

When decommissioned, and if fluorescent light fixtures of older vintage (without high-efficiency light tubes) are discovered in concealed locations or areas not accessed, verify the PCB content of ballasts as per the Environment Canada publication *Identification of Lamp Ballasts Containing PCBs*, 1991. In the unlikely event that PCB-containing items are identified for removal and disposal, they should be handled, transported, stored and disposed of in accordance with the following:

- The disposal requirements of the *British Columbia Hazardous Waste Regulation* (*BC Reg. 63/88*)
- The transportation requirements of the Federal *Transportation of Dangerous Goods Regulation*
- The Federal *PCB Regulations* (*SOR/2008-273*).

Should a material suspected to contain PCBs become uncovered during renovation activities (i.e., dielectric fluids, hydraulic fluids), all work in the areas that may disturb the material should be stopped. Samples of the suspect material should be submitted for laboratory analysis to determine if PCBs are present. Confirmed PCBs should be handled in accordance with Federal *Regulation SOR/2008-273* and *BC Reg. 63/88*.

5.4 MOULD

Documents published by Health Canada, Ontario Ministry of Health, American Industrial Hygiene Association (AIHA), American Conference of Governmental Industrial Hygienists (ACGIH) and others, provide guidance for interpreting the results of mold investigations. The Health Canada Guide states that:

> *"Identifiable promoters of fungal growth require correction, and any visible fungi require removal."*

To this end, Stantec recommends the following course of action within the subject building:

- Cannery Building:
  - Remove and replace mould impacted wood panel in the back of staff room lockers. This work should be conducted in accordance with accepted industry practices and guidelines (e.g., CCA 82), by a competent person or contractor that is knowledgeable of potential hazards of mould exposure, and appropriate remediation precautions.
  - An assessment to determine the likely source(s) of moisture impact should be undertaken. Issues leading to moisture impacts and/or mould growth should be identified and addressed prior to reinstating building materials to areas where mould abatement is conducted, to avoid the potential for re-wetting of new materials, and repeated mould growth.

5.5 MERCURY

Identified mercury-containing items can be managed in place, therefore no further action is recommended at this time. Mercury vapour within light fixtures poses no risk to workers or occupants provided the mercury containers remain intact and undisturbed.

Complete removal of mercury-containing equipment is required prior to renovation or demolition activities that may disturb the equipment. When mercury-containing items (e.g., fluorescent light bulbs/tubes, thermostats) are removed, ensure all mercury waste is handled, stored and disposed of in accordance with the requirements of the disposal requirements of the following:

- The disposal requirements of the *British Columbia Hazardous Waste Regulation* (*BC Reg. 63/88*)
- The transportation requirements of the Federal *Transportation of Dangerous Goods Regulation*.

Precautions should be taken if workers may potentially be exposed to mercury or mercury vapours to ensure that workers exposure levels do not exceed the occupational exposure limit of 0.025 mg/m^3 as per the *BC Reg. 296/97*. This can be achieved by providing respiratory and skin protection applicable to the hazard and task to be completed.

5.6 OZONE DEPLETING SUBSTANCES

ODS-containing equipment can be managed in place and must be serviced by licensed refrigeration technicians (as defined in the Federal *Halocarbon Regulations*).

When refrigeration equipment that is suspect or confirmed ODS-containing is decommissioned, it should be emptied and inspected by licensed refrigeration technician (as defined in the Federal *Halocarbon Regulations*).

If ODS-containing equipment is to be removed during demolition activities, ODSs must be handled, recycled, stored, and/or disposed of in accordance with the requirements of the following:

- *British Columbia Waste Management Act—Ozone Depleting Substances and Other Halocarbons Regulation* (*BC Reg. 387/99* as amended by *BC Reg. 109/2002*)
- The transportation requirements of the Federal *Transportation of Dangerous Goods Regulation*
- The Federal *Halocarbons Regulations*.

5.7 SILICA

Silica-containing materials can be managed in place, therefore no further action is recommended at this time.

If silica-containing materials within the subject building are to be disturbed and/or removed (e.g., coring through concrete slabs, demolition of masonry or concrete units), ensure dust control measures are employed such that airborne silica dust concentrations do not exceed the exposure limit as stipulated by *BC Reg. 296/97* (Cristobalite and Quartz – each 0.025 mg/m^3). This would include, but not be limited to, the following:

- Providing workers with respiratory protection
- Wetting the surface of the materials, use of water or dust suppressing agents to prevent dust emissions
- Providing workers with facilities to properly wash prior to exiting the work area.

6.0 CLOSURE

This report has been prepared by Stantec Consulting Ltd. for the sole benefit of Public Works and Government Services Canada. Any use that a third party makes of this report, or any reliance on decisions to be made based on it, is the responsibility of such third parties. Stantec Consulting Ltd. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

The conclusions presented represent the best judgment of the assessor based on current environmental, health and safety standards and the site conditions observed on the dates cited within this report. This report is based on, and limited by, circumstances and conditions stated herein, and on information available at the time of preparation of the report. Due to the limited nature of the investigation and the limited data available, Stantec Consulting Ltd. cannot warrant against undiscovered environmental, health and/or safety liabilities. It is possible that additional, concealed hazardous materials may become evident during renovation and/or demolition activities within the subject buildings.

If any conditions become apparent that differ significantly from our understanding of conditions as presented in this report, we request that we be notified immediately to reassess the conclusions provided herein.

We trust that the report meets your current requirements. Should you have any questions or concerns regarding the above, please do not hesitate to contact the undersigned.

Respectfully submitted,

STANTEC CONSULTING LTD.

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KW/TW/SB/dsc

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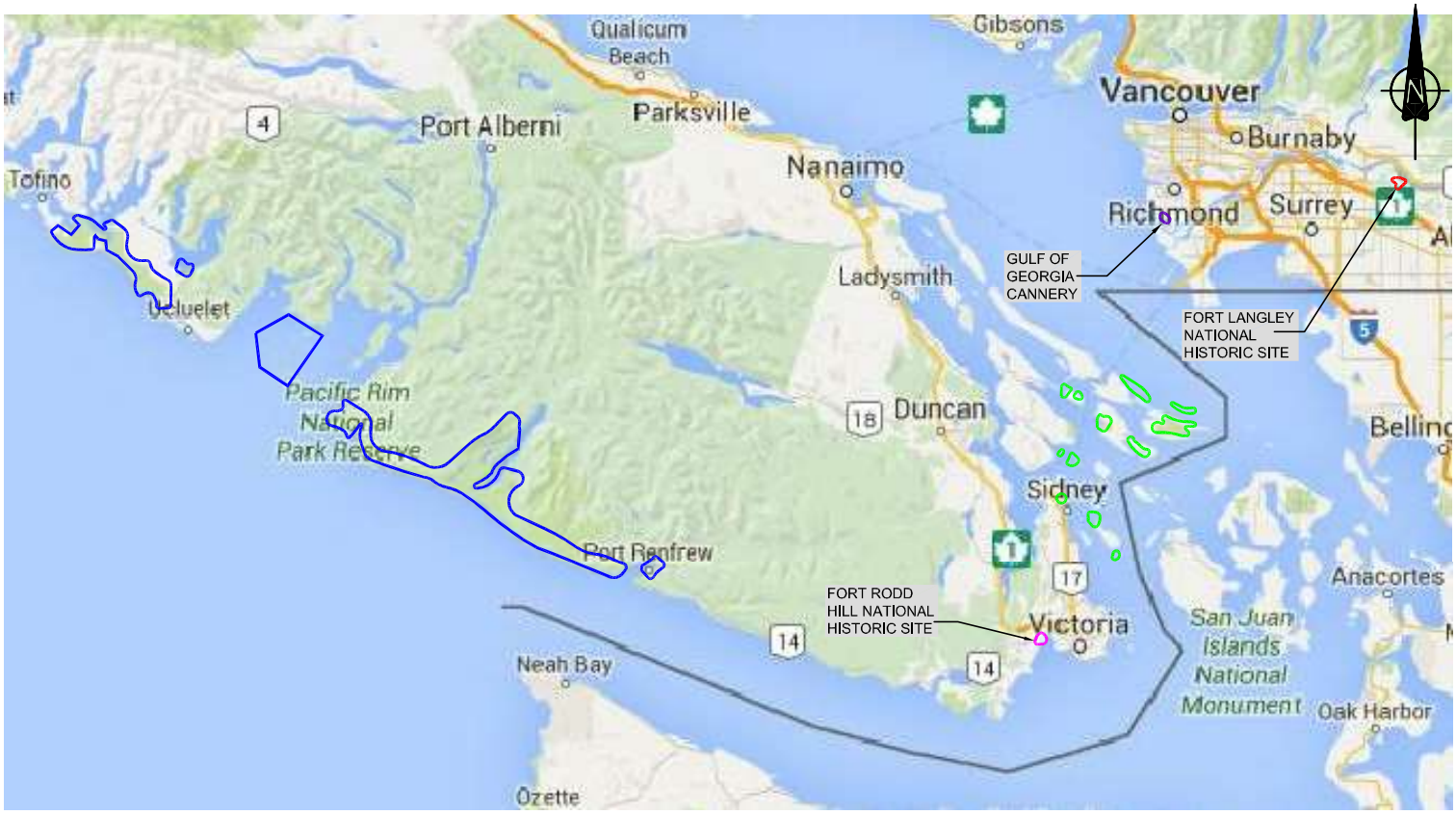
Appendix A FLOOR PLANS SHOWING SAMPLING LOCATIONS AND LOCATIONS OF IDENTIFIED HAZARDOUS BUILDING MATERIALS



LEGEND

- FORT LANGLEY NATIONAL HISTORIC SITE
- GULF OF GEORGIA CANNERY
- FORT RODD HILL NATIONAL HISTORIC SITE
- GULF ISLANDS NATIONAL PARK
- PACIFIC RIM NATIONAL PARK

NOTE: THIS DRAWING ILLUSTRATES SUPPORTING INFORMATION SPECIFIC TO A STANTEC CONSULTING LTD. REPORT AND MUST NOT BE USED FOR OTHER PURPOSES.

SITE LOCATIONS

SOUTH COAST NATIONAL PARKS OF CANADA

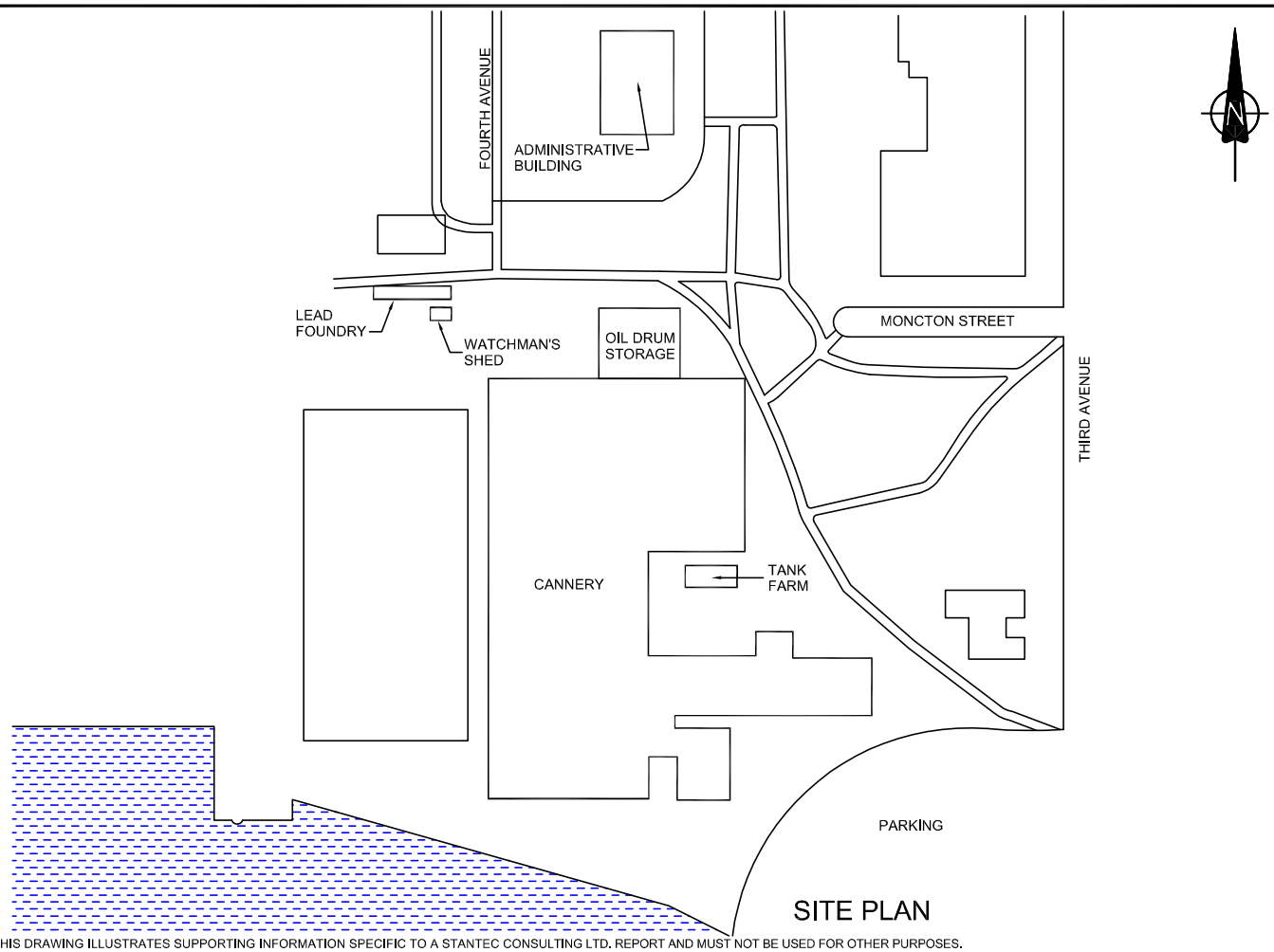
SOUTH COAST OF BRITISH COLUMBIA

Client: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA

Project No.:	123220330
Scale:	N.T.S.
Date:	16/01/15
Dwn. By:	CD DM SL2016010230
App'd By:	TW

Dwg. No.: A1

Stantec



SITE PLAN

NOTE: THIS DRAWING ILLUSTRATES SUPPORTING INFORMATION SPECIFIC TO A STANTEC CONSULTING LTD. REPORT AND MUST NOT BE USED FOR OTHER PURPOSES.

SITE PLAN SHOWING BUILDING LOCATIONS

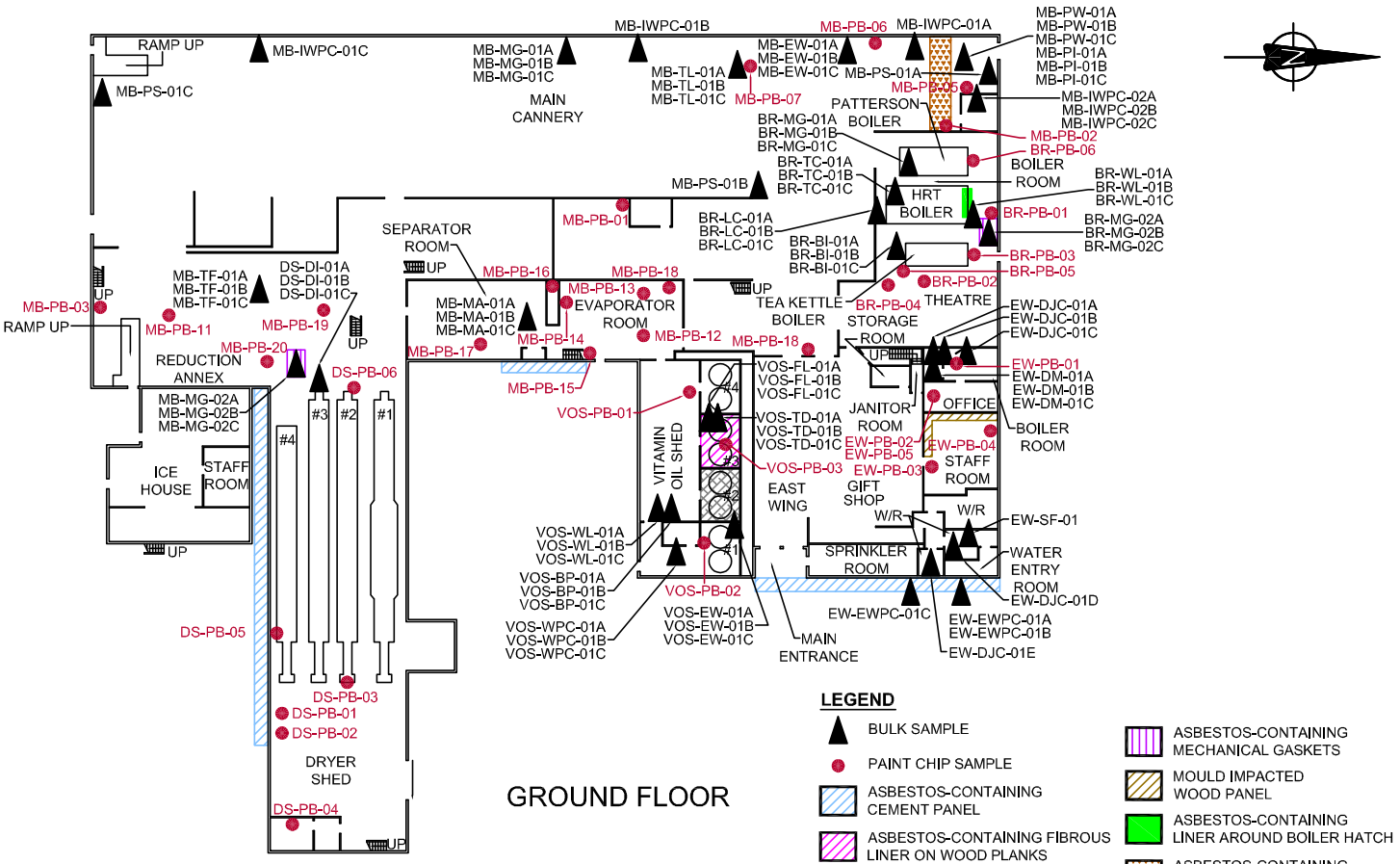
GULF OF GEORGIA CANNERY, RICHMOND, BC

Client: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA

Project No.:	123220330-300.100
Scale:	N.T.S.
Date:	16/02/16
Dwn. By:	CD SL2016020103 PK/DM
App'd By:	TW

Dwg. No.: A2

Stantec



NOTES: **1. CEMENT PANEL BEHIND GE TRANSFORMER BOXES THROUGHOUT IS ASBESTOS-CONTAINING.**
2. MECHANICAL GASKETS ON FLANGES ATTACHED TO THE TWO LARGE TANKS IN THE TANK FARM ARE ASBESTOS-CONTAINING.
3. BLUE SPRINKLER PIPE SEALANT THROUGHOUT IS ASBESTOS-CONTAINING.
4. THIS DRAWING ILLUSTRATES SUPPORTING INFORMATION SPECIFIC TO A STANTEC CONSULTING LTD. REPORT AND MUST NOT BE USED FOR OTHER PURPOSES.

FLOOR PLAN SHOWING HAZARDOUS BUILDING MATERIALS AND BULK SAMPLE LOCATIONS

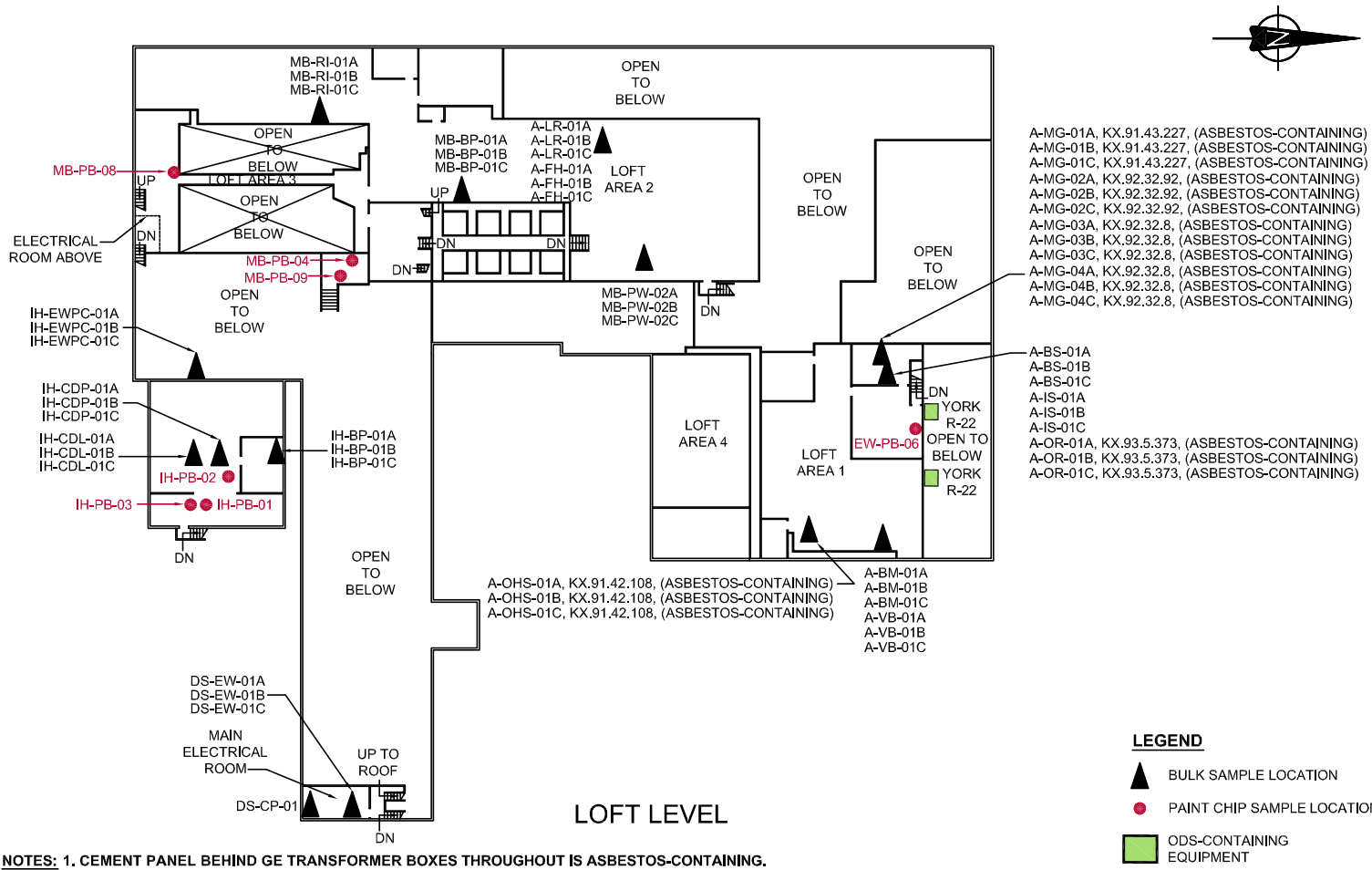
GULF OF GEORGIA CANNERY, RICHMOND, BC

Client: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA

Project No.:	123220330-300.100
Scale:	N.T.S.
Date:	16/02/18
Dwn. By:	CD SL2016020129 PK/DM
App'd By:	TW

Dwg. No.: A3

Stantec



NOTES: 1. CEMENT PANEL BEHIND GE TRANSFORMER BOXES THROUGHOUT IS ASBESTOS-CONTAINING.
2. BLUE SPRINKLER PIPE SEALANT THROUGHOUT IS ASBESTOS-CONTAINING.
3. THIS DRAWING ILLUSTRATES SUPPORTING INFORMATION SPECIFIC TO A STANTEC CONSULTING LTD. REPORT AND MUST NOT BE USED FOR OTHER PURPOSES.

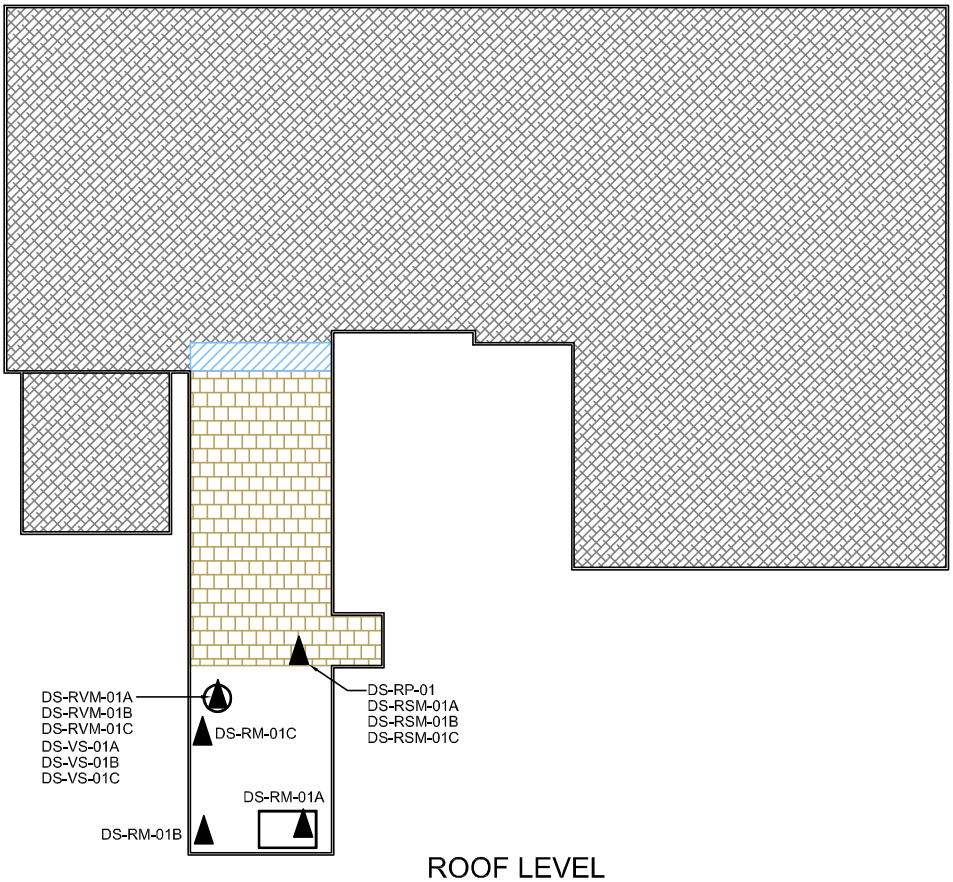
FLOOR PLAN SHOWING HAZARDOUS BUILDING MATERIALS AND BULK SAMPLE LOCATIONS

GULF OF GEORGIA CANNERY, RICHMOND, BC

Client: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA

Project No.:	123220330-300.100
Scale:	N.T.S.
Date:	16/02/18
Dwn. By:	CD SL2016020130 VM/DM
App'd By:	TW
Dwg. No.:	A4

Stantec



ROOF LEVEL

LEGEND

- BULK SAMPLE LOCATION
- ASBESTOS-CONTAINING CEMENT PANELLING
- ASBESTOS-CONTAINING ROOF PANELLING
- AREA NOT ACCESSED

NOTE: THIS DRAWING ILLUSTRATES SUPPORTING INFORMATION SPECIFIC TO A STANTEC CONSULTING LTD. REPORT AND MUST NOT BE USED FOR OTHER PURPOSES.

FLOOR PLAN SHOWING HAZARDOUS BUILDING MATERIALS AND BULK SAMPLE LOCATIONS

GULF OF GEORGIA CANNERY, RICHMOND, BC

Client: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA

Project No.:	123220330-300.100
Scale:	N.T.S.
Date:	16/02/18
Dwn. By:	CD SL2016020131 VM/DM
App'd By:	TW

Dwg. No.: A5

Stantec

WATCHMAN'S SHED

LEGEND

- BULK SAMPLE
- PAINT CHIP SAMPLE
- ASBESTOS-CONTAINING CEMENT PANELS

NOTE: THIS DRAWING ILLUSTRATES SUPPORTING INFORMATION SPECIFIC TO A STANTEC CONSULTING LTD. REPORT AND MUST NOT BE USED FOR OTHER PURPOSES.

FLOOR PLAN SHOWING HAZARDOUS BUILDING MATERIALS AND BULK SAMPLE LOCATIONS

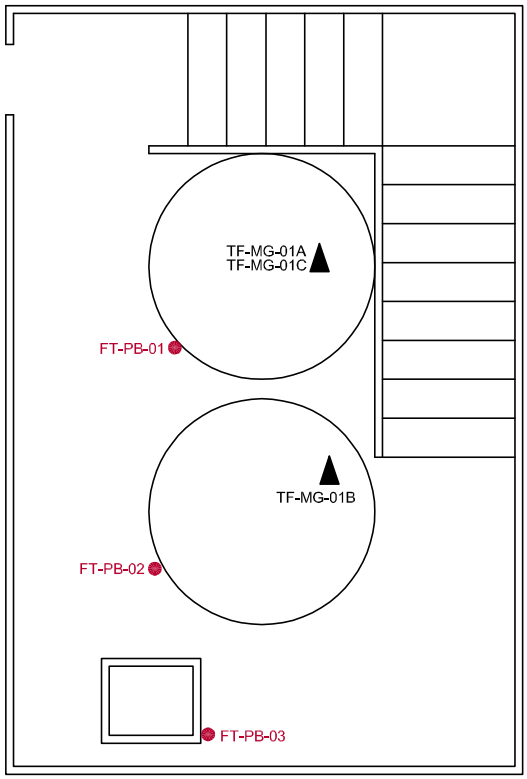
GULF OF GEORGIA CANNERY, RICHMOND, BC

Client: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA

Project No.:	123220330-300.100
Scale:	N.T.S.
Date:	16/02/18
Dwn. By:	CD SL2016020132 PK/DM
App'd By:	TW

Dwg. No.: A6

Stantec



TANK FARM

LEGEND

- BULK SAMPLE
- PAINT CHIP SAMPLE

NOTE: THIS DRAWING ILLUSTRATES SUPPORTING INFORMATION SPECIFIC TO A STANTEC CONSULTING LTD. REPORT AND MUST NOT BE USED FOR OTHER PURPOSES.

FLOOR PLAN SHOWING HAZARDOUS BUILDING MATERIALS AND BULK SAMPLE LOCATIONS

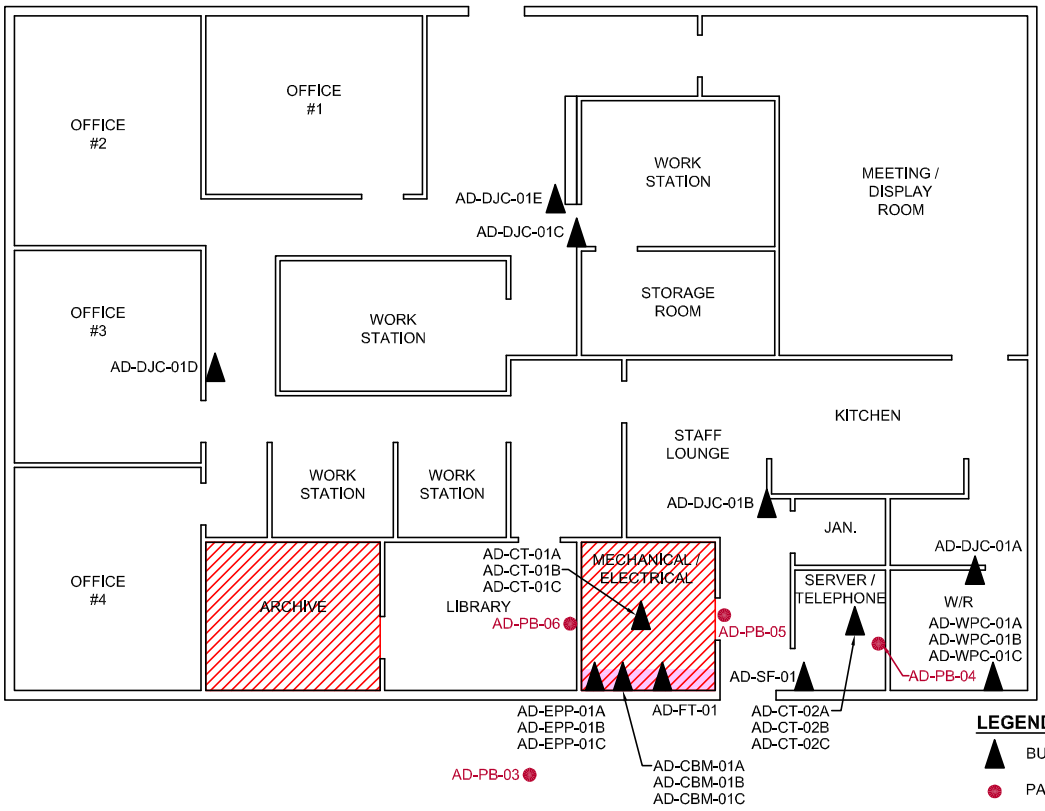
GULF OF GEORGIA CANNERY, RICHMOND, BC

Client: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA

Project No.:	123220330-300.100
Scale:	N.T.S.
Date:	16/02/18
Dwn. By:	CD SL2016020133 PK/DM
App'd By:	TW

Dwg. No.: A7

Stantec



ADMIN BUILDING

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FLOOR PLAN SHOWING HAZARDOUS BUILDING MATERIALS AND BULK SAMPLE LOCATIONS

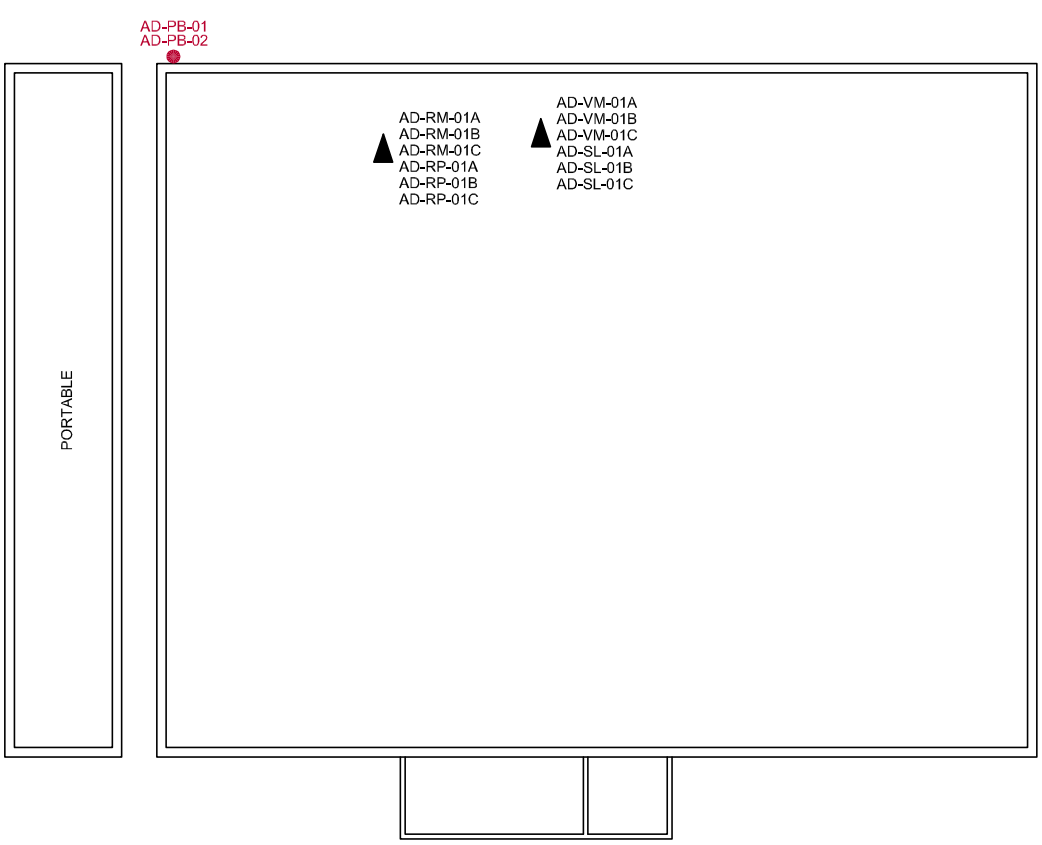
GULF OF GEORGIA CANNERY, RICHMOND, BC

Client: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA

Project No.:	123220330-300.100
Scale:	N.T.S.
Date:	16/02/18
Dwn. By:	CD SL2016020134 PK/DM
App'd By:	TW

Dwg. No.: A8

Stantec



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FLOOR PLAN SHOWING HAZARDOUS BUILDING MATERIALS AND BULK SAMPLE LOCATIONS

GULF OF GEORGIA CANNERY, RICHMOND, BC

Client: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA

Project No.:	123220330-300.100
Scale:	N.T.S.
Date:	16/02/18
Dwn. By:	CD SL2016020135 PK/DM
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Dwg. No.: A9

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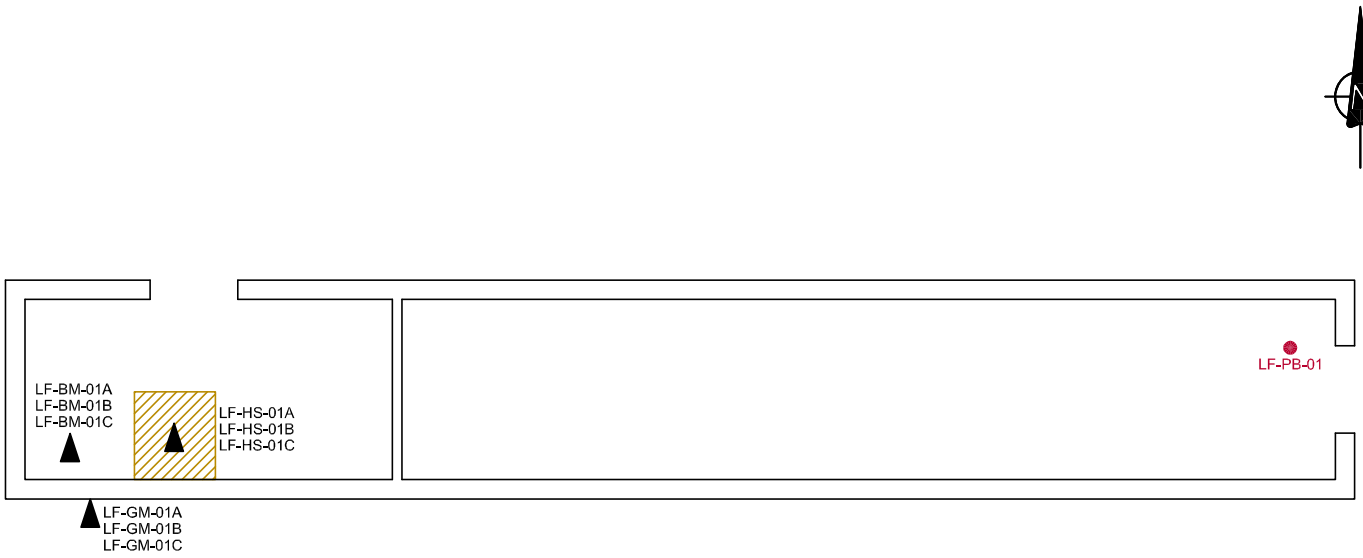

LEAD FOUNDRY

LEGEND

- BULK SAMPLE
- PAINT CHIP SAMPLE
- ASBESTOS-CONTAINING HEAT SHIELD

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FLOOR PLAN SHOWING HAZARDOUS BUILDING MATERIALS AND BULK SAMPLE LOCATIONS

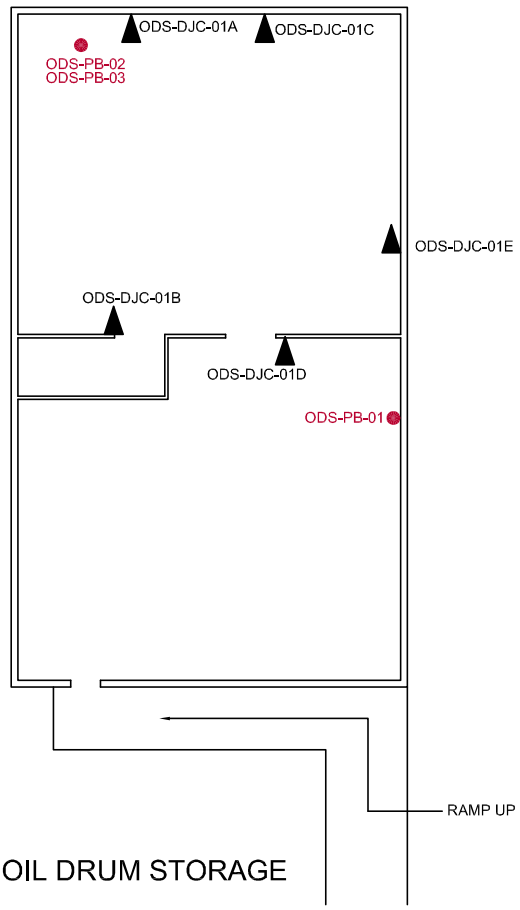
GULF OF GEORGIA CANNERY, RICHMOND, BC

Client: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA

Project No.:	123220330-300.100
Scale:	N.T.S.
Date:	16/02/18
Dwn. By:	CD SL2016020136 PK/DM
App'd By:	TW

Dwg. No.: A10

Stantec



LEGEND

- BULK SAMPLE
- PAINT CHIP SAMPLE

NOTE: THIS DRAWING ILLUSTRATES SUPPORTING INFORMATION SPECIFIC TO A STANTEC CONSULTING LTD. REPORT AND MUST NOT BE USED FOR OTHER PURPOSES.

FLOOR PLAN SHOWING HAZARDOUS BUILDING MATERIALS AND BULK SAMPLE LOCATIONS

GULF OF GEORGIA CANNERY, RICHMOND, BC

Client: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA

Project No.:	123220330-300.100
Scale:	N.T.S.
Date:	16/02/18
Dwn. By:	CD SL2016020137 PK/DM
App'd By:	TW

Dwg. No.: A11

Stantec

Appendix B SUMMARY OF RESULTS OF ANALYSIS OF BULK SAMPLES FOR ASBESTOS

Table E-1 Cannery Building – Suspected ACM Sample Collection and Analysis Summary

Sample Number	Material Description	Serial #	Results
Cannery "Artifacts" (A)			
A-MG-01A	**Mechanical gasket**	**KX.91.43.227**	**25% Chrysotile**
A-MG-01B	**Mechanical gasket**	**KX.91.43.227**	**Stop Positive (Not Analyzed)**
A-MG-01C	**Mechanical gasket**	**KX.91.43.227**	**Stop Positive (Not Analyzed)**
A-MG-02A	**Mechanical gasket**	**KX.92.32.92**	**25% Chrysotile**
A-MG-02B	**Mechanical gasket**	**KX.92.32.92**	**Stop Positive (Not Analyzed)**
A-MG-02C	**Mechanical gasket**	**KX.92.32.92**	**Stop Positive (Not Analyzed)**
A-MG-03A	**Mechanical gasket**	**KX.92.32.8**	**40% Chrysotile**
A-MG-03B	**Mechanical gasket**	**KX.92.32.8**	**Stop Positive (Not Analyzed)**
A-MG-03C	**Mechanical gasket**	**KX.92.32.8**	**Stop Positive (Not Analyzed)**
A-MG-04A	**Mechanical gasket**	**KX.92.32.8**	**35.8% Chrysotile**
A-MG-04B	**Mechanical gasket**	**KX.92.32.8**	**Stop Positive (Not Analyzed)**
A-MG-04C	**Mechanical gasket**	**KX.92.32.8**	**Stop Positive (Not Analyzed)**
A-VB-01A	White vinyl belt	n/a	None Detected
A-VB-01B	White vinyl belt	n/a	None Detected
A-VB-01C	White vinyl belt	n/a	None Detected
A-BM-01A	Black belt	KX.91.42.81	None Detected
A-BM-01B	Black belt	KX.91.42.81	None Detected
A-BM-01C	Black belt	KX.91.42.81	None Detected
A-BS-01A	Boat strip	KX.91.43.318	None Detected
A-BS-01B	Boat strip	KX.91.43.318	None Detected
A-BS-01C	Boat strip	KX.91.43.318	None Detected
A-OR-01A	**'O' ring**	**KX.93.5.373**	**35.3% Chrysotile**
A-OR-01B	**'O' ring**	**KX.93.5.373**	**Stop Positive (Not Analyzed)**
A-OR-01C	**'O' ring**	**KX.93.5.373**	**Stop Positive (Not Analyzed)**
A-IS-01A	Insulation strip	KX.91.43.330	None Detected

Table E-1 Cannery Building – Suspected ACM Sample Collection and Analysis Summary

A-IS-01B	Insulation strip	KX.91.43.330	None Detected
A-IS-01C	Insulation strip	KX.91.43.330	None Detected
A-OHS-01A	**Oven heat shield**	**KX.91.42.108**	**7.4% Chrysotile**
A-OHS-01B	**Oven heat shield**	**KX.91.42.108**	**Stop Positive (Not Analyzed)**
A-OHS-01C	**Oven heat shield**	**KX.91.42.108**	**Stop Positive (Not Analyzed)**
A-LR-01A	Lead roll	n/a	None Detected
A-LR-01B	Lead roll	n/a	None Detected
A-LR-01C	Lead roll	n/a	None Detected
A-FH-01A	Fire hose	n/a	None Detected
A-FH-01B	Fire hose	n/a	None Detected
A-FH-01C	Fire hose	n/a	None Detected
Dryer Shed/Grinding and Sacking Room (DS)			
DS-DI-01A	White dryer insulation	Inside dryer #3	None Detected
DS-DI-01B	White dryer insulation	Inside dryer #3	None Detected
DS-DI-01C	White dryer insulation	Inside dryer #3	None Detected
DS-EW-01A	Grey electrical wrap	Upper Level – south wall of electrical room	None Detected
DS-EW-01B	Grey electrical wrap	Upper Level – south wall of electrical room	None Detected
DS-EW-01C	Grey electrical wrap	Upper Level – south wall of electrical room	None Detected
DS-CP-01	**Cement panel**	**Upper Level – West wall of electrical room behind transformer**	**15% Chrysotile**
DS-RVM-01A	Black roof vent mastic	Roof – base seams of vent	None Detected
DS-RVM-01B	Black roof vent mastic	Roof – base seams of vent	None Detected
DS-RVM-01C	Black roof vent mastic	Roof – base seams of vent	None Detected
DS-RP-01	**Grey roof panel**	**Roof – east side below walkway**	**18.3% Chrysotile**
DS-RSM-01A	Black roof structure mastic	Roof – below grey roof panel on wood structure	None Detected
DS-RSM-01B	Black roof structure mastic	Roof – below grey roof panel on wood structure	None Detected
DS-RSM-01C	Black roof structure mastic	Roof – below grey roof panel on wood structure	None Detected
DS-RM-01A	Black roof material	Roof of staircase	<0.25% Chrysotile
DS-RM-01B	Black roof material	Roof of staircase	None Detected

Table E-1 Cannery Building – Suspected ACM Sample Collection and Analysis Summary

DS-RM-01C	Black roof material	Roof of staircase	<0.25% Chrysotile
DS-VS-01A	Grey roof vent sealant	Roof – edge of vent	None Detected
DS-VS-01B	Grey roof vent sealant	Roof – edge of vent	None Detected
DS-VS-01C	Grey roof vent sealant	Roof – edge of vent	<0.25% Chrysotile
Vitamin Oil Shed (VOS)			
VOS-BP-01A	Black building paper	North interior wall south of office	None Detected
VOS-BP-01B	Black building paper	North interior wall south of office	None Detected
VOS-BP-01C	Black building paper	North interior wall south of office	None Detected
VOS-WL-01A	Brown woven liner	Around edge of heavy duty door north of shed	None Detected
VOS-WL-01B	Brown woven liner	Around edge of heavy duty door north of shed	None Detected
VOS-WL-01C	Brown woven liner	Around edge of heavy duty door north of shed	None Detected
VOS-TD-01A	Black tank debris	Wood plank in tank room #3	None Detected
VOS-TD-01B	Black tank debris	Wood plank in tank room #3	None Detected
VOS-TD-01C	Black tank debris	Wood plank in tank room #3	None Detected
VOS-EW-01A	Brown electrical wrap	West wall of tank room #1	None Detected
VOS-EW-01B	Brown electrical wrap	West wall of tank room #1	None Detected
VOS-EW-01C	Brown electrical wrap	West wall of tank room #1	None Detected
VOS-WPC-01A	Grey window pane caulking	Exterior window between pane and frame of office	None Detected
VOS-WPC-01B	Grey window pane caulking	Exterior window between pane and frame of office	None Detected
VOS-WPC-01C	Grey window pane caulking	Exterior window between pane and frame of office	None Detected
VOS-FL-01A	**Tan fibrous liner**	**Wood plank in tank room #3**	**30% Chrysotile**
VOS-FL-01B	**Tan fibrous liner**	**Wood plank in tank room #3**	**Stop Positive (Not Analyzed)**
VOS-FL-01C	**Tan fibrous liner**	**Wood plank in tank room #3**	**Stop Positive (Not Analyzed)**
Boiler Room (BR)			
BR-WL-01A	**Tan woven liner**	**'HRT' boiler – perimeter of hatch**	**None Detected**
BR-WL-01B	**Tan woven liner**	**'HRT' boiler – perimeter of hatch**	**None Detected**
BR-WL-01B – Tan Layer	**Tan woven liner**	**'HRT' boiler – perimeter of hatch**	**30% Chrysotile**

Table E-1 Cannery Building – Suspected ACM Sample Collection and Analysis Summary

BR-WL-01C	**Tan woven liner**	**'HRT' boiler – perimeter of hatch**	**Stop Positive (Not Analyzed)**
BR-TC-01A	White taping compound	'HRT' boiler - seams of ducting on ceiling	None Detected
BR-TC-01B	White taping compound	'HRT' boiler - seams of ducting on ceiling	None Detected
BR-TC-01C	White taping compound	'HRT' boiler - seams of ducting on ceiling	None Detected
BR-BI-01A	Brown boiler insulation	Tea Kettle boiler	<0.25% Chrysotile
BR-BI-01B	Brown boiler insulation	Tea Kettle boiler	None Detected
BR-BI-01C	Brown boiler insulation	Tea Kettle boiler	None Detected
BR-LC-01A	Leveling compound	'HRT' boiler – base	None Detected
BR-LC-01B	Leveling compound	'HRT' boiler – base	None Detected
BR-LC-01C	Leveling compound	'HRT' boiler – base	None Detected
BR-MG-01A	Brown mechanical gasket	Patterson boiler – stack opening	None Detected
BR-MG-01B	Brown mechanical gasket	Patterson boiler – stack opening	None Detected
BR-MG-01C	Brown mechanical gasket	Patterson boiler – stack opening	None Detected
BR-MG-02A	**Dark brown mechanical gasket**	**Small tank on north east side of the building on wall**	**42.3% Chrysotile**
BR-MG-02B	**Dark brown mechanical gasket**	**Small tank on north east side of the building on wall**	**Stop Positive (Not Analyzed)**
BR-MG-02C	**Dark brown mechanical gasket**	**Small tank on north east side of the building on wall**	**Stop Positive (Not Analyzed)**
East Wing (EW)			
EW-DJC-01A	Dry wall joint compound	West wall of mechanical room	None Detected
EW-DJC-01B	Dry wall joint compound	West wall of mechanical room	None Detected
EW-DJC-01C	Dry wall joint compound	West wall of mechanical room	None Detected
EW-DJC-01D	Dry wall joint compound	North wall of men's washroom	None Detected
EW-DJC-01E	Dry wall joint compound	East wall of handicap washroom	None Detected
EW-DM-01A	Grey duct mastic	Mechanical room	None Detected
EW-DM-01B	Grey duct mastic	Mechanical room	None Detected
EW-DM-01C	Grey duct mastic	Mechanical room	None Detected
EW-SF-01	Grey sheet flooring	Men's washroom	None Detected
EW-EWPC-01A	White exterior window pane caulking	North side of the building between pane and frame	None Detected

Table E-1 Cannery Building – Suspected ACM Sample Collection and Analysis Summary

EW-EWPC-01B	White exterior window pane caulking	North side of the building between pane and frame	None Detected
EW-EWPC-01C	White exterior window pane caulking	North side of the building between pane and frame	None Detected
Ice House (IH)			
IH-CDP-01A	Brown cooler door paper	Upper level -- inside wood panel	None Detected
IH-CDP-01B	Brown cooler door paper	Upper level -- inside wood panel	None Detected
IH-CDP-01C	Brown cooler door paper	Upper level -- inside wood panel	None Detected
IH-CDL-01A	Brown cooler door liner	Upper level – perimeter of cooler door	None Detected
IH-CDL-01B	Brown cooler door liner	Upper level – perimeter of cooler door	None Detected
IH-CDL-01C	Brown cooler door liner	Upper level – perimeter of cooler door	None Detected
IH-BP-01A	Black building paper	Upper level – inside wood panels of cooler room	None Detected
IH-BP-01B	Black building paper	Upper level – inside wood panels of cooler room	None Detected
IH-BP-01C	Black building paper	Upper level – inside wood panels of cooler room	None Detected
IH-EWPC-01A	White exterior window pane caulking	West window of building between pane and frame	None Detected
IH-EWPC-01B	White exterior window pane caulking	West window of building between pane and frame	None Detected
IH-EWPC-01C	White exterior window pane caulking	West window of building between pane and frame	None Detected
Main Building (MB)			
MB-PI-01A	**White air cell insulation**	**Ceiling space in north east exit**	**40% Chrysotile**
MB-PI-01B	**White air cell insulation**	**Ceiling space in north east exit**	**Stop Positive (Not Analyzed)**
MB-PI-01C	**White air cell insulation**	**Ceiling space in north east exit**	**Stop Positive (Not Analyzed)**
MB-PW-01A	White woven air cell pipe wrap	Ceiling space in north east exit	None Detected
MB-PW-01B	White woven air cell pipe wrap	Ceiling space in north east exit	None Detected
MB-PW-01C	White woven air cell pipe wrap	Ceiling space in north east exit	None Detected
MB-PS-01A	**Blue sprinkler pipe sealant**	**Interior wall west of plant office**	**1.4% Chrysotile**
MB-PS-01B	**Blue sprinkler pipe sealant**	**East wall of evaporator adjacent to Vitamin Oil Shed**	**Stop Positive (Not Analyzed)**

Table E-1 Cannery Building – Suspected ACM Sample Collection and Analysis Summary

MB-PS-01C	**Blue sprinkler pipe sealant**	**Interior wall by south west exit**	**Stop Positive (Not Analyzed)**
MB-MG-01A	Black mechanical gasket	Canning crew station	None Detected
MB-MG-01B	Black mechanical gasket	Canning crew station	None Detected
MB-MG-01C	Black mechanical gasket	Canning crew station	None Detected
MB-MA-01A	Black mastic	Yellow separator	None Detected
MB-MA-01B	Black mastic	Yellow separator	None Detected
MB-MA-01C	Black mastic	Yellow separator	None Detected
MB-MG-02A	**Silver mechanical gasket**	**Press in south east of the building**	**29.6% Chrysotile**
MB-MG-02B	**Silver mechanical gasket**	**Press in south east of the building**	**Stop Positive (Not Analyzed)**
MB-MG-02C	**Silver mechanical gasket**	**Press in south east of the building**	**Stop Positive (Not Analyzed)**
MB-IWPC-01A	White interior window pane caulking	North west corner of building between pane and window	None Detected
MB-IWPC-01B	White interior window pane caulking	west side of the building between pane and window	None Detected
MB-IWPC-01C	White interior window pane caulking	South west corner of the building between pane and window	None Detected
MB-IWPC-02A	Yellow interior window pane caulking	Exterior windows of plant office between pane and window by north east corner of building	None Detected
MB-IWPC-02B	Yellow interior window pane caulking	Exterior windows of plant office between pane and window by north east corner of building	None Detected
MB-IWPC-02C	Yellow interior window pane caulking	Exterior windows of plant office between pane and window by north east corner of building	None Detected
MB-RI-01A	Yellow remnant insulation	Mezzanine level – south of tank area around pipe	None Detected
MB-RI-01B	Yellow remnant insulation	Mezzanine level – south of tank area around pipe	None Detected
MB-RI-01C	Yellow remnant insulation	Mezzanine level – south of tank area around pipe	None Detected
MB-TL-01A	Brown woven tank liner	Canning boiler by caning crew station	None Detected
MB-TL-01B	Brown woven tank liner	Canning boiler by caning crew station	None Detected
MB-TL-01C	Brown woven tank liner	Canning boiler by caning crew station	None Detected

Table E-1 Cannery Building – Suspected ACM Sample Collection and Analysis Summary

MB-BP-01A	Black roof paper	Mezzanine level – south west storage area under roof material	None Detected
MB-BP-01B	Black roof paper	Mezzanine level – south west storage area under roof material	None Detected
MB-BP-01C	Black roof paper	Mezzanine level – south west storage area under roof material	None Detected
MB-EW-01A	Black and tan woven electrical wrap	North west exit hanging from the ceiling	None Detected
MB-EW-01B	Black and tan woven electrical wrap	North west exit hanging from the ceiling	None Detected
MB-EW-01C	Black and tan woven electrical wrap	North west exit hanging from the ceiling	None Detected
MB-PW-02A	Black pipe wrap	Mezzanine level – between west tanks in tank area	None Detected
MB-PW-02A	Black pipe wrap	Mezzanine level – between west tanks in tank area	None Detected
MB-PW-02A	Black pipe wrap	Mezzanine level – between west tanks in tank area	None Detected
MB-TF-01A	Black textured floor	Reduction Annex	None Detected
MB-TF-01B	Black textured floor	Reduction Annex	None Detected
MB-TF-01C	Black textured floor	Reduction Annex	None Detected

Table E-2 Watchman's Shed – Suspected ACM Sample Collection and Analysis Summary

Sample Number	Material Description	Location	Results
WS-CP-01	**Grey cement panel**	**Lower east wall of shed**	**20% Chrysotile**

Table E-3 Tank Farm – Suspected ACM Sample Collection and Analysis Summary

Sample Number	Material Description	Location	Results
TF-MG-01A	**Grey mechanical gasket**	**West tank**	**39.2% Chrysotile**
TF-MG-01B	**Grey mechanical gasket**	**East tank**	**Stop Positive (Not Analyzed)**
TF-MG-01C	**Grey mechanical gasket**	**West tank**	**Stop Positive (Not Analyzed)**

Table E-4 Administrative Building – Suspected ACM Sample Collection and Analysis Summary

Sample Number	Material Description	Location	Results
AD-DJC-01A	Dry wall joint compound	Interior wall of washroom	None Detected
AD-DJC-01B	Dry wall joint compound	North wall of staff lounge	None Detected
AD-DJC-01C	Dry wall joint compound	East wall of reception	None Detected
AD-DJC-01D	Dry wall joint compound	North wall of office #3	None Detected
AD-DJC-01E	Dry wall joint compound	North wall of reception	None Detected
AD-WPC-01A	Black window pane caulking	Window on east side of the washroom between pane and frame	None Detected
AD-WPC-01B	Black window pane caulking	Window on east side of the washroom between pane and frame	None Detected
AD-WPC-01C	Black window pane caulking	Window on east side of the washroom between pane and frame	None Detected
AD-EPP-01A	**Grey electrical penetration putty**	**Upper east wall of the mechanical room**	**12.3% Chrysotile**
AD-EPP-01B	**Grey electrical penetration putty**	**Upper east wall of the mechanical room**	**Stop Positive (Not Analyzed)**
AD-EPP-01C	**Grey electrical penetration putty**	**Upper east wall of the mechanical room**	**Stop Positive (Not Analyzed)**
AD-CT-01A	2'x4' standard fissure and pinhole ceiling tile	Mechanical room	None Detected
AD-CT-01B	2'x4' standard fissure and pinhole ceiling tile	Mechanical room	None Detected
AD-CT-01C	2'x4' standard fissure and pinhole ceiling tile	Mechanical room	None Detected
AD-CT-02A	1'x1' large and small pinhole ceiling tile	Server room	None Detected
AD-CT-02B	1'x1' large and small pinhole ceiling tile	Server room	None Detected
AD-CT-02C	1'x1' large and small pinhole ceiling tile	Server room	None Detected
AD-FT-01	**12"x12" pink stone pattern floor tile**	**Mechanical room**	**1.1% Chrysotile**
AD-FT-01 mastic	**Mastic on 12"x12" pink stone pattern floor tile**	**Mechanical room**	**2% Chrysotile**
AD-SF-01	White marble pattern sheet flooring	Server room	None Detected
AD-RP-01A	White penetration mastic	Roof – base of steel post holding wires	None Detected
AD-RP-01B	White penetration mastic	Roof – base of steel post holding wires	None Detected

Table E-4 Administrative Building – Suspected ACM Sample Collection and Analysis Summary

AD-RP-01C	White penetration mastic	Roof – base of steel post holding wires	None Detected
AD-SL-01A	Black stack liner	Roof – base on ventilation stack	None Detected
AD-SL-01B	Black stack liner	Roof – base on ventilation stack	None Detected
AD-SL-01C	Black stack liner	Roof – base on ventilation stack	None Detected
AD-RM-01A	Black roof material	Floor of roof	None Detected
AD-RM-01B	Black roof material	Floor of roof	None Detected
AD-RM-01C	Black roof material	Floor of roof	None Detected
AD-VM-01A	Clear vent mastic	Roof – base on ventilation stack	None Detected
AD-VM-01B	Clear vent mastic	Roof – base on ventilation stack	None Detected
AD-VM-01C	Clear vent mastic	Roof – base on ventilation stack	None Detected
AD-CBM-01A	Brown cove base mastic	Mechanical room	None Detected
AD-CBM-01B	Brown cove base mastic	Mechanical room	None Detected
AD-CBM-01C	Brown cove base mastic	Mechanical room	None Detected

Table E-5 Lead Foundry – Suspected ACM Sample Collection and Analysis Summary

Sample Number	Material Description	Location	Results
LF-GM-01A	Black gutter mastic	South exterior side of the building	None Detected
LF-GM-01B	Black gutter mastic	South exterior side of the building	None Detected
LF-GM-01C	Black gutter mastic	South exterior side of the building	None Detected
LF-BM-01A	Brick mortar	Chimney area west side of the building	None Detected
LF-BM-01B	Brick mortar	Chimney area west side of the building	None Detected
LF-BM-01C	Brick mortar	Chimney area west side of the building	None Detected
LF-HS-01A	**Grey heat shield**	**Hanging from wood column on west side of the building**	**30% Chrysotile**
LF-HS-01B	**Grey heat shield**	**Hanging from wood column on west side of the building**	**Stop Positive (Not Analyzed)**
LF-HS-01C	**Grey heat shield**	**Hanging from wood column on west side of the building**	**Stop Positive (Not Analyzed)**

Table E-6 Oil Drum Storage – Suspected ACM Sample Collection and Analysis Summary

Sample Number	Material Description	Location	Results
ODS-DJC-01A	Dry wall joint compound	West wall	None Detected
ODS-DJC-01B	Dry wall joint compound	West wall of bathroom	None Detected
ODS-DJC-01C	Dry wall joint compound	West wall	None Detected
ODS-DJC-01D	Dry wall joint compound	East interior wall	None Detected
ODS-DJC-01E	Dry wall joint compound	North wall	None Detected

Appendix C LABORATORY ANALYTICAL REPORT—ASBESTOS: POLARIZED LIGHT MICROSCOPY

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EMSL Canada Order 551507881
Customer ID: 55JACQ30L
Customer PO: 123220330.300
Project ID:

Attn: Steve Chou
Stantec Consulting, Ltd.
500 - 4730 Kingsway
Burnaby, BC V5H 0C6

Phone: (604) 412-3004
Fax:
Collected:
Received: 07/22/2015
Analyzed: 07/30/2015

Proj: GOG/123220330.300.100

Test Report: Asbestos Analysis in Bulk Material for Occupational Health and Safety British Columbia Regulation 188/2011 via EPA 600/R-93/116 Method

Client Sample ID: A-MG-01A ***Lab Sample ID:*** **551507881-0001**
Sample Description: KX.91.43.227/Mechanical gasket

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	07/28/2015	White	0%	75%	**25% Chrysotile**	limited sample submitted

Client Sample ID: A-MG-01B ***Lab Sample ID:*** **551507881-0002**
Sample Description: KX.91.43.227/Mechanical gasket

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	07/28/2015				Stop Positive (Not Analyzed)	

Client Sample ID: A-MG-01C ***Lab Sample ID:*** **551507881-0003**
Sample Description: KX.91.43.227/Mechanical gasket

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	07/28/2015				Stop Positive (Not Analyzed)	

Client Sample ID: A-MG-02A ***Lab Sample ID:*** **551507881-0004**
Sample Description: KX.92.32.92/Mechanical gasket

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	07/28/2015	Blue	0%	75%	**25% Chrysotile**	limited sample submitted

Client Sample ID: A-MG-02B ***Lab Sample ID:*** **551507881-0005**
Sample Description: KX.92.32.92/Mechanical gasket

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	07/28/2015				Stop Positive (Not Analyzed)	

Client Sample ID: A-MG-02C ***Lab Sample ID:*** **551507881-0006**
Sample Description: KX.92.32.92/Mechanical gasket

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	07/28/2015				Stop Positive (Not Analyzed)	

Client Sample ID: A-MG-03A ***Lab Sample ID:*** **551507881-0007**
Sample Description: KX.92.32.8/Mechanical gasket

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	07/28/2015	Brown	0%	60%	**40% Chrysotile**	

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Test Report: Asbestos Analysis in Bulk Material for Occupational Health and Safety British Columbia Regulation 188/2011 via EPA 600/R-93/116 Method

Client Sample ID: A-MG-03B **Lab Sample ID:** **551507881-0008**
Sample Description: KX.92.32.8/Mechanical gasket

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	07/28/2015				Stop Positive (Not Analyzed)	

Client Sample ID: A-MG-03C **Lab Sample ID:** **551507881-0009**
Sample Description: KX.92.32.8/Mechanical gasket

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	07/28/2015				Stop Positive (Not Analyzed)	

Client Sample ID: A-MG-04A **Lab Sample ID:** **551507881-0010**
Sample Description: KX.92.32.8/Mechanical gasket

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	07/29/2015	Gray	0.0%	64.2%	**35.8% Chrysotile**	

Client Sample ID: A-MG-04B **Lab Sample ID:** **551507881-0011**
Sample Description: KX.92.32.8/Mechanical gasket

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	07/29/2015				Positive Stop (Not Analyzed)	

Client Sample ID: A-MG-04C **Lab Sample ID:** **551507881-0012**
Sample Description: KX.92.32.8/Mechanical gasket

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	07/29/2015				Positive Stop (Not Analyzed)	

Client Sample ID: A-VB-01A **Lab Sample ID:** **551507881-0013**
Sample Description: n/a/White vinyl belt

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	07/29/2015	Tan	0.0%	100%	None Detected	

Client Sample ID: A-VB-01B **Lab Sample ID:** **551507881-0014**
Sample Description: n/a/White vinyl belt

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	07/29/2015	Tan	0.0%	100%	None Detected	

Client Sample ID: A-VB-01C **Lab Sample ID:** **551507881-0015**
Sample Description: n/a/White vinyl belt

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	07/29/2015	Tan	0.0%	100%	None Detected	

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Test Report: Asbestos Analysis in Bulk Material for Occupational Health and Safety British Columbia Regulation 188/2011 via EPA 600/R-93/116 Method

Client Sample ID: A-BM-01A **Lab Sample ID:** **551507881-0016**
Sample Description: KX.91.42.81/Black belt

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	07/29/2015	Black	0.0%	100%	None Detected	☑

Client Sample ID: A-BM-01B **Lab Sample ID:** **551507881-0017**
Sample Description: KX.91.42.81/Black belt

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	07/29/2015	Black	0.0%	100%	None Detected	☑

Client Sample ID: A-BM-01C **Lab Sample ID:** **551507881-0018**
Sample Description: KX.91.42.81/Black belt

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	07/29/2015	Black	0.0%	100%	None Detected	☑

Client Sample ID: A-BS-01A **Lab Sample ID:** **551507881-0019**
Sample Description: KX.91.43.318/Boat strip

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	07/29/2015	Various/Black	0.0%	100%	None Detected	☑

Client Sample ID: A-BS-01B **Lab Sample ID:** **551507881-0020**
Sample Description: KX.91.43.318/Boat strip

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	07/29/2015	Various/Black	0.0%	100%	None Detected	☑

Client Sample ID: A-BS-01C **Lab Sample ID:** **551507881-0021**
Sample Description: KX.91.43.318/Boat strip

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	07/29/2015	Various/Black	0.0%	100%	None Detected	☑

Client Sample ID: A-OR-01A **Lab Sample ID:** **551507881-0022**
Sample Description: KX.93.5.373/'O' ring

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	07/29/2015	Tan	0.0%	64.7%	**35.3% Chrysotile**	⊘

Client Sample ID: A-OR-01B **Lab Sample ID:** **551507881-0023**
Sample Description: KX.93.5.373/'O' ring

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	07/29/2015				Positive Stop (Not Analyzed)	

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Client Sample ID: A-OR-01C **Lab Sample ID:** **551507881-0024**
Sample Description: KX.93.5.373/'O' ring

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	07/29/2015				Positive Stop (Not Analyzed)	

Client Sample ID: A-IS-01A **Lab Sample ID:** **551507881-0025**
Sample Description: KX.91.43.330/Insulation strip

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	07/29/2015	Black/Silver	0.0%	100%	None Detected	☑

Client Sample ID: A-IS-01B **Lab Sample ID:** **551507881-0026**
Sample Description: KX.91.43.330/Insulation strip

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	07/29/2015	Black/Silver	0.0%	100%	None Detected	☑

Client Sample ID: A-IS-01C **Lab Sample ID:** **551507881-0027**
Sample Description: KX.91.43.330/Insulation strip

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	07/29/2015	Black/Silver	0.0%	100%	None Detected	☑

Client Sample ID: A-OHS-01A **Lab Sample ID:** **551507881-0028**
Sample Description: KX.91.42.108/Oven heat shield

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	07/29/2015	Brown/Tan	0.0%	92.6%	**7.4% Chrysotile**	⊘

Client Sample ID: A-OHS-01B **Lab Sample ID:** **551507881-0029**
Sample Description: KX.91.42.108/Oven heat shield

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	07/29/2015				Positive Stop (Not Analyzed)	

Client Sample ID: A-OHS-01C **Lab Sample ID:** **551507881-0030**
Sample Description: KX.91.42.108/Oven heat shield

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	07/29/2015				Positive Stop (Not Analyzed)	

Client Sample ID: A-LR-01A **Lab Sample ID:** **551507881-0031**
Sample Description: n/a/Lead roll

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	07/28/2015	Brown	90%	10%	None Detected	☑

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Client Sample ID: A-LR-01B **Lab Sample ID:** **551507881-0032**
Sample Description: n/a/Lead roll

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	07/28/2015	Brown	90%	10%	None Detected	☑

Client Sample ID: A-LR-01C **Lab Sample ID:** **551507881-0033**
Sample Description: n/a/Lead roll

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	07/29/2015	Tan	90%	10%	None Detected	☑

Client Sample ID: A-FH-01A **Lab Sample ID:** **551507881-0034**
Sample Description: n/a/Fire hose

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	07/28/2015	White	90%	10%	None Detected	☑

Client Sample ID: A-FH-01B **Lab Sample ID:** **551507881-0035**
Sample Description: n/a/Fire hose

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	07/28/2015	White	90%	10%	None Detected	☑

Client Sample ID: A-FH-01C **Lab Sample ID:** **551507881-0036**
Sample Description: n/a/Fire hose

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	07/29/2015	Gray/White	90%	10%	None Detected	☑

Client Sample ID: DS-DI-01A **Lab Sample ID:** **551507881-0037**
Sample Description: White dryer insulation/White dryer insulation

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	07/28/2015	White/Beige	0%	100%	None Detected	☑

Client Sample ID: DS-DI-01B **Lab Sample ID:** **551507881-0038**
Sample Description: White dryer insulation/White dryer insulation

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	07/28/2015	White	0%	100%	None Detected	☑

Client Sample ID: DS-DI-01C **Lab Sample ID:** **551507881-0039**
Sample Description: White dryer insulation/White dryer insulation

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	07/29/2015	White	0%	100%	None Detected	☑

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Client Sample ID: DS-EW-01A **Lab Sample ID:** **551507881-0040**
Sample Description: Grey electrical wrap/Grey electrical wrap

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	07/29/2015	Black	0.0%	100%	None Detected	

Client Sample ID: DS-EW-01B **Lab Sample ID:** **551507881-0041**
Sample Description: Grey electrical wrap/Grey electrical wrap

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	07/29/2015	Black	0.0%	100%	None Detected	

Client Sample ID: DS-EW-01C **Lab Sample ID:** **551507881-0042**
Sample Description: Grey electrical wrap/Grey electrical wrap

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	07/29/2015	Black	0.0%	100%	None Detected	

Client Sample ID: DS-CP-01 **Lab Sample ID:** **551507881-0043**
Sample Description: Cement Panel/Cement Panel

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	07/28/2015	Gray	0%	85%	**15% Chrysotile**	

Client Sample ID: DS-RVM-01A **Lab Sample ID:** **551507881-0044**
Sample Description: Black roof vent mastic/Black roof vent mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	07/29/2015	Black	0.0%	100%	None Detected	

Client Sample ID: DS-RVM-01B **Lab Sample ID:** **551507881-0045**
Sample Description: Black roof vent mastic/Black roof vent mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	07/29/2015	Black	0.0%	100%	None Detected	

Client Sample ID: DS-RVM-01C **Lab Sample ID:** **551507881-0046**
Sample Description: Black roof vent mastic/Black roof vent mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	07/29/2015	Black	0.0%	100%	None Detected	

Client Sample ID: DS-RP-01 **Lab Sample ID:** **551507881-0047**
Sample Description: Grey roof panel/Grey roof panel

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	07/29/2015	White/Green	0.0%	81.7%	**18.3% Chrysotile**	

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Client Sample ID: DS-RSM-01A **Lab Sample ID:** **551507881-0048**
Sample Description: Black roof structure mastic/Black roof structure mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	07/29/2015	Black	0.0%	100%	None Detected	

Client Sample ID: DS-RSM-01B **Lab Sample ID:** **551507881-0049**
Sample Description: Black roof structure mastic/Black roof structure mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	07/29/2015	Black	0.0%	100%	None Detected	

Client Sample ID: DS-RSM-01C **Lab Sample ID:** **551507881-0050**
Sample Description: Black roof structure mastic/Black roof structure mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	07/29/2015	Black	0.0%	100%	None Detected	

Client Sample ID: DS-RM-01A **Lab Sample ID:** **551507881-0051**
Sample Description: Black roof material/Black roof material

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	07/29/2015	Black	0.0%	100%	**<0.25% Chrysotile**	

Client Sample ID: DS-RM-01B **Lab Sample ID:** **551507881-0052**
Sample Description: Black roof material/Black roof material

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	07/29/2015	Black	0.0%	100%	None Detected	

Client Sample ID: DS-RM-01C **Lab Sample ID:** **551507881-0053**
Sample Description: Black roof material/Black roof material

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	07/29/2015	Black	0.0%	100%	**<0.25% Chrysotile**	

Client Sample ID: DS-VS-01A **Lab Sample ID:** **551507881-0054**
Sample Description: Grey roof vent sealant/Grey roof vent sealant

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	07/29/2015	Gray	0.0%	100%	None Detected	

Client Sample ID: DS-VS-01B **Lab Sample ID:** **551507881-0055**
Sample Description: Grey roof vent sealant/Grey roof vent sealant

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	07/29/2015	Gray	0.0%	100%	None Detected	

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Client Sample ID: DS-VS-01C **Lab Sample ID:** **551507881-0056**
Sample Description: Grey roof vent sealant/Grey roof vent sealant

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	07/29/2015	Gray	0.0%	100%	**<0.25% Chrysotile**	⚠

Client Sample ID: VOS-BP-01A **Lab Sample ID:** **551507881-0057**
Sample Description: North interior wall south of office/Black building paper

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	07/29/2015	Black	0.0%	100%	None Detected	☑

Client Sample ID: VOS-BP-01B **Lab Sample ID:** **551507881-0058**
Sample Description: North interior wall south of office/Black building paper

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	07/29/2015	Black	0.0%	100%	None Detected	☑

Client Sample ID: VOS-BP-01C **Lab Sample ID:** **551507881-0059**
Sample Description: North interior wall south of office/Black building paper

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	07/29/2015	Black	0.0%	100%	None Detected	☑

Client Sample ID: VOS-WL-01A **Lab Sample ID:** **551507881-0060**
Sample Description: Around edge of heavy duty door north of shed/Brown woven liner

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	07/29/2015	Gray/White	90%	10%	None Detected	☑

Client Sample ID: VOS-WL-01B **Lab Sample ID:** **551507881-0061**
Sample Description: Around edge of heavy duty door north of shed/Brown woven liner

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	07/29/2015	Gray/White	90%	10%	None Detected	☑

Client Sample ID: VOS-WL-01C **Lab Sample ID:** **551507881-0062**
Sample Description: Around edge of heavy duty door north of shed/Brown woven liner

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	07/29/2015	Gray	90%	10%	None Detected	☑

Client Sample ID: VOS-TD-01A **Lab Sample ID:** **551507881-0063**
Sample Description: Wood plank in tank room #3/Black tank debris

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	07/29/2015	Brown/Black	0%	100%	None Detected	☑

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Client Sample ID: VOS-TD-01B **Lab Sample ID:** **551507881-0064**
Sample Description: Wood plank in tank room #3/Black tank debris

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	07/29/2015	Brown/Black	0%	100%	None Detected	☑

Client Sample ID: VOS-TD-01C **Lab Sample ID:** **551507881-0065**
Sample Description: Wood plank in tank room #3/Black tank debris

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	07/29/2015	Brown/Black	0%	100%	None Detected	☑

Client Sample ID: VOS-EW-01A **Lab Sample ID:** **551507881-0066**
Sample Description: West wall of tank room #1/Brown electrical wrap

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	07/29/2015	Brown/Tan	0.0%	100%	None Detected	☑

Client Sample ID: VOS-EW-01B **Lab Sample ID:** **551507881-0067**
Sample Description: West wall of tank room #1/Brown electrical wrap

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	07/29/2015	Brown/Tan	0.0%	100%	None Detected	☑

Client Sample ID: VOS-EW-01C **Lab Sample ID:** **551507881-0068**
Sample Description: West wall of tank room #1/Brown electrical wrap

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	07/29/2015	Brown/Tan	0.0%	100%	None Detected	☑

Client Sample ID: VOS-WPC-01A **Lab Sample ID:** **551507881-0069**
Sample Description: Exterior window between pane & frame of office/Grey window pane caulking

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	07/29/2015	Gray	0%	100%	None Detected	☑

Client Sample ID: VOS-WPC-01B **Lab Sample ID:** **551507881-0070**
Sample Description: Exterior window between pane & frame of office/Grey window pane caulking

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	07/29/2015	Gray	0%	100%	None Detected	☑

Client Sample ID: VOS-WPC-01C **Lab Sample ID:** **551507881-0071**
Sample Description: Exterior window between pane & frame of office/Grey window pane caulking

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	07/29/2015	White	0%	100%	None Detected	☑

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Client Sample ID: VOS-FL-01A **Lab Sample ID:** **551507881-0072**
Sample Description: Wood plank in tank room #3/Tan fibrous liner

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	07/29/2015	Tan	50%	20%	**30% Chrysotile**	

Client Sample ID: VOS-FL-01B **Lab Sample ID:** **551507881-0073**
Sample Description: Wood plank in tank room #3/Tan fibrous liner

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	07/29/2015				Stop Positive (Not Analyzed)	

Client Sample ID: VOS-FL-01C **Lab Sample ID:** **551507881-0074**
Sample Description: Wood plank in tank room #3/Tan fibrous liner

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	07/29/2015				Stop Positive (Not Analyzed)	

Client Sample ID: BR-WL-01A **Lab Sample ID:** **551507881-0080**
Sample Description: 'HRT' boiler – perimeter of hatch /Black woven liner

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	07/29/2015	Brown/Black	0%	100%	None Detected	

Client Sample ID: BR-WL-01B **Lab Sample ID:** **551507881-0081**
Sample Description: 'HRT' boiler – perimeter of hatch/Black woven liner

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	07/29/2015	Brown/Black	0%	100%	None Detected	

Client Sample ID: BR-WL-01B-Tan layer **Lab Sample ID:** **551507881-0081A**
Sample Description: 'HRT' boiler – perimeter of hatch/Black woven liner

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	07/29/2015	Tan	0%	70%	**30% Chrysotile**	

Client Sample ID: BR-WL-01C **Lab Sample ID:** **551507881-0082**
Sample Description: 'HRT' boiler – perimeter of hatch/Black woven liner

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	07/29/2015				Stop Positive (Not Analyzed)	

Client Sample ID: BR-TC-01A **Lab Sample ID:** **551507881-0083**
Sample Description: 'HRT' boiler - seams of ducting on ceiling/White taping compound

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	07/29/2015	White	0%	100%	None Detected	

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Client Sample ID: BR-TC-01B **Lab Sample ID:** **551507881-0084**
Sample Description: 'HRT' boiler - seams of ducting on ceiling/White taping compound

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	07/29/2015	White	0%	100%	None Detected	

Client Sample ID: BR-TC-01C **Lab Sample ID:** **551507881-0085**
Sample Description: 'HRT' boiler - seams of ducting on ceiling/White taping compound

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	07/29/2015	White	0%	100%	None Detected	

Client Sample ID: BR-BI-01A **Lab Sample ID:** **551507881-0086**
Sample Description: Tea Kettle boiler /Brown boiler insulation

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
400 PLM Pt Ct	07/29/2015	Brown	0%	100%	**<0.25% Chrysotile**	

Client Sample ID: BR-BI-01B **Lab Sample ID:** **551507881-0087**
Sample Description: Tea Kettle boiler/Brown boiler insulation

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	07/29/2015	Brown	0%	100%	None Detected	

Client Sample ID: BR-BI-01C **Lab Sample ID:** **551507881-0088**
Sample Description: Tea Kettle boiler/Brown boiler insulation

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	07/29/2015	Brown/Black	0%	100%	None Detected	

Client Sample ID: BR-LC-01A **Lab Sample ID:** **551507881-0089**
Sample Description: 'HRT' boiler- base/Leveling compound

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	07/29/2015	Brown	0%	100%	None Detected	

Client Sample ID: BR-LC-01B **Lab Sample ID:** **551507881-0090**
Sample Description: 'HRT' boiler- base/Leveling compound

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	07/29/2015	Brown	0%	100%	None Detected	

Client Sample ID: BR-LC-01C **Lab Sample ID:** **551507881-0091**
Sample Description: 'HRT' boiler- base/Leveling compound

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	07/29/2015	Gray/Black	0%	100%	None Detected	

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Client Sample ID: BR-MG-01A ***Lab Sample ID:*** **551507881-0092**
Sample Description: Patterson boiler- stack opening/Brown mechanical gasket

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	07/29/2015	Brown	0.0%	100%	None Detected	☑

Client Sample ID: BR-MG-01B ***Lab Sample ID:*** **551507881-0093**
Sample Description: Patterson boiler- stack opening/Brown mechanical gasket

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	07/29/2015	Brown	0.0%	100%	None Detected	☑

Client Sample ID: BR-MG-01C ***Lab Sample ID:*** **551507881-0094**
Sample Description: Patterson boiler- stack opening/Brown mechanical gasket

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	07/29/2015	Brown	0.0%	100%	None Detected	☑

Client Sample ID: BR-MG-02A ***Lab Sample ID:*** **551507881-0095**
Sample Description: Small tank on north east side of the bldg on wall/Dark brown mechanical gasket

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	07/29/2015	Brown	0.0%	57.7%	**42.3% Chrysotile**	⊘

Client Sample ID: BR-MG-02B ***Lab Sample ID:*** **551507881-0096**
Sample Description: Small tank on north east side of the bldg on wall/Dark brown mechanical gasket

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	07/29/2015				Positive Stop (Not Analyzed)	

Client Sample ID: BR-MG-02C ***Lab Sample ID:*** **551507881-0097**
Sample Description: Small tank on north east side of the bldg on wall/Dark brown mechanical gasket

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	07/29/2015				Positive Stop (Not Analyzed)	

Client Sample ID: EW-DJC-01A ***Lab Sample ID:*** **551507881-0132**
Sample Description: West wall of mechanical room/Dry wall joint compound

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	07/29/2015	White	0%	100%	None Detected	☑

Client Sample ID: EW-DJC-01B ***Lab Sample ID:*** **551507881-0133**
Sample Description: West wall of mechanical room/Dry wall joint compound

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	07/29/2015	White	0%	100%	None Detected	☑

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Client Sample ID: EW-DJC-01C **Lab Sample ID:** **551507881-0134**
Sample Description: West wall of mechanical room/Dry wall joint compound

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	07/29/2015	White	0%	100%	None Detected	☑

Client Sample ID: EW-DJC-01D **Lab Sample ID:** **551507881-0135**
Sample Description: North wall of men's washroom/Dry wall joint compound

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	07/29/2015	White	0%	100%	None Detected	☑

Client Sample ID: EW-DJC-01E **Lab Sample ID:** **551507881-0136**
Sample Description: East wall of handicap washroom/Dry wall joint compound

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	07/29/2015	White	0%	100%	None Detected	☑

Client Sample ID: EW-DM-01A **Lab Sample ID:** **551507881-0137**
Sample Description: Mechanical room/Grey duct mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	07/29/2015	Gray	0.0%	100%	None Detected	☑

Client Sample ID: EW-DM-01B **Lab Sample ID:** **551507881-0138**
Sample Description: Mechanical room/Grey duct mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	07/29/2015	Gray	0.0%	100%	None Detected	☑

Client Sample ID: EW-DM-01C **Lab Sample ID:** **551507881-0139**
Sample Description: Mechanical room/Grey duct mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	07/29/2015	Gray	0.0%	100%	None Detected	☑

Client Sample ID: EW-SF-01 **Lab Sample ID:** **551507881-0140**
Sample Description: Men's washroom/Grey sheet flooring

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	07/29/2015	Gray	0.0%	100%	None Detected	☑

Client Sample ID: EW-EWPC-01A **Lab Sample ID:** **551507881-0141**
Sample Description: North side of the bldg between pane & frame/White exterior window pane caulking

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	07/29/2015	White	0.0%	100%	None Detected	☑

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Client Sample ID: EW-EWPC-01B **Lab Sample ID:** **551507881-0142**
Sample Description: North side of the bldg between pane & frame/White exterior window pane caulking

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	07/29/2015	White	0.0%	100%	None Detected	☑

Client Sample ID: EW-EWPC-01C **Lab Sample ID:** **551507881-0143**
Sample Description: North side of the bldg between pane & frame/White exterior window pane caulking

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	07/29/2015	White	0.0%	100%	None Detected	☑

Client Sample ID: IH-CDP-01A **Lab Sample ID:** **551507881-0153**
Sample Description: Upper level -- inside wood panel /Brown cooler door paper

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	07/29/2015	Brown/Black	50%	50%	None Detected	☑

Client Sample ID: IH-CDP-01B **Lab Sample ID:** **551507881-0154**
Sample Description: Upper level -- inside wood panel/Brown cooler door paper

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	07/29/2015	Brown/Black	50%	50%	None Detected	☑

Client Sample ID: IH-CDP-01C **Lab Sample ID:** **551507881-0155**
Sample Description: Upper level -- inside wood panel/Brown cooler door paper

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	07/29/2015	Gray/Black	60%	40%	None Detected	☑

Client Sample ID: IH-CDL-01A **Lab Sample ID:** **551507881-0156**
Sample Description: Upper level – perimeter of cooler door/Brown cooler door liner

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	07/29/2015	Black	90%	10%	None Detected	☑

Client Sample ID: IH-CDL-01B **Lab Sample ID:** **551507881-0157**
Sample Description: Upper level – perimeter of cooler door/Brown cooler door liner

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	07/29/2015	Black	90%	10%	None Detected	☑

Client Sample ID: IH-CDL-01C **Lab Sample ID:** **551507881-0158**
Sample Description: Upper level – perimeter of cooler door/Brown cooler door liner

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	07/29/2015	Black	90%	10%	None Detected	☑

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Client Sample ID: IH-BP-01A ***Lab Sample ID:*** **551507881-0159**
Sample Description: Upper level – inside wood panels of cooler room/Black building paper

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	07/29/2015	Brown	0.0%	100%	None Detected	☑

Client Sample ID: IH-BP-01B ***Lab Sample ID:*** **551507881-0160**
Sample Description: Upper level – inside wood panels of cooler room/Black building paper

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	07/29/2015	Brown	0.0%	100%	None Detected	☑

Client Sample ID: IH-BP-01C ***Lab Sample ID:*** **551507881-0161**
Sample Description: Upper level – inside wood panels of cooler room/Black building paper

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	07/29/2015	Brown	0.0%	100%	None Detected	☑

Client Sample ID: IH-EWPC-01A ***Lab Sample ID:*** **551507881-0162**
Sample Description: West window of building between pane & frame/White exterior window pane caulking

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	07/29/2015	White	0.0%	100%	None Detected	☑

Client Sample ID: IH-EWPC-01B ***Lab Sample ID:*** **551507881-0163**
Sample Description: West window of building between pane & frame/White exterior window pane caulking

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	07/29/2015	White	0.0%	100%	None Detected	☑

Client Sample ID: IH-EWPC-01C ***Lab Sample ID:*** **551507881-0164**
Sample Description: West window of building between pane & frame/White exterior window pane caulking

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	07/29/2015	White	0.0%	100%	None Detected	☑

Client Sample ID: MB-PI-01A ***Lab Sample ID:*** **551507881-0168**
Sample Description: Ceiling space in north east exit/White aerosol

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	07/29/2015	Gray	50%	10%	**40% Chrysotile**	⊘

Client Sample ID: MB-PI-01B ***Lab Sample ID:*** **551507881-0169**
Sample Description: Ceiling space in north east exit/White aerosol

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	07/29/2015				Stop Positive (Not Analyzed)	

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Client Sample ID: MB-PI-01C **Lab Sample ID:** **551507881-0170**
Sample Description: Ceiling space in north east exit/White aerosol

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	07/29/2015				Stop Positive (Not Analyzed)	

Client Sample ID: MB-PW-01A **Lab Sample ID:** **551507881-0171**
Sample Description: Ceiling space in north east exit/White woven aerosol pipe wrap

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	07/29/2015	White	95%	5%	None Detected	☑

Client Sample ID: MB-PW-01B **Lab Sample ID:** **551507881-0172**
Sample Description: Ceiling space in north east exit/White woven aerosol pipe wrap

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	07/29/2015	White	95%	5%	None Detected	☑

Client Sample ID: MB-PW-01C **Lab Sample ID:** **551507881-0173**
Sample Description: Ceiling space in north east exit/White woven aerosol pipe wrap

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	07/29/2015	White	90%	10%	None Detected	☑

Client Sample ID: MB-PS-01A **Lab Sample ID:** **551507881-0174**
Sample Description: Interior wall west of plant office/Blue sprinkler pipe sealant

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	07/30/2015	Blue	0.0%	98.6%	**1.4% Chrysotile**	⊘

Client Sample ID: MB-PS-01B **Lab Sample ID:** **551507881-0175**
Sample Description: East wall of evaporator adjacent to vit. shed/Blue sprinkler pipe sealant

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	07/30/2015				Positive Stop (Not Analyzed)	

Client Sample ID: MB-PS-01C **Lab Sample ID:** **551507881-0176**
Sample Description: Interior wall by south west exit /Blue sprinkler pipe sealant

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	07/30/2015				Positive Stop (Not Analyzed)	

Client Sample ID: MB-MG-01A **Lab Sample ID:** **551507881-0177**
Sample Description: Canning crew station/Black mechanical gasket

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	07/30/2015	Black/Blue	0.0%	100%	None Detected	☑

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Client Sample ID: MB-MG-01B **Lab Sample ID:** **551507881-0178**
Sample Description: Canning crew station/Black mechanical gasket

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	07/30/2015	Black/Blue	0.0%	100%	None Detected	

Client Sample ID: MB-MG-01C **Lab Sample ID:** **551507881-0179**
Sample Description: Canning crew station/Black mechanical gasket

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	07/30/2015	Black/Blue	0.0%	100%	None Detected	

Client Sample ID: MB-MA-01A **Lab Sample ID:** **551507881-0180**
Sample Description: Yellow separator/Black mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	07/30/2015	Black	0.0%	100%	None Detected	

Client Sample ID: MB-MA-01B **Lab Sample ID:** **551507881-0181**
Sample Description: Yellow separator/Black mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	07/30/2015	Black	0.0%	100%	None Detected	

Client Sample ID: MB-MA-01C **Lab Sample ID:** **551507881-0182**
Sample Description: Yellow separator/Black mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	07/30/2015	Black	0.0%	100%	None Detected	

Client Sample ID: MB-MG-02A **Lab Sample ID:** **551507881-0183**
Sample Description: Press in south east of the building/Silver mechanical gasket

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	07/30/2015	Gray	0.0%	70.4%	**29.6% Chrysotile**	

Client Sample ID: MB-MG-02B **Lab Sample ID:** **551507881-0184**
Sample Description: Press in south east of the building/Silver mechanical gasket

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	07/30/2015				Positive Stop (Not Analyzed)	

Client Sample ID: MB-MG-02C **Lab Sample ID:** **551507881-0185**
Sample Description: Press in south east of the building/Silver mechanical gasket

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	07/30/2015				Positive Stop (Not Analyzed)	

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Customer PO: 123220330.300
Project ID:

Test Report: Asbestos Analysis in Bulk Material for Occupational Health and Safety British Columbia Regulation 188/2011 via EPA 600/R-93/116 Method

Client Sample ID: MB-IWPC-01A **Lab Sample ID:** **551507881-0186**
Sample Description: N.west cor. of bldg btwn pane & window/White interior window pane caulking

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	07/30/2015	White	0.0%	100%	None Detected	☑

Client Sample ID: MB-IWPC-01B **Lab Sample ID:** **551507881-0187**
Sample Description: W.side of bldg btwn pane & window/White interior window pane caulking

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	07/30/2015	White	0.0%	100%	None Detected	☑

Client Sample ID: MB-IWPC-01C **Lab Sample ID:** **551507881-0188**
Sample Description: S.west cor. of bldg btwn pane & window/White interior window pane caulking

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	07/30/2015	White	0.0%	100%	None Detected	☑

Client Sample ID: MB-IWPC-02A **Lab Sample ID:** **551507881-0189**
Sample Description: Ext. windows of plant ofc. btwn pane & window/by NE cor. of bldg/ Yellow interior window pane caulking

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	07/30/2015	White	0%	100%	None Detected	☑

Client Sample ID: MB-IWPC-02B **Lab Sample ID:** **551507881-0190**
Sample Description: Ext. windows of plant ofc. btwn pane & window/by NE cor. of bldg/ Yellow interior window pane caulking

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	07/30/2015	White	0%	100%	None Detected	☑

Client Sample ID: MB-IWPC-02C **Lab Sample ID:** **551507881-0191**
Sample Description: Ext. windows of plant ofc. btwn pane & window/by NE cor. of bldg/ Yellow interior window pane caulking

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	07/30/2015	Gray	0%	100%	None Detected	☑

Client Sample ID: MB-RI-01A **Lab Sample ID:** **551507881-0192**
Sample Description: Mezzanine level-south of tank area around pipe/Yellow remnant insulation

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	07/29/2015	Tan	90%	10%	None Detected	☑

Client Sample ID: MB-RI-01B **Lab Sample ID:** **551507881-0193**
Sample Description: Mezzanine level-south of tank area around pipe/Yellow remnant insulation

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	07/29/2015	Tan	90%	10%	None Detected	☑

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Client Sample ID: MB-RI-01C **Lab Sample ID:** **551507881-0194**
Sample Description: Mezzanine level-south of tank area around pipe/Yellow remnant insulation

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	07/29/2015	Brown	90%	10%	None Detected	☑

Client Sample ID: MB-TL-01A **Lab Sample ID:** **551507881-0195**
Sample Description: Canning boiler by caning crew station/Brown woven tank liner

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	07/29/2015	Black	70%	30%	None Detected	☑

Client Sample ID: MB-TL-01B **Lab Sample ID:** **551507881-0196**
Sample Description: Canning boiler by caning crew station/Brown woven tank liner

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	07/29/2015	Tan/Black	70%	30%	None Detected	☑

Client Sample ID: MB-TL-01C **Lab Sample ID:** **551507881-0197**
Sample Description: Canning boiler by caning crew station/Brown woven tank liner

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	07/29/2015	Brown/Black	70%	30%	None Detected	☑

Client Sample ID: MB-BP-01A **Lab Sample ID:** **551507881-0198**
Sample Description: Mezzanine level-SW storage area under roof mat./Black roof paper

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	07/30/2015	Black	0.0%	100%	None Detected	☑

Client Sample ID: MB-BP-01B **Lab Sample ID:** **551507881-0199**
Sample Description: Mezzanine level-SW storage area under roof mat./Black roof paper

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	07/30/2015	Black	0.0%	100%	None Detected	☑

Client Sample ID: MB-BP-01C **Lab Sample ID:** **551507881-0200**
Sample Description: Mezzanine level-SW storage area under roof mat./Black roof paper

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	07/30/2015	Black	0.0%	100%	None Detected	☑

Client Sample ID: MB-EW-01A **Lab Sample ID:** **551507881-0201**
Sample Description: North west exit hanging from the ceiling/Black and tan woven electrical wrap

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	07/29/2015	Tan/Black	60%	40%	None Detected	☑

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Client Sample ID: MB-EW-01B **Lab Sample ID:** **551507881-0202**
Sample Description: North west exit hanging from the ceiling/Black and tan woven electrical wrap

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	07/29/2015	Tan/Black	60%	40%	None Detected	☑

Client Sample ID: MB-EW-01C **Lab Sample ID:** **551507881-0203**
Sample Description: North west exit hanging from the ceiling/Black and tan woven electrical wrap

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	07/29/2015	Gray/Black	40%	60%	None Detected	☑

Client Sample ID: MB-PW-02A **Lab Sample ID:** **551507881-0204**
Sample Description: Mezzanine level -btwn west tanks in tank area/Black pipe wrap

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	07/30/2015	Gray/Various	0.0%	100%	None Detected	☑

Client Sample ID: MB-PW-02B **Lab Sample ID:** **551507881-0205**
Sample Description: Mezzanine level -btwn west tanks in tank area/Black pipe wrap

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	07/30/2015	Gray/Various	0.0%	100%	None Detected	☑

Client Sample ID: MB-PW-02C **Lab Sample ID:** **551507881-0206**
Sample Description: Mezzanine level -btwn west tanks in tank area/Black pipe wrap

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	07/30/2015	Gray/Various	0.0%	100%	None Detected	☑

Client Sample ID: MB-TF-01A **Lab Sample ID:** **551507881-0207**
Sample Description: Mezzanine/L-on wood staircase south of tank area/Black textured floor

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	07/30/2015	Brown/Black	0.0%	100%	None Detected	☑

Client Sample ID: MB-TF-01B **Lab Sample ID:** **551507881-0208**
Sample Description: Mezzanine/L-on wood staircase south of tank area/Black textured floor

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	07/30/2015	Brown/Black	0.0%	100%	None Detected	☑

Client Sample ID: MB-TF-01C **Lab Sample ID:** **551507881-0209**
Sample Description: Mezzanine/L-on wood staircase south of tank area/Black textured floor

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	07/30/2015	Brown/Black	0.0%	100%	None Detected	☑

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EMSL Canada Order 551507881
Customer ID: 55JACQ30L
Customer PO: 123220330.300
Project ID:

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500 - 4730 Kingsway
Burnaby, BC V5H 0C6

Phone: (604) 412-3004
Fax:
Collected:
Received: 07/22/2015
Analyzed: 07/30/2015

Proj: GOG/123220330.300.100

Client Sample ID: WS-CP-01 ***Lab Sample ID:*** **551507881-0210**

Sample Description: Lower east wall of shed/Grey cement paneling

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	07/29/2015	Gray	0%	80%	**20% Chrysotile**	

No Asbestos Detected

Between OHS BC Regulation 188/2011 and Expected Limit of Detection

Above OHS BC Regulation 188/2011 Limt

These guidance limits are typically used in most scenarios. More stringent local or project specific guidelines may apply.

Analyst(s)

Jon Delos Santos	PLM	(16)
	PLM Grav. Reduction	(41)
Natalie D'Amico	PLM	(10)
Nicole Dimou	PLM	(3)
	PLM Grav. Reduction	(33)
Nicole Yeo	PLM	(33)
	400 PLM Pt Ct	(1)

Matthew Davis
or other Approved Signatory

Any questions please contact Matthew Davis.

Report amended: 07/30/201517:01:26 Replaces initial report from: 07/29/201520:26:28 Reason Code: Client-Samples Added

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Proj: GOG/123220330.300.100

Test Report: Asbestos Analysis in Bulk Material for Occupational Health and Safety British Columbia Regulation 188/2011 via EPA 600/R-93/116 Method

Client Sample ID: WS-CP-01 ***Lab Sample ID:*** **551507881-0210**

Sample Description: Lower east wall of shed/Grey cement paneling

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	7/29/2015	Gray	0%	80%	**20% Chrysotile**	

Analyst(s):

Nicole Yeo PLM (1)

Reviewed and approved by:

Matthew Davis
or Other Approved Signatory

None Detected = <0.5%. EMSL maintains liability limited to cost of analysis. This report relates only to the samples reported above and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities or analytical method limitations. Interpretation and use of test results are the responsibility of the client. Samples received in good condition unless otherwise noted. This report must not be used to claim product endorsement by NVLAP of any agency of the U.S. Government.

Samples analyzed by EMSL Canada Inc. Mississauga, ON NVLAP Lab Code 200877-0

Initial report from: 07/29/201520:26:28

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Analyzed: 7/29/2015

Proj: GOG/123220330.300.100

Test Report: Asbestos Analysis in Bulk Material for Occupational Health and Safety British Columbia Regulation 188/2011 via EPA 600/R-93/116 Method

Client Sample ID: TF-MG-01A ***Lab Sample ID:*** **551507881-0165**

Sample Description: East tank/Grey mechanical gasket

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/29/2015	Gray	0.0%	60.8%	**39.2% Chrysotile**	

Client Sample ID: TF-MG-01B ***Lab Sample ID:*** **551507881-0166**

Sample Description: East tank/Grey mechanical gasket

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/29/2015			Positive Stop (Not Analyzed)		

Client Sample ID: TF-MG-01C ***Lab Sample ID:*** **551507881-0167**

Sample Description: East tank/Grey mechanical gasket

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/29/2015			Positive Stop (Not Analyzed)		

Analyst(s):

Jon Delos Santos PLM Grav. Reduction (1)

Reviewed and approved by:

Matthew Davis
or Other Approved Signatory

None Detected = <0.5%. EMSL maintains liability limited to cost of analysis. This report relates only to the samples reported above and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities or analytical method limitations. Interpretation and use of test results are the responsibility of the client. Samples received in good condition unless otherwise noted. This report must not be used to claim product endorsement by NVLAP of any agency of the U.S. Government.

Samples analyzed by EMSL Canada Inc. Mississauga, ON NVLAP Lab Code 200877-0

Report amended: 07/30/201517:01:26 Replaces initial report from: 07/29/201520:26:28 Reason Code: Client-Samples Added

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Analyzed: 7/29/2015

Proj: GOG/123220330.300.100

Test Report: Asbestos Analysis in Bulk Material for Occupational Health and Safety British Columbia Regulation 188/2011 via EPA 600/R-93/116 Method

Client Sample ID: AD-DJC-01A ***Lab Sample ID:*** **551507881-0098**
Sample Description: Interior wall of washroom/Dry wall joint compound

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	7/29/2015	White	0%	100%	None Detected	

Client Sample ID: AD-DJC-01B ***Lab Sample ID:*** **551507881-0099**
Sample Description: North wall of staff lounge/Dry wall joint compound

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	7/29/2015	White	0%	100%	None Detected	

Client Sample ID: AD-DJC-01C ***Lab Sample ID:*** **551507881-0100**
Sample Description: East wall of reception/Dry wall joint compound

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	7/29/2015	White	0%	100%	None Detected	

Client Sample ID: AD-DJC-01D ***Lab Sample ID:*** **551507881-0101**
Sample Description: North wall of office #3/Dry wall joint compound

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	7/29/2015	Gray/White	0%	100%	None Detected	

Client Sample ID: AD-DJC-01E ***Lab Sample ID:*** **551507881-0102**
Sample Description: South wall of reception/Dry wall joint compound

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	7/29/2015	White	0%	100%	None Detected	

Client Sample ID: AD-WPC-01A ***Lab Sample ID:*** **551507881-0103**
Sample Description: Window on E.side of washroom btwn pane & frame/Black window pane caulking

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/29/2015	Black	0.0%	100%	None Detected	

Client Sample ID: AD-WPC-01B ***Lab Sample ID:*** **551507881-0104**
Sample Description: Window on E.side of washroom btwn pane & frame/Black window pane caulking

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	7/29/2015	Black	0%	100%	None Detected	

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Test Report: Asbestos Analysis in Bulk Material for Occupational Health and Safety British Columbia Regulation 188/2011 via EPA 600/R-93/116 Method

Client Sample ID: AD-WPC-01C ***Lab Sample ID:*** **551507881-0105**

Sample Description: Window on E.side of washroom btwn pane & frame/Black window pane caulking

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/29/2015	Black	0.0%	100%	None Detected	

Client Sample ID: AD-EPP-01A ***Lab Sample ID:*** **551507881-0106**

Sample Description: Upper east wall of the mechanical room/Grey electrical penetration putty

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/29/2015	Gray/White	0.0%	87.7%	**12.3% Chrysotile**	

Client Sample ID: AD-EPP-01B ***Lab Sample ID:*** **551507881-0107**

Sample Description: Upper east wall of the mechanical room/Grey electrical penetration putty

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/29/2015				Positive Stop (Not Analyzed)	

Client Sample ID: AD-EPP-01C ***Lab Sample ID:*** **551507881-0108**

Sample Description: Upper east wall of the mechanical room/Grey electrical penetration putty

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/29/2015				Positive Stop (Not Analyzed)	

Client Sample ID: AD-CT-01A ***Lab Sample ID:*** **551507881-0109**

Sample Description: Mechanical room/2'x4' standard fissure and pinhole ceiling tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	7/29/2015	Gray	80%	20%	None Detected	

Client Sample ID: AD-CT-01B ***Lab Sample ID:*** **551507881-0110**

Sample Description: Mechanical room/2'x4' standard fissure and pinhole ceiling tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	7/29/2015	Gray	80%	20%	None Detected	

Client Sample ID: AD-CT-01C ***Lab Sample ID:*** **551507881-0111**

Sample Description: Mechanical room/2'x4' standard fissure and pinhole ceiling tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	7/29/2015	Gray/White	80%	20%	None Detected	

Client Sample ID: AD-CT-02A ***Lab Sample ID:*** **551507881-0112**

Sample Description: Server room/1'x1' large and small pinhole ceiling tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	7/29/2015	Tan	90%	10%	None Detected	

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Client Sample ID: AD-CT-02B **Lab Sample ID:** **551507881-0113**
Sample Description: Server room/1'x1' large and small pinhole ceiling tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	7/29/2015	Tan	90%	10%	None Detected	

Client Sample ID: AD-CT-02C **Lab Sample ID:** **551507881-0114**
Sample Description: Server room/1'x1' large and small pinhole ceiling tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	7/29/2015	Brown	90%	10%	None Detected	

Client Sample ID: AD-FT-01 **Lab Sample ID:** **551507881-0115**
Sample Description: Mechanical room /12" x 12" pink stone pattern floor tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/29/2015	Black/Beige	0.0%	98.9%	**1.1% Chrysotile**	

Client Sample ID: AD-FT-01-Mastic **Lab Sample ID:** **551507881-0115A**
Sample Description: Mechanical room /12" x 12" pink stone pattern floor tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	7/29/2015	Black	0%	98%	**2% Chrysotile**	

Client Sample ID: AD-SF-01 **Lab Sample ID:** **551507881-0116**
Sample Description: Server room/White marble pattern

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/29/2015	White	0.0%	100%	None Detected	

Client Sample ID: AD-RP-01A **Lab Sample ID:** **551507881-0117**
Sample Description: Roof- base of steel post holding wires/White penetration

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/29/2015	White	0.0%	100%	None Detected	

Client Sample ID: AD-RP-01B **Lab Sample ID:** **551507881-0118**
Sample Description: Roof- base of steel post holding wires/White penetration

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/29/2015	White	0.0%	100%	None Detected	

Client Sample ID: AD-RP-01C **Lab Sample ID:** **551507881-0119**
Sample Description: Roof- base of steel post holding wires/White penetration

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/29/2015	White	0.0%	100%	None Detected	

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Client Sample ID: AD-SL-01A ***Lab Sample ID:*** **551507881-0120**

Sample Description: Roof - base on ventilation stack/Black stack liner

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/29/2015	Black	0.0%	100%	None Detected	

Client Sample ID: AD-SL-01B ***Lab Sample ID:*** **551507881-0121**

Sample Description: Roof - base on ventilation stack/Black stack liner

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/29/2015	Black	0.0%	100%	None Detected	

Client Sample ID: AD-SL-01C ***Lab Sample ID:*** **551507881-0122**

Sample Description: Roof - base on ventilation stack/Black stack liner

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/29/2015	Black	0.0%	100%	None Detected	

Client Sample ID: AD-RM-01A ***Lab Sample ID:*** **551507881-0123**

Sample Description: Floor of roof/Black roof material

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/29/2015	Black	0.0%	100%	None Detected	

Client Sample ID: AD-RM-01B ***Lab Sample ID:*** **551507881-0124**

Sample Description: Floor of roof/Black roof material

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/29/2015	Black	0.0%	100%	None Detected	

Client Sample ID: AD-RM-01C ***Lab Sample ID:*** **551507881-0125**

Sample Description: Floor of roof/Black roof material

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/29/2015	Black	0.0%	100%	None Detected	

Client Sample ID: AD-VM-01A ***Lab Sample ID:*** **551507881-0126**

Sample Description: Roof- base on ventilation stack/Clear vent mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/29/2015	Clear	0.0%	100%	None Detected	

Client Sample ID: AD-VM-01B ***Lab Sample ID:*** **551507881-0127**

Sample Description: Roof- base on ventilation stack/Clear vent mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/29/2015	Clear	0.0%	100%	None Detected	

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EMSL Canada Order 551507881
Customer ID: 55JACQ30L
Customer PO: 123220330.300
Project ID:

Test Report: Asbestos Analysis in Bulk Material for Occupational Health and Safety British Columbia Regulation 188/2011 via EPA 600/R-93/116 Method

Client Sample ID: AD-VM-01C ***Lab Sample ID:*** **551507881-0128**

Sample Description: Roof- base on ventilation stack/Clear vent mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/29/2015	Clear	0.0%	100%	None Detected	

Client Sample ID: AD-CBM-01A ***Lab Sample ID:*** **551507881-0129**

Sample Description: Mechanical room/Brown cove base mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/29/2015	Brown	0.0%	100%	None Detected	

Client Sample ID: AD-CBM-01B ***Lab Sample ID:*** **551507881-0130**

Sample Description: Mechanical room/Brown cove base mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/29/2015	Brown	0.0%	100%	None Detected	

Client Sample ID: AD-CBM-01C ***Lab Sample ID:*** **551507881-0131**

Sample Description: Mechanical room/Brown cove base mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/29/2015	Brown	0.0%	100%	None Detected	

Analyst(s):

Jon Delos Santos	PLM (6) PLM Grav. Reduction (14)
Nicole Dimou	PLM Grav. Reduction (6)
Nicole Yeo	PLM (7)

Reviewed and approved by:

Matthew Davis
or Other Approved Signatory

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Samples analyzed by EMSL Canada Inc. Mississauga, ON NVLAP Lab Code 200877-0

Report amended: 07/30/201517:01:26 Replaces initial report from: 07/29/201520:26:28 Reason Code: Client-Samples Added

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Customer ID: 55JACQ30L
Customer PO: 123220330.300
Project ID:

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Stantec Consulting, Ltd.
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Burnaby, BC V5H 0C6

Phone: (604) 412-3004
Fax:
Collected:
Received: 7/22/2015
Analyzed: 7/29/2015

Proj: GOG/123220330.300.100

Test Report: Asbestos Analysis in Bulk Material for Occupational Health and Safety British Columbia Regulation 188/2011 via EPA 600/R-93/116 Method

Client Sample ID: LF-GM-01A **Lab Sample ID:** **551507881-0144**
Sample Description: South exterior side of the building/Black gutter mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	7/29/2015	Black	0%	100%	None Detected	

Client Sample ID: LF-GM-01B **Lab Sample ID:** **551507881-0145**
Sample Description: South exterior side of the building/Black gutter mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/29/2015	Black	0.0%	100%	None Detected	

Client Sample ID: LF-GM-01C **Lab Sample ID:** **551507881-0146**
Sample Description: South exterior side of the building/Black gutter mastic

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	7/29/2015	Black	0.0%	100%	None Detected	

Client Sample ID: LF-BM-01A **Lab Sample ID:** **551507881-0147**
Sample Description: Chimney area west side of the building/Brick motor

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	7/29/2015	Gray	0%	100%	None Detected	

Client Sample ID: LF-BM-01B **Lab Sample ID:** **551507881-0148**
Sample Description: Chimney area west side of the building/Brick motor

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	7/29/2015	Gray	0%	100%	None Detected	

Client Sample ID: LF-BM-01C **Lab Sample ID:** **551507881-0149**
Sample Description: Chimney area west side of the building/Brick motor

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	7/29/2015	Gray	0%	100%	None Detected	

Client Sample ID: LF-HS-01A **Lab Sample ID:** **551507881-0150**
Sample Description: Hanging from wood column on W.side of bldg/Grey heat shield

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	7/29/2015	Gray	50%	20%	**30% Chrysotile**	

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Customer ID: 55JACQ30L
Customer PO: 123220330.300
Project ID:

Test Report: Asbestos Analysis in Bulk Material for Occupational Health and Safety British Columbia Regulation 188/2011 via EPA 600/R-93/116 Method

Client Sample ID: LF-HS-01B ***Lab Sample ID:*** **551507881-0151**

Sample Description: Hanging from wood column on W.side of bldg/Grey heat shield

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	7/29/2015			Stop Positive (Not Analyzed)		

Client Sample ID: LF-HS-01C ***Lab Sample ID:*** **551507881-0152**

Sample Description: Hanging from wood column on W.side of bldg/Grey heat shield

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	7/29/2015			Stop Positive (Not Analyzed)		

Analyst(s):

Jon Delos Santos	PLM (2) PLM Grav. Reduction (1)
Nicole Dimou	PLM Grav. Reduction (1)
Nicole Yeo	PLM (3)

Reviewed and approved by:

Matthew Davis
or Other Approved Signatory

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Samples analyzed by EMSL Canada Inc. Mississauga, ON NVLAP Lab Code 200877-0

Report amended: 07/30/201517:01:26 Replaces initial report from: 07/29/201520:26:28 Reason Code: Client-Samples Added

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Project ID:

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Received: 7/22/2015
Analyzed: 7/29/2015

Proj: GOG/123220330.300.100

Test Report: Asbestos Analysis in Bulk Material for Occupational Health and Safety British Columbia Regulation 188/2011 via EPA 600/R-93/116 Method

Client Sample ID: ODS-DJC-01A **Lab Sample ID:** **551507881-0075**
Sample Description: West wall/Dry wall joint compound

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	7/29/2015	White	0%	100%	None Detected	

Client Sample ID: ODS-DJC-01B **Lab Sample ID:** **551507881-0076**
Sample Description: West wall of bathroom/Dry wall joint compound

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	7/29/2015	White	0%	100%	None Detected	

Client Sample ID: ODS-DJC-01C **Lab Sample ID:** **551507881-0077**
Sample Description: West wall/Dry wall joint compound

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	7/29/2015	White	0%	100%	None Detected	

Client Sample ID: ODS-DJC-01D **Lab Sample ID:** **551507881-0078**
Sample Description: East interior wall/Dry wall joint compound

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	7/29/2015	White	0%	100%	None Detected	

Client Sample ID: ODS-DJC-01E **Lab Sample ID:** **551507881-0079**
Sample Description: North wall/Dry wall joint compound

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	7/29/2015	White	0%	100%	None Detected	

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Project ID:

Test Report: Asbestos Analysis in Bulk Material for Occupational Health and Safety British Columbia Regulation 188/2011 via EPA 600/R-93/116 Method

Analyst(s):

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Nicole Yeo PLM (3)

Reviewed and approved by:

Matthew Davis
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Samples analyzed by EMSL Canada Inc. Mississauga, ON NVLAP Lab Code 200877-0

Initial report from: 07/29/201520:26:28

Appendix D SUMMARY OF IDENTIFIED ACMS

Table D-1 Summary of Identified ACMs – Cannery Building

<table>
<tr><th colspan="2">Identified ACM Description and Condition Information</th></tr>
<tr><td colspan="2">Previously identified exterior cement in the following locations:
• At the front entrance of the East Wing (exterior)
• On the east wall of the Cannery building (exterior)
• On the south wall of the Dryer Shed (exterior)
• On the west wall of the Dryer Shed at the roof (exterior).</td><td rowspan="4">  </td></tr>
<tr><td>% Type</td><td>20% Chrysotile</td></tr>
<tr><td>Friability</td><td>Non-friable</td></tr>
<tr><td>Condition</td><td>Good</td></tr>
<tr><td colspan="2">Mechanical gasket, artifact serial #: KX.91.43.227. Similar large mechanical gaskets were observed in the Vitamin Oil Shed.</td><td rowspan="4"> 

 </td></tr>
<tr><td>% Type</td><td>25% Chrysotile</td></tr>
<tr><td>Friability</td><td>Non-friable</td></tr>
<tr><td>Condition</td><td>Good</td></tr>
</table>

Table D-1 Summary of Identified ACMs – Cannery Building

Identified ACM Description and Condition Information		
Mechanical gasket, artifact serial #: KX.92.32.92		
% Type	25% Chrysotile	
Friability	Non-friable	
Condition	Good	
Mechanical gasket on artifact serial #: KX.92.32.8		
% Type	40% Chrysotile	
Friability	Non-friable	
Condition	Poor	

Table D-1 Summary of Identified ACMs – Cannery Building

Identified ACM Description and Condition Information		
Mechanical gasket on artifact serial #: KX.92.32.8		
% Type	35.8% Chrysotile	
Friability	Non-friable	
Condition	Good	
O-ring, artifact serial #: KX.93.5.373		
% Type	35.3% Chrysotile	
Friability	Non-friable	
Condition	Good	

Table D-1 Summary of Identified ACMs – Cannery Building

Identified ACM Description and Condition Information		
Oven heat shield on artifact serial #: KX.91.42.108		 
% Type	7.4% Chrysotile	
Friability	Friable	
Condition	Poor	

Table D-1 Summary of Identified ACMs – Cannery Building

Identified ACM Description and Condition Information		
Cement panel behind GE transformer boxes throughout		
% Type	15% Chrysotile	
Friability	Non-friable	
Condition	Good	
Grey roof panel on dryer shed		
% Type	18.3% Chrysotile	
Friability	Non-friable	
Condition	Good	

Table D-1 Summary of Identified ACMs – Cannery Building

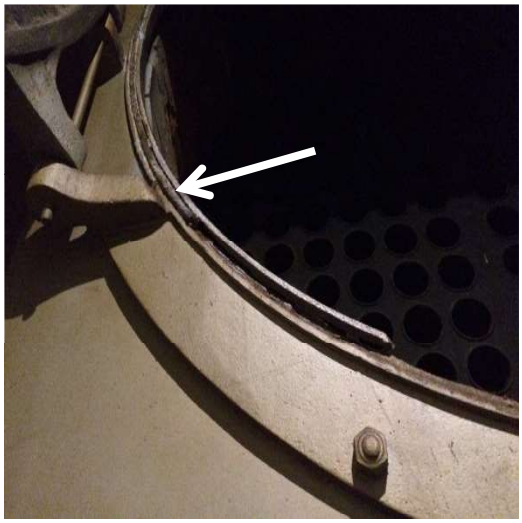
Identified ACM Description and Condition Information		
Tan fibrous liner on the wood plank in tank room #3 of the vitamin oil shed		
% Type	30% Chrysotile	
Friability	Friable	
Condition	Poor	
Tan fibrous liner around the perimeter of the hatch on the "HRT" boiler		
% Type	30% Chrysotile	
Friability	Friable	
Condition	Poor	

Table D-1 Summary of Identified ACMs – Cannery Building

Identified ACM Description and Condition Information		
Dark brown mechanical gasket on the small tank in the northeast corner of the Boiler Room		
% Type	42.3% Chrysotile	
Friability	Non-friable	
Condition	Good	
White Aircell mechanical pipe insulation by the north west exit		
% Type	40% Chrysotile	
Friability	Friable	
Condition	Poor	

Table D-1 Summary of Identified ACMs – Cannery Building

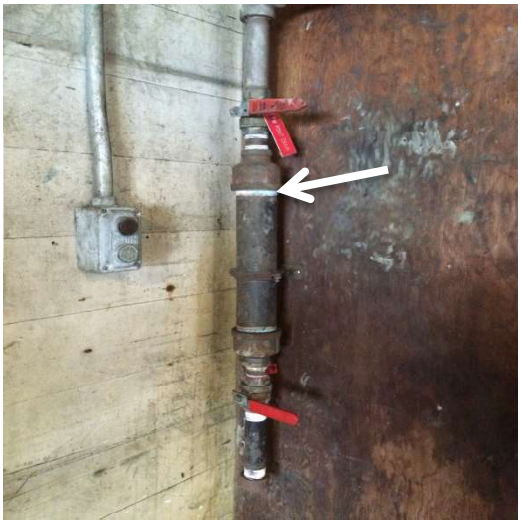
Identified ACM Description and Condition Information		
Blue pipe sealant on sprinkler piping throughout Main Building		
% Type	1.4% Chrysotile	
Friability	Non-friable	
Condition	Good	

Table D-1 Summary of Identified ACMs – Cannery Building

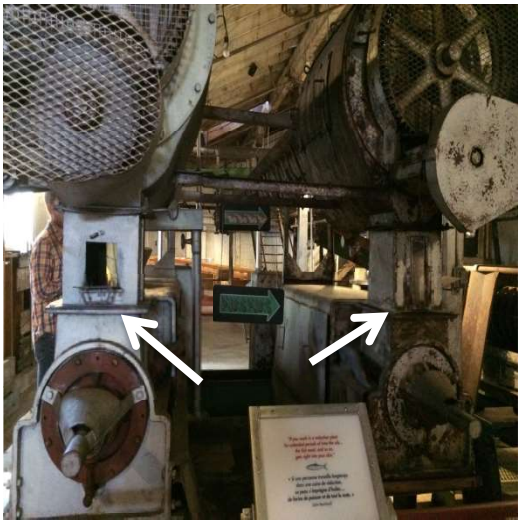
Identified ACM Description and Condition Information		
Silver mechanical gaskets on the presses in the reduction annex		 
% Type	29.6% Chrysotile	
Friability	Non-friable	
Condition	Good	

Table D-2 Summary of Identified ACMs – Watchman's Shed

Identified ACM Description and Condition Information		
Grey cement paneling on the lower east wall		
% Type	20% Chrysotile	
Friability	Non-friable	
Condition	Poor	

Table D-3 Summary of Identified ACMs – Tank Farm

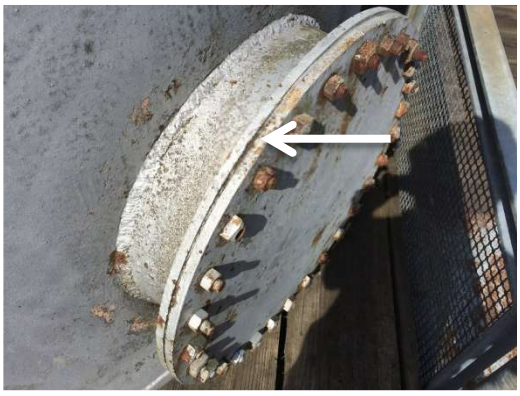
Identified ACM Description and Condition Information		
Grey mechanical gasket on flanges attached to the two large tanks in the Tank Farm		
% Type	39.2 % Chrysotile	
Friability	Non-friable	
Condition	Good	

Table D-4 Summary of Identified ACMs – Administrative Building

Identified ACM Description and Condition Information		
Grey electrical penetration putty on the upper east wall of the Mechanical Room		
% Type	12.3% Chrysotile	
Friability	Non-friable	
Condition	Good	
12"x12" pink stone pattern floor tile and associated mastic in the mechanical/electrical room and the archive room		
% Type	1.1-2% Chrysotile	
Friability	Non-friable	
Condition	Good	

Table D-5 Summary of Identified ACMs – Lead Foundry

Identified ACM Description and Condition Information		
Grey heat shield hanging from wood column on the west side of the building		
% Type	30% Chrysotile	
Friability	Friable	
Condition	Poor	

Appendix E SUMMARY OF RESULTS OF ANALYSIS OF PAINT CHIP SAMPLES FOR LEAD CONTENT

Summary of Suspected LCP Chip Samples
February 16, 2016

Table E-1 Cannery Building – Suspected LCP Sample Collection and Analysis Summary

Sample Number	Paint Description	Location	Result (PPM Lead)	Lead Containing
Dryer Shed/Grinding and Sacking Room (DS)				
DS-PB-01	**Lime Green**	**Chute**	**11,000**	**Yes**
DS-PB-02	Silver	Funnel	160	No
DS-PB-03	**Silver**	**Dryer**	**820**	**Yes**
DS-PB-04	Silver	Ground level – west wall of south east office	<90	No
DS-PB-05	Grey	North wall	<110	No
DS-PB-06	Cream	Dryer Hatch	450	No
Vitamin Oil Shed (VOS)				
VOS-PB-01	**White**	**Interior wall**	**3,900**	**Yes**
VOS-PB-02	**Silver**	**Oil tank in tank room#1**	**3,200**	**Yes**
VOS-PB-03	**Black**	**Oil tank in tank room #3**	**1,500**	**Yes**
Boiler Room (BR)				
BR-PB-01	**Grey**	**East interior wall**	**3,800**	**Yes**
BR-PB-02	**Grey**	**Staircase**	**200,000**	**Yes**
BR-PB-03	Silver	Tea Kettle boiler	<90	No
BR-PB-04	Red	Handrail in west side of the building	450	No
BR-PB-05	**Black**	**Tea Kettle boiler**	**3,200**	**Yes**
BR-PB-06	**Green**	**Patterson boiler**	**77,000**	**Yes**
East Wing (EW)				
EW-PB-01	Cream	Mechanical room wall	<90	No
EW-PB-02	Silver	Main door of east staff room	120	No
EW-PB-03	**Grey**	**Interior wall of west staff room**	**15,000**	**Yes**
EW-PB-04	**Teal**	**Interior wall of west staff room**	**2,900**	**Yes**
EW-PB-05	**White**	**West interior wall**	**8,700**	**Yes**
EW-PB-06	**Cream**	**Mezzanine Level wall**	**690**	**Yes**
Ice House (IH)				
IH-PB-01	**Cream**	**Upper level walls**	**3,600**	**Yes**
IH-PB-02	**Red**	**Upper level switch boxes**	**870**	**Yes**
IH-PB-03	**Black**	**Upper level – lower walls**	**3,100**	**Yes**

Table E-1 Cannery Building – Suspected LCP Sample Collection and Analysis Summary

Sample Number	Paint Description	Location	Result (PPM Lead)	Lead Containing
Main Building (MB)				
MB-PB-01	**White**	**Interior wood column on west side of building**	**7,200**	**Yes**
MB-PB-02	**Teal**	**Door of plant office by north west side of building**	**2,400**	**Yes**
MB-PB-03	Silver	Interior wall on south side of building	320	No
MB-PB-04	**Silver**	**Mezzanine level – south of tank area**	**15,000**	**Yes**
MB-PB-05	**White**	**Window trim on plant office**	**3,300**	**Yes**
MB-PB-06	**White**	**Interior wood panel walls on north west side of building**	**7,800**	**Yes**
MB-PB-07	Black	Black platform north west side of building	<210	No
MB-PB-08	**White**	**Wood column in loft area 3**	**2,200**	**Yes**
MB-PB-09	**Blue**	**Upper Level – mechanical room west of Dryer Shed**	**14,000**	**Yes**
MB-PB-11	**Teal**	**Chute in south west side of building**	**18,000**	**Yes**
MB-PB-12	**Green**	**Evaporator**	**2,600**	**Yes**
MB-PB-13	**Yellow**	**Evaporator**	**26,000**	**Yes**
MB-PB-14	**Silver**	**Evaporator**	**22,000**	**Yes**
MB-PB-15	**Dark green**	**Stairs in evaporator room**	**19,000**	**Yes**
MB-PB-16	Silver	Interior wall in separator room	450	No
MB-PB-17	**Yellow**	**Interior wall in separator room**	**1,400**	**Yes**
MB-PB-18	**Green**	**Interior wall in evaporator room**	**3,500**	**Yes**
MB-PB-19	Red	Handrails west of Dryer Shed	<330	No
MB-PB-20	**Silver**	**Press**	**660**	**Yes**

Table E-2 Watchman's Shed – Suspected LCP Sample Collection and Analysis Summary

Sample Number	Paint Description	Location	Result (PPM Lead)	Lead Containing
WS-PB-01	**Teal**	**Interior wall and trim**	**740**	**Yes**
WS-PB-02	**Green**	**Floor**	**27,000**	**Yes**

Table E-3 Tank Farm – Suspected LCP Sample Collection and Analysis Summary

Sample Number	Paint Description	Location	Result (PPM Lead)	Lead Containing
FT-PB-01	**Red**	**Pipes**	**52,000**	**Yes**
FT-PB-02	**Grey**	**On tank**	**120,000**	**Yes**
FT-PB-03	**Blue**	**On pump**	**1,100**	**Yes**

Table E-4 Administrative Building – Suspected LCP Sample Collection and Analysis Summary

Sample Number	Paint Description	Location	Result (PPM Lead)	Lead Containing
AD-PB-01	White	Exterior wall	180	No
AD-PB-02	Red	Exterior trim	420	No
AD-PB-03	**Yellow**	**Curb on east side of the building**	**6,500**	**Yes**
AD-PB-04	Cream	Interior wall of server room	<90	No
AD-PB-05	**White**	**Interior wall**	**640**	**Yes**
AD-PB-06	Pink	Interior wall of library	<130	No

Table E-5 Lead Foundry – Suspected LCP Sample Collection and Analysis Summary

Sample Number	Paint Description	Location	Result (PPM Lead)	Lead Containing
LF-PB-01	**White**	**Interior wall**	**11,000**	**Yes**

Table E-6 Oil Drum Storage – Suspected LCP Sample Collection and Analysis Summary

Sample Number	Paint Description	Location	Result (PPM Lead)	Lead Containing
ODS-PB-01	**White**	**Interior trim of garage**	**3,800**	**Yes**
ODS-PB-02	Beige	Interior door trim	<90	No
ODS-PB-03	Light Beige	Interior wall	<90	No

Appendix F LABORATORY ANALYTICAL REPORT—LEAD: PAINT CHIP ANALYSIS

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Burnaby, BC V5H 0C6

Phone: (604) 412-3004
Fax:
Received: 07/22/15 11:06 AM
Collected:

Project: **GOG/123220330.300.100**

Test Report: Lead in Paint Chips by Flame AAS (SW 846 3050B/7000B)*

Client Sample Description	*Lab ID*	*Collected*	*Analyzed*	*Lead Concentration*
DS-PB-01	*551507888-0001*		7/28/2015	11000 ppm
	Site: CHUTE Desc: LIME GREEN			
DS-PB-02	*551507888-0002*		7/28/2015	160 ppm
	Site: FUNNEL Desc: SILVER			
DS-PB-03	*551507888-0003*		7/28/2015	820 ppm
	Site: DRYER Desc: SILVER			
DS-PB-04	*551507888-0004*		7/28/2015	<90 ppm
	Site: GROUND LEVEL- WEST WALL OF SOUTH EAST OFFICE Desc: SILVER			
DS-PB-05	*551507888-0005*		7/28/2015	<110 ppm
	Site: NORTH WALL Desc: GREY Insufficient sample to reach reporting limit.			
DS-PB-06	*551507888-0006*		7/28/2015	450 ppm
	Site: DRYER HATCH Desc: CREAM			

Lisa Podzyhun
or other approved signatory

*Analysis following Lead in Paint by EMSL SOP/Determination of Environmental Lead by FLAA. Reporting limit is 0.010 % wt based on the minimum sample weight per our SOP. Unless noted, results in this report are not blank corrected. This report relates only to the samples reported above and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities. Samples received in good condition unless otherwise noted. "<" (less than) result signifies that the analyte was not detected at or above the reporting limit. Measurement of uncertainty is available upon request. The QC data associated with the sample results included in this report meet the recovery and precision requirements established by the AIHA-LAP, unless specifically indicated otherwise.

Samples analyzed by EMSL Canada Inc. Mississauga, ON A2LA Accredited Environmental Testing Cert #2845.08

Initial report from 07/29/2015 09:32:36

EMSL Canada Inc.
2756 Slough Street, Mississauga, ON L4T 1G3
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EMSL Canada Or	551507888
CustomerID:	55JACQ30L
CustomerPO:	123220330
ProjectID:	

Attn: **Steve Chou**
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500 - 4730 Kingsway
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Phone: (604) 412-3004
Fax:
Received: 07/22/15 11:06 AM
Collected:

Project: **GOG/123220330.300.100**

Test Report: Lead in Paint Chips by Flame AAS (SW 846 3050B/7000B)*

Client Sample Description	*Lab ID*	*Collected*	*Analyzed*	*Lead Concentration*
VOS-PB-01	*551507888-0007*		7/28/2015	3900 ppm
	Site: INTERIOR WALL Desc: WHITE			
VOS-PB-02	*551507888-0008*		7/28/2015	3200 ppm
	Site: OIL TANK IN TANK ROOM #1 Desc: SILVER			
VOS-PB-03	*551507888-0009*		7/28/2015	1500 ppm
	Site: OIL TANK IN TANK ROOM #3 Desc: BLACK			

Lisa Podzyhun
or other approved signatory

*Analysis following Lead in Paint by EMSL SOP/Determination of Environmental Lead by FLAA. Reporting limit is 0.010 % wt based on the minimum sample weight per our SOP. Unless noted, results in this report are not blank corrected. This report relates only to the samples reported above and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities. Samples received in good condition unless otherwise noted. "<" (less than) result signifies that the analyte was not detected at or above the reporting limit. Measurement of uncertainty is available upon request. The QC data associated with the sample results included in this report meet the recovery and precision requirements established by the AIHA-LAP, unless specifically indicated otherwise.

Samples analyzed by EMSL Canada Inc. Mississauga, ON A2LA Accredited Environmental Testing Cert #2845.08

Initial report from 07/29/2015 09:41:53

EMSL Canada Inc.
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EMSL Canada Or	551507888
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Phone: (604) 412-3004
Fax:
Received: 07/22/15 11:06 AM
Collected:

Project: **GOG/123220330.300.100**

Test Report: Lead in Paint Chips by Flame AAS (SW 846 3050B/7000B)*

Client Sample Description	*Lab ID*	*Collected*	*Analyzed*	*Lead* ***Concentration***
BR-PB-01	*551507888-0013*		7/28/2015	3800 ppm
	Site: EAST INTERIOR WALL Desc: GREY			
BR-PB-02	*551507888-0014*		7/28/2015	200000 ppm
	Site: STAIRCASE Desc: GREY			
BR-PB-03	*551507888-0015*		7/28/2015	<90 ppm
	Site: TEA KETTLE BOILER Desc: SILVER			
BR-PB-04	*551507888-0016*		7/28/2015	450 ppm
	Site: HANDRAIL IN WEST SIDE OF THE BUILDING Desc: RED			
BR-PB-05	*551507888-0017*		7/28/2015	3200 ppm
	Site: TEA KETTLE BOILER Desc: BLACK			
BR-PB-06	*551507888-0018*		7/28/2015	77000 ppm
	Site: PATTERSON BOILER Desc: GREEN			

Lisa Podzyhun
or other approved signatory

*Analysis following Lead in Paint by EMSL SOP/Determination of Environmental Lead by FLAA. Reporting limit is 0.010 % wt based on the minimum sample weight per our SOP. Unless noted, results in this report are not blank corrected. This report relates only to the samples reported above and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities. Samples received in good condition unless otherwise noted. "<" (less than) result signifies that the analyte was not detected at or above the reporting limit. Measurement of uncertainty is available upon request. The QC data associated with the sample results included in this report meet the recovery and precision requirements established by the AIHA-LAP, unless specifically indicated otherwise.

Samples analyzed by EMSL Canada Inc. Mississauga, ON A2LA Accredited Environmental Testing Cert #2845.08

Initial report from 07/29/2015 09:43:58

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Phone: (604) 412-3004
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Received: 07/22/15 11:06 AM
Collected:

Project: **GOG/123220330.300.100**

Test Report: Lead in Paint Chips by Flame AAS (SW 846 3050B/7000B)*

Client Sample Description	*Lab ID*	*Collected*	*Analyzed*	*Lead Concentration*
EW-PB-01	*551507888-0025*		7/28/2015	<90 ppm
	Site: MECHANICAL ROOM WALL Desc: CREAM			
EW-PB-02	*551507888-0026*		7/28/2015	120 ppm
	Site: MAIN DOOR OF EAST STAFF ROOM Desc: SILVER			
EW-PB-03	*551507888-0027*		7/28/2015	15000 ppm
	Site: INTERIOR WALL OF WEST STAFF ROOM Desc: GREY			
EW-PB-04	*551507888-0028*		7/28/2015	2900 ppm
	Site: INTERIOR WALL OF WEST STAFF ROOM Desc: TEAL			
EW-PB-05	*551507888-0029*		7/28/2015	8700 ppm
	Site: WEST INTERIOR WALL Desc: WHITE			
EW-PB-06	*551507888-0030*		7/28/2015	690 ppm
	Site: MEZZANINE LEVEL WALL Desc: CREAM			

Lisa Podzyhun
or other approved signatory

*Analysis following Lead in Paint by EMSL SOP/Determination of Environmental Lead by FLAA. Reporting limit is 0.010 % wt based on the minimum sample weight per our SOP. Unless noted, results in this report are not blank corrected. This report relates only to the samples reported above and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities. Samples received in good condition unless otherwise noted. "<" (less than) result signifies that the analyte was not detected at or above the reporting limit. Measurement of uncertainty is available upon request. The QC data associated with the sample results included in this report meet the recovery and precision requirements established by the AIHA-LAP, unless specifically indicated otherwise.

Samples analyzed by EMSL Canada Inc. Mississauga, ON A2LA Accredited Environmental Testing Cert #2845.08

Initial report from 07/29/2015 09:46:19

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Phone: (604) 412-3004
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Received: 07/22/15 11:06 AM
Collected:

Project: **GOG/123220330.300.100**

Test Report: Lead in Paint Chips by Flame AAS (SW 846 3050B/7000B)*

Client Sample Description	*Lab ID*	*Collected*	*Analyzed*	*Lead Concentration*
IH-PB-01	*551507888-0033*		7/28/2015	3600 ppm
	Site: UPPER LEVEL WALLS Desc: CREAM			
IH-PB-02	*551507888-0034*		7/28/2015	870 ppm
	Site: UPPER LEVEL SWITCH BOXES Desc: RED			
IH-PB-03	*551507888-0035*		7/28/2015	3100 ppm
	Site: UPPER LEVEL LOWER WALLS Desc: BLACK			

Lisa Podzyhun
or other approved signatory

*Analysis following Lead in Paint by EMSL SOP/Determination of Environmental Lead by FLAA. Reporting limit is 0.010 % wt based on the minimum sample weight per our SOP. Unless noted, results in this report are not blank corrected. This report relates only to the samples reported above and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities. Samples received in good condition unless otherwise noted. "<" (less than) result signifies that the analyte was not detected at or above the reporting limit. Measurement of uncertainty is available upon request. The QC data associated with the sample results included in this report meet the recovery and precision requirements established by the AIHA-LAP, unless specifically indicated otherwise.

Samples analyzed by EMSL Canada Inc. Mississauga, ON A2LA Accredited Environmental Testing Cert #2845.08

Initial report from 07/29/2015 09:50:00

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CustomerPO:	123220330
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Phone: (604) 412-3004
Fax:
Received: 07/22/15 11:06 AM
Collected:

Project: **GOG/123220330.300.100**

Test Report: Lead in Paint Chips by Flame AAS (SW 846 3050B/7000B)*

Client Sample Description	*Lab ID*	*Collected*	*Analyzed*	*Lead Concentration*
MB-PB-01	*551507888-0036*		7/28/2015	7200 ppm
	Site: INTERIOR WOOD COLUMN ON WEST SIDE OF BLDG Desc: WHITE			
MB-PB-02	*551507888-0037*		7/28/2015	2400 ppm
	Site: DOOR OF PLANT OFFICE BY NORTH WEST SIDE OF BLDG Desc: TEAL			
MB-PB-03	*551507888-0038*		7/28/2015	320 ppm
	Site: INTERIOR WALL ON SOUTH SIDE OF BUILDING Desc: SILVER			
MB-PB-04	*551507888-0039*		7/28/2015	15000 ppm
	Site: MEZZANINE LEVEL- SOUTH OF TANK AREA Desc: SILVER			
MB-PB-05	*551507888-0040*		7/28/2015	3300 ppm
	Site: WINDOW TRIM ON PLANT OFFICE Desc: WHITE			
MB-PB-06	*551507888-0041*		7/28/2015	7800 ppm
	Site: INTERIOR WOOD PANEL WALLS ON NORTH WEST SIDE OF BL Desc: WHITE			
MB-PB-07	*551507888-0042*		7/28/2015	<210 ppm
	Site: BLACK PLATFORM NORTH WEST SIDE OF BLDG Desc: BLACK Insufficient sample to reach reporting limit.			
MB-PB-08	*551507888-0043*		7/28/2015	2200 ppm
	Site: WOOD COLUMN SOUTH WEST OF BOILER ROOM Desc: WHITE			
MB-PB-09	*551507888-0044*		7/28/2015	14000 ppm
	Site: UPPER LEVEL MECHANICAL ROOM WEST OF DRYER SHED Desc: BLUE			
MB-PB-10	*551507888-0045*		7/28/2015	18000 ppm
	Site: CHUTE IN SOUTH WEST SIDE OF BUILDING Desc: TEAL			

Lisa Podzyhun
or other approved signatory

*Analysis following Lead in Paint by EMSL SOP/Determination of Environmental Lead by FLAA. Reporting limit is 0.010 % wt based on the minimum sample weight per our SOP. Unless noted, results in this report are not blank corrected. This report relates only to the samples reported above and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities. Samples received in good condition unless otherwise noted. "<" (less than) result signifies that the analyte was not detected at or above the reporting limit. Measurement of uncertainty is available upon request. The QC data associated with the sample results included in this report meet the recovery and precision requirements established by the AIHA-LAP, LLC, unless specifically indicated otherwise.

Samples analyzed by EMSL Canada Inc. Mississauga, ON A2LA Accredited Environmental Testing Cert #2845.08

Report Amended: 02/17/2016 17:53:08 Replaces Report Amended: 02/16/2016 09:24:24. Reason Code: Client-Change to Sample ID

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EMSL Canada Or	551507888
CustomerID:	55JACQ30L
CustomerPO:	123220330
ProjectID:	

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Phone: (604) 412-3004
Fax:
Received: 07/22/15 11:06 AM
Collected:

Project: **GOG/123220330.300.100**

Test Report: Lead in Paint Chips by Flame AAS (SW 846 3050B/7000B)*

Client Sample Description	*Lab ID*	*Collected*	*Analyzed*	*Lead Concentration*
MB-PB-11	*551507888-0046*		7/28/2015	2600 ppm
	Site: EVAPORATOR Desc: GREEN			
MB-PB-12	*551507888-0047*		7/28/2015	26000 ppm
	Site: EVAPORATOR Desc: YELLOW			
MB-PB-13	*551507888-0048*		7/28/2015	22000 ppm
	Site: EVAPORATOR Desc: SILVER			
MB-PB-14	*551507888-0049*		7/28/2015	19000 ppm
	Site: STAIRS IN EVAPORATOR ROOM Desc: DARK GREEN			
MB-PB-15	*551507888-0050*		7/28/2015	450 ppm
	Site: INTERIOR WALL IN SEPARTOR ROOM Desc: SILVER			
MB-PB-16	*551507888-0051*		7/28/2015	1400 ppm
	Site: INTERIOR WALL IN SEPARTOR ROOM Desc: YELLOW			
MB-PB-17	*551507888-0052*		7/28/2015	3500 ppm
	Site: INTERIOR WALL IN EVAPORATOR ROOM Desc: TEAL			
MB-PB-18	*551507888-0053*		7/28/2015	<330 ppm
	Site: HANDRAILS WEST OF DRYER SHED Desc: RED Insufficient sample to reach reporting limit.			
MB-PB-19	*551507888-0054*		7/28/2015	660 ppm
	Site: PRESS Desc: SILVER			
MB-PB-20	*551507888-0055*		7/28/2015	740 ppm
	Site: INTERIOR WALL & TRIM Desc: WHITE & TEAL LAYER			

Lisa Podzyhun
or other approved signatory

*Analysis following Lead in Paint by EMSL SOP/Determination of Environmental Lead by FLAA. Reporting limit is 0.010 % wt based on the minimum sample weight per our SOP. Unless noted, results in this report are not blank corrected. This report relates only to the samples reported above and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities. Samples received in good condition unless otherwise noted. "<" (less than) result signifies that the analyte was not detected at or above the reporting limit. Measurement of uncertainty is available upon request. The QC data associated with the sample results included in this report meet the recovery and precision requirements established by the AIHA-LAP, LLC, unless specifically indicated otherwise.

Samples analyzed by EMSL Canada Inc. Mississauga, ON A2LA Accredited Environmental Testing Cert #2845.08

Report Amended: 02/17/2016 17:53:08 Replaces Report Amended: 02/16/2016 09:24:24. Reason Code: Client-Change to Sample ID

EMSL Canada Inc.
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EMSL Canada Or	551507888
CustomerID:	55JACQ30L
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ProjectID:	

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Phone: (604) 412-3004
Fax:
Received: 07/22/15 11:06 AM
Collected:

Project: **GOG/123220330.300.100**

Test Report: Lead in Paint Chips by Flame AAS (SW 846 3050B/7000B)*

Client Sample Description	*Lab ID*	*Collected*	*Analyzed*	*Lead Concentration*
WS-PB-01	*551507888-0055*		7/28/2015	740 ppm
	Site: INTERIOR WALL & TRIM Desc: WHITE & TEAL LAYER			
WS-PB-02	*551507888-0056*		7/28/2015	27000 ppm
	Site: FLOOR Desc: GREEN			

Lisa Podzyhun
or other approved signatory

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Samples analyzed by EMSL Canada Inc. Mississauga, ON A2LA Accredited Environmental Testing Cert #2845.08

Initial report from 07/29/2015 09:54:34

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CustomerPO:	123220330
ProjectID:	

Attn: **Steve Chou**
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Phone: (604) 412-3004
Fax:
Received: 07/22/15 11:06 AM
Collected:

Project: **GOG/123220330.300.100**

Test Report: Lead in Paint Chips by Flame AAS (SW 846 3050B/7000B)*

Client Sample Description	*Lab ID*	*Collected*	*Analyzed*	*Lead Concentration*
FT-PB-01	*551507888-0032*		7/28/2015	52000 ppm
	Site: PIPES Desc: RED			
FT-PB-02	*551507888-0057*		7/28/2015	120000 ppm
	Site: (NOT ON COC) Desc: GREY ON TANK			
FT-PB-03	*551507888-0058*		7/28/2015	1100 ppm
	Site: (NOT ON COC) Desc: BLUE ON PUMP			

Lisa Podzyhun
or other approved signatory

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Samples analyzed by EMSL Canada Inc. Mississauga, ON A2LA Accredited Environmental Testing Cert #2845.08

Report Amended: 02/16/2016 09:24:24 Replaces the Inital Report 07/29/2015 09:48:39. Reason Code: Client-Change to Sample ID

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EMSL Canada Or	551507888
CustomerID:	55JACQ30L
CustomerPO:	123220330
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Attn: **Steve Chou**
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Phone: (604) 412-3004
Fax:
Received: 07/22/15 11:06 AM
Collected:

Project: **GOG/123220330.300.100**

Test Report: Lead in Paint Chips by Flame AAS (SW 846 3050B/7000B)*

Client Sample Description	*Lab ID*	*Collected*	*Analyzed*	*Lead Concentration*
AD-PB-01	*551507888-0019*		7/28/2015	180 ppm
	Site: EXTERIOR WALL Desc: WHITE			
AD-PB-02	*551507888-0020*		7/28/2015	420 ppm
	Site: EXTERIOR TRIM Desc: RED			
AD-PB-03	*551507888-0021*		7/28/2015	6500 ppm
	Site: CURB ON EAST SIDE OF THE BUILDING Desc: YELLOW			
AD-PB-04	*551507888-0022*		7/28/2015	<90 ppm
	Site: INTERIOR WALL OF SERVER ROOM Desc: CREAM			
AD-PB-05	*551507888-0023*		7/28/2015	640 ppm
	Site: INTERIOR WALL Desc: WHITE			
AD-PB-06	*551507888-0024*		7/28/2015	<130 ppm
	Site: INTERIOR WALL OF LIBRARY Desc: PINK Insufficient sample to reach reporting limit.			

Lisa Podzyhun
or other approved signatory

*Analysis following Lead in Paint by EMSL SOP/Determination of Environmental Lead by FLAA. Reporting limit is 0.010 % wt based on the minimum sample weight per our SOP. Unless noted, results in this report are not blank corrected. This report relates only to the samples reported above and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities. Samples received in good condition unless otherwise noted. "<" (less than) result signifies that the analyte was not detected at or above the reporting limit. Measurement of uncertainty is available upon request. The QC data associated with the sample results included in this report meet the recovery and precision requirements established by the AIHA-LAP, unless specifically indicated otherwise.

Samples analyzed by EMSL Canada Inc. Mississauga, ON A2LA Accredited Environmental Testing Cert #2845.08

Initial report from 07/29/2015 09:45:09

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Phone: (604) 412-3004
Fax:
Received: 07/22/15 11:06 AM
Collected:

Project: **GOG/123220330.300.100**

Test Report: Lead in Paint Chips by Flame AAS (SW 846 3050B/7000B)*

Client Sample Description	*Lab ID*	*Collected*	*Analyzed*	*Lead Concentration*
LF-PB-01	*551507888-0031*		7/28/2015	11000 ppm
	Site: INTERIOR WALL Desc: WHITE			

Lisa Podzyhun
or other approved signatory

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Samples analyzed by EMSL Canada Inc. Mississauga, ON A2LA Accredited Environmental Testing Cert #2845.08

Initial report from 07/29/2015 09:47:31

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Phone: (604) 412-3004
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Received: 07/22/15 11:06 AM
Collected:

Project: **GOG/123220330.300.100**

Test Report: Lead in Paint Chips by Flame AAS (SW 846 3050B/7000B)*

Client Sample Description	*Lab ID*	*Collected*	*Analyzed*	*Lead Concentration*
ODS-PB-01	*551507888-0010*		7/28/2015	3800 ppm
	Site: INTERIOR TRIM OF GARAGE Desc: WHITE			
ODS-PB-02	*551507888-0011*		7/28/2015	<90 ppm
	Site: INTERIOR DOOR TRIM Desc: BEIGE			
ODS-PB-03	*551507888-0012*		7/28/2015	<90 ppm
	Site: INTERIOR WALL Desc: LIGHT BEIGE			

Lisa Podzyhun
or other approved signatory

*Analysis following Lead in Paint by EMSL SOP/Determination of Environmental Lead by FLAA. Reporting limit is 0.010 % wt based on the minimum sample weight per our SOP. Unless noted, results in this report are not blank corrected. This report relates only to the samples reported above and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities. Samples received in good condition unless otherwise noted. "<" (less than) result signifies that the analyte was not detected at or above the reporting limit. Measurement of uncertainty is available upon request. The QC data associated with the sample results included in this report meet the recovery and precision requirements established by the AIHA-LAP, unless specifically indicated otherwise.

Samples analyzed by EMSL Canada Inc. Mississauga, ON A2LA Accredited Environmental Testing Cert #2845.08

Initial report from 07/29/2015 09:42:53

Appendix G SUMMARY OF IDENTIFIED LCPS

Table G-1 Summary of Identified LCPs – Cannery Building

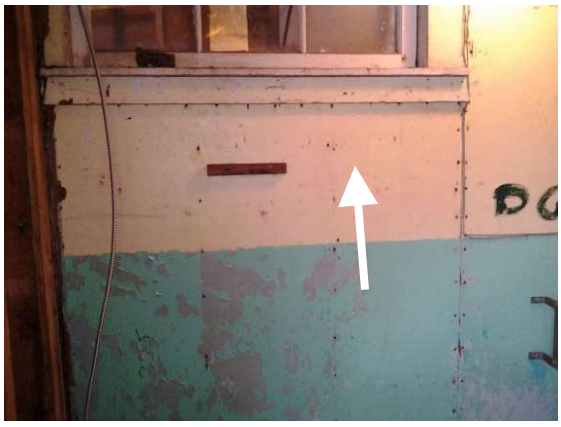
Identified LCP Description	Photo
Green coloured paint on interior walls and window frames of the Evaporator and Separator Rooms (previously identified and re-sampled during the current assessment). This paint was observed to be in poor condition (bubbling, flaking or peeling).	
Yellow coloured paint on interior walls and window frames of the Evaporator and Separator Rooms (previously identified and re-sampled during the current assessment). This paint was observed to be in good condition (minimal bubbling, flaking or peeling).	
White coloured paint on the interior wall of the Vitamin Oil Shed (previously identified and re-sampled during the current assessment). This paint was observed to be in good condition (minimal bubbling, flaking or peeling).	

Table G-1 Summary of Identified LCPs – Cannery Building

Identified LCP Description	Photo
White coloured paint on exterior walls of Vitamin Oil Shed (previously identified). This paint was observed to be in good condition (minimal bubbling, flaking or peeling).	
Burgundy coloured paint on exterior trim throughout the Cannery (previously identified). This paint was observed to be in good condition (minimal bubbling, flaking or peeling).	
Cream coloured paint on the Cannery building ceiling and west wall (previously identified). This paint was observed to be in poor condition (flaking and peeling).	

Table G-1 Summary of Identified LCPs – Cannery Building

Identified LCP Description	Photo
Silver coloured paint on upper interior walls of the Ice House (previously identified). This paint was observed to be in good condition (minimal bubbling, flaking or peeling).	
White coloured paint on lower interior walls of the Ice House (previously identified). This paint was observed to be in good condition (minimal bubbling, flaking or peeling).	
White coloured paint on the North exterior wall (previously identified). This paint was observed to be in good condition (minimal bubbling, flaking or peeling).	

Table G-1 Summary of Identified LCPs – Cannery Building

Identified LCP Description	Photo
White coloured paint on the West exterior wall (previously identified). This paint was observed to be in good condition (minimal bubbling, flaking or peeling).	
Lime green coloured paint on the chute of the Dryer Shed / Grinding and Sacking Room. This paint was observed to be in good condition (minimal bubbling, flaking or peeling).	
Silver coloured paint on the dryers in the Dryer Shed. This paint was observed to be in good condition (minimal bubbling, flaking or peeling).	No Photo.
Silver coloured paint on the oil tanks of the Vitamin Oil Shed. This paint was observed to be in good condition (minimal bubbling, flaking or peeling).	

Table G-1 Summary of Identified LCPs – Cannery Building

Identified LCP Description	Photo
Black coloured paint on the oil tanks of the Vitamin Oil Shed. This paint was observed to be in good condition (minimal bubbling, flaking or peeling).	
Grey coloured paint on the north interior wall of the Boiler Room. This paint was observed to be in good condition (minimal bubbling, flaking or peeling).	
Grey coloured paint on the staircase of the Boiler Room. This paint was observed to be in good condition (minimal bubbling, flaking or peeling).	

Table G-1 Summary of Identified LCPs – Cannery Building

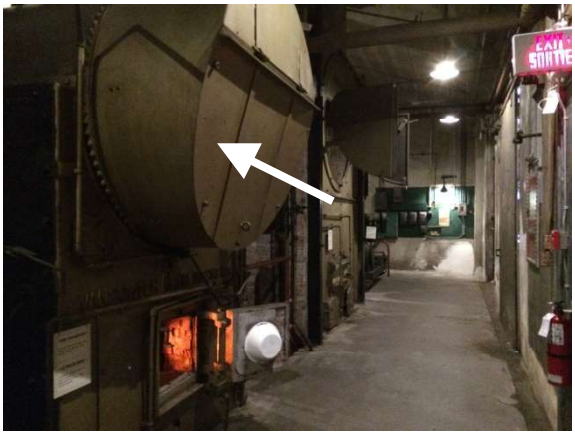
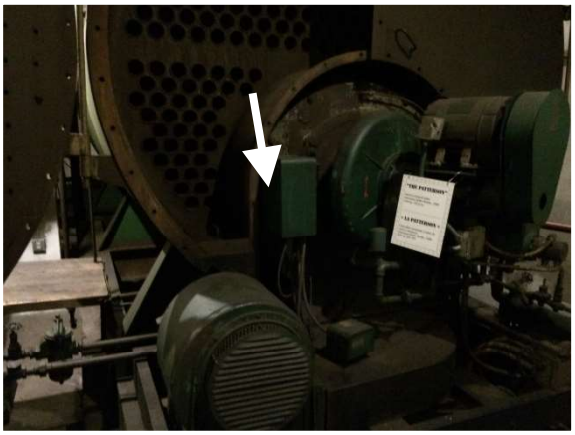
Identified LCP Description	Photo
Black coloured paint on the Tea Kettle Boiler of the Boiler Room. This paint was observed to be in good condition (minimal bubbling, flaking or peeling).	
Green coloured paint on the Patterson Boiler of the Boiler Room. This paint was observed to be in good condition (minimal bubbling, flaking or peeling).	
Grey coloured paint on the interior walls of the west staff room in the East Wing. This paint was observed to be in good condition (minimal bubbling, flaking or peeling).	

Table G-1 Summary of Identified LCPs – Cannery Building

Identified LCP Description	Photo
Teal coloured paint on the interior walls of the west staff room in the East Wing. This paint was observed to be in good condition (minimal bubbling, flaking or peeling).	
White coloured paint on the walls of the East Wing office. This paint was observed to be in good condition (minimal bubbling, flaking or peeling).	No Photo.
Cream coloured paint on the interior walls of the loft level in the East Wing. This paint was observed to be in good condition (minimal bubbling, flaking or peeling).	
Cream coloured paint on interior walls of the upper level Ice House. This paint was observed to be in good condition (minimal bubbling, flaking or peeling).	

Table G-1 Summary of Identified LCPs – Cannery Building

Identified LCP Description	Photo
Red coloured paint on switch boxes on the upper level of the Ice House. This paint was observed to be in poor condition (flaking or peeling).	
Black coloured paint on interior walls of the upper level Ice House. This paint was observed to be in good condition (minimal bubbling, flaking or peeling).	
White coloured paint on the interior wood columns throughout. This paint was observed to be in good condition (minimal bubbling, flaking or peeling).	

Table G-1 Summary of Identified LCPs – Cannery Building

Identified LCP Description	Photo
Teal coloured paint on the door of the Plant Office. This paint was observed to be in good condition (minimal bubbling, flaking or peeling).	
Silver coloured paint on the walls of the loft level Electrical Room. This paint was observed to be in good condition (minimal bubbling, flaking or peeling).	
White coloured paint on the window trims of the Plant Office. These paints were observed to be in good condition (minimal bubbling, flaking or peeling).	

Table G-1 Summary of Identified LCPs – Cannery Building

Identified LCP Description	Photo
White coloured paint on wood panel walls throughout. These paints were observed to be in good condition (minimal bubbling, flaking or peeling).	
Blue coloured paint on the door of the loft level Electrical Room. This paint was observed to be in good condition (minimal bubbling, flaking or peeling).	
Teal coloured paint on the chute in the Reduction Annex. This paint was observed to be in good condition (minimal bubbling, flaking or peeling).	

Table G-1 Summary of Identified LCPs – Cannery Building

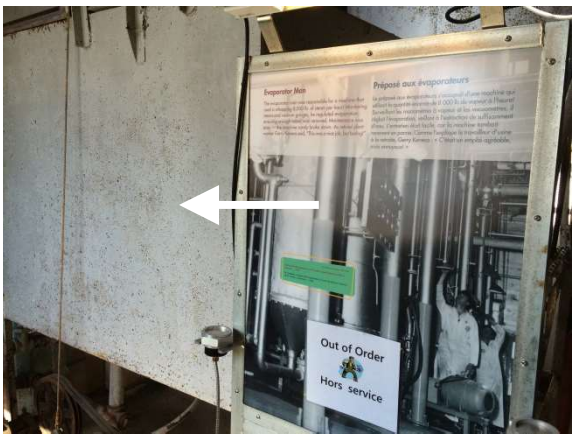
Identified LCP Description	Photo
Green coloured paint on the Evaporator. This paint was observed to be in good condition (minimal bubbling, flaking or peeling).	
Yellow coloured paint on the Evaporator. This paint was observed to be in good condition (minimal bubbling, flaking or peeling).	
Silver coloured paint on the Evaporator. This paint was observed to be in good condition (minimal bubbling, flaking or peeling).	

Table G-1 Summary of Identified LCPs – Cannery Building

Identified LCP Description	Photo
Dark green coloured paint on the stairs of the Evaporator Room. This paint was observed to be in good condition (minimal bubbling, flaking or peeling).	
Silver coloured paint on the press. This paint was observed to be in good condition (minimal bubbling, flaking or peeling).	

Table G-2 Summary of Identified LCPs – Watchman's Shed

Identified LCP Description	Photo
Purple coloured paint on exterior trim (previously identified, a new coat of Red paint was observed during the current assessment, however, unless paint was completely removed prior to repainting then this application should still be considered an LCP). This paint was observed to be in good condition during the current assessment (minimal bubbling, flaking or peeling).	
Teal coloured paint on the interior walls. This paint was observed to be in good condition (minimal bubbling, flaking or peeling).	
Green coloured paint on the floor. This paint was observed to be in good condition (minimal bubbling, flaking or peeling).	

Table G-3 Summary of Identified LCPs – Tank Farm

Identified LCP Description	Photo
Red coloured paint on the pipes. This paint was observed to be in poor condition (flaking or peeling).	
Grey coloured paint on tanks. This paint was observed to be in good condition (minimal bubbling, flaking or peeling).	
Blue coloured paint on pumps. This paint was observed to be in poor condition (flaking or peeling).	

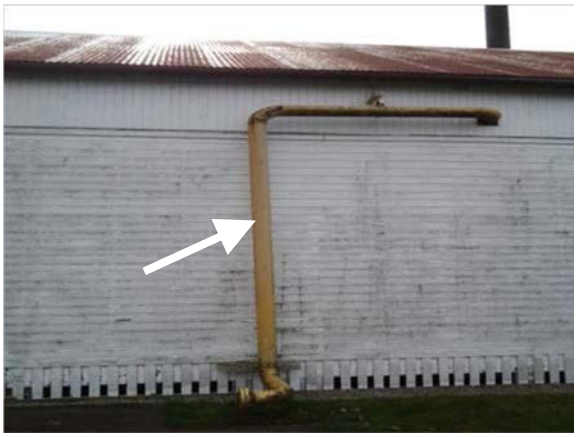
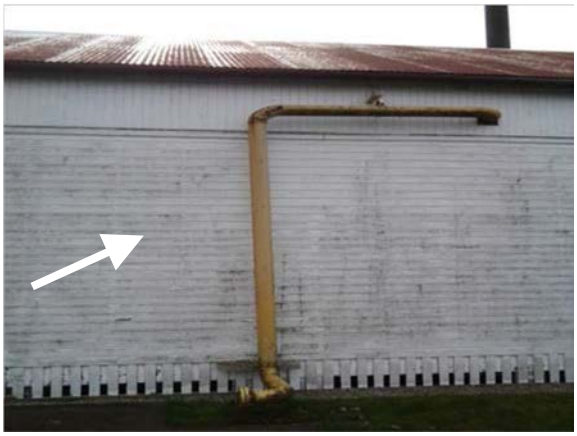
Table G-4 Summary of Identified LCPs – Administrative Building

Identified LCP Description	Photo
Yellow coloured paint on the curb on the east of the building. This paint was observed to be in good condition (minimal bubbling, flaking or peeling).	
White coloured paint on the interior walls throughout. This paint was observed to be in good condition (minimal bubbling, flaking or peeling).	

Table G-5 Summary of Identified LCPs – Lead Foundry

Identified LCP Description	Photo
Purple coloured paint on exterior trim (previously identified, a new coat of Red paint was observed during the current assessment, however, unless paint was completely removed prior to repainting then this application should still be considered an LCP). This paint was observed to be in good condition during the current assessment (minimal bubbling, flaking or peeling).	
White coloured paint on the interior walls of the Lead Foundry. This paint was observed to be in good condition (minimal bubbling, flaking or peeling).	No Photo.

Table G-6 Summary of Identified LCPs – Oil Drum Storage

Identified LCP Description	Photo
Yellow coloured paint on mechanical pipe on the north exterior (previously identified). This paint was observed to be in good condition (minimal bubbling, flaking or peeling).	
White coloured paint on exterior walls (previously identified). This paint was observed to be in good condition (minimal bubbling, flaking or peeling).	
White coloured paint on the interior trim of the garage. This paint was observed to be in good condition (minimal bubbling, flaking or peeling).	No Photo.

Appendix H LABORATORY ANALYTICAL REPORT—MOULD: BULK MATERIAL

Sporometrics Inc.
219 Dufferin Street, Suite 20C, Toronto, ON M6K 1Y9 - t.416-516-1660 - f.416-516-1670 - www.sporometrics.com

RESULTS OF LABORATORY ANALYSES: JOB NO. 25137.00

To:	Steve Chou	**Date of report:**	2015/07/29
Company:	Stantec Consulting Ltd. - Burnaby, BC	**Date of sampling:**	2015/07/13
Client Project:	123220330.300.100 / Gulf of Georgia Cannery	**Analyst:**	Susan Du
Client Address:	500-4730 Kingsway, Burnaby, BC V5H 0C6	**Date Received:**	2015/07/22

BULK / TAPELIFT / BIOTAPE SAMPLE NO.:	**EW-MS-01**	-	-	-	-	-
Location:	East Wing - Staff Room Locker (west)					
Serial #:	N/A					
Expiry date:	N/A					
FUNGAL IDENTIFICATION:[a] **ELEMENTS:**	**MICROSCOPIC OBSERVATIONS**[b] **(RATING**[c]**):**					
hyphal fragments, pigmented	2+					
OTHER OBSERVATIONS:						
background rating	2+					
FUNGAL GROWTH INDICATED?[d]**:**	**Y**					

AIHA LAP, LLC LAB NO: 171117

Samples were received in satisfactory condition and tested in accordance with SOP 5.4.1.1.3. These results relate only to the samples tested.

[a] **NOS** = not otherwise specified.

[b] Mounted in lactofuchsin / lactic acid, or other medium as required, with 50-100 fields examined in bright field microscopy at 400x magnification.

[c] **-** = not detected; **tr** = 10^0 - 10^1 elements in total; **1+** = 10^0 - 10^1 elements in each of ~25% fields; **2+** = 10^1 - 10^2 elements in each of ~50% fields; **3+** = 10^2 - 10^3 elements in each of ~75 fields; **4+** => 75% fields obscured.

[d] Possibility of fungal growth *in situ* based on microscopic observations; **Y** = yes; **N** = no; **?** = ambiguous. For explanation please refer to the final page of this report.

END OF REPORT

Examined By

Susan Du, MSc

Analyst

Released By

Pan American Aerobiology Spore Analyst Level 1 Mike Saleh 01080130 Certification Board

Mike Saleh, MHSc

Analyst

PAN AMERICAN AEROBIOLOGY CERTIFICATION BOARD PAACB Certified Analysts on Staff

ilac-MRA

AIHA LAP, LLC ACCREDITED LABORATORY ENVIRONMENTAL MICROBIOLOGY ISO/IEC 17025:2005 www.aihaaccreditedlabs.org LAB #171117

Sporometrics Inc.
219 Dufferin Street, Suite 20C, Toronto, ON M6K 1Y9 - t.416-516-1660 - f.416-516-1670 - www.sporometrics.com

RESULTS OF LABORATORY ANALYSES: JOB NO. 25137.00

To:	Steve Chou	**Date of report:**	2015/07/29
Company:	Stantec Consulting Ltd. - Burnaby, BC	**Date of sampling:**	2015/07/13
Client Project:	123220330.300.100 / Gulf of Georgia Cannery	**Analyst:**	Susan Du
Client Address:	500-4730 Kingsway, Burnaby, BC V5H 0C6	**Date Received:**	2015/07/22

Guidance on the interpretation of microscopic findings Samples of bulk materials as well as tape lift samples from potentially contaminated surfaces may be examined microscopically to assess the potential of these materials to be supporting fungal growth and serving as indoor fungal amplification sites. Guidelines on indoor microbial contamination proposed by Health Canada (HC. 1995. Indoor air quality in office buildings: A technical guide. Federal-Provincial Advisory Committee on Environmental and Occupational Health. Ottawa: Environmental Health Directorate 93-EHD-166 rev.) state unambiguously that indoor, active fungal growth sites are unacceptable regardless of the extent to which these amplifiers impact on the indoor airborne spore-load. Fungal spores are commonly borne on air currents and settle on flat surfaces as a matter of course. Thus, the observation of fungal spores alone is insufficient to characterize a specimen as a growth site. This judgment primarily requires the microscopic visualization of fungal filaments ("hyphae", or *en masse*, "mycelia"). Additionally, the identification of different kinds of fungi usually requires the observation of spores (e.g. conidia, ascospores, etc.) along with the organs responsible for their production (e.g. conidiophores, ascomata, etc.). However, the latter rarely persist long after the spores have been produced, making definitive identification difficult or impossible in aged specimens. The rating system used by Sporometrics to score the frequency of structures observed microscopically is based on a 5-point assessment of 50-100 microscopic fields, usually taken at 400 x magnification. This system uses the following rating criteria:

Descriptor	Criteria (based on 50-100 fields)	Interpretation of growth *in situ* according to observations:	
		Spores alone	Spores and spore-bearing structures or mycelia
tr	10^0-10^1 elements in total	growth **not** indicated	growth **not** indicated
1+	10^0-10^1 elements per ~25% fields	unclear	growth indicated
2+	10^1-10^2 elements per ~50% fields	growth indicated	growth indicated
3+	10^2-10^3 elements per ~75% fields	growth indicated	growth indicated
4+	> 75% fields obscured by elements	growth indicated	growth indicated

APPENDIX C

85-13

Steveston, British Columbia
Former Gulf of Georgia Cannery

HERITAGE CHARACTER STATEMENT

The former Gulf of Georgia Cannery was built in 1894 as a salmon cannery. Since then it has served as a raw fish depot, herring cannery, and herring reduction plant. In 1979 the property was acquired by the Small Craft Harbours Branch, Fisheries and Oceans, as part of a larger site. In 1978 the cannery was designated a National Historic Site by the Minister of the Environment. It was transferred to the Canadian Parks Service, Environment Canada in 1984. The Parks Canada is the custodian. See FHBRO Building Report 85-13.

Reasons for Designation

The former Gulf of Georgia Cannery building was designated Classified because of its strong historical associations, its architectural design and its importance to the Steveston waterfront. The building is directly associated with the fishing industry throughout the 1894 to 1970s period.

The cannery is a vivid and complex document of the development of the fish processing industry. The building consists of a main block (1894), an east wing (c.1897), a main block extension (1906) and various additions and outbuildings (1940 and later).

In design the building clearly expresses both the functional aspects of the various fish processing activities carried out there and the changing needs of the fish processing industry over much of this century. The historical integrity of the building is high. The survival of machinery from the later stages of the plant's operations increases its importance and legibility.

Situated in a prominent location on the Steveston waterfront at the end of Moncton Street, the cannery is a strong focal point in the Steveston community.

Character Defining Elements

The heritage value of the Gulf of Georgia Cannery resides in the form and fabric of the building, the historic equipment it contains and its compatible context.

The cannery is a large, wood-frame building situated on a wharf which projects over the Fraser River.

Its construction and evolution over a 50-60 year period through addition, extension and alteration (the main block, east wing, main block extension and various other additions

.../2

and outbuildings), have resulted in a complex building of which its exterior form and massing, interior volumes and construction and variety of finishes are among its most prominent characteristics. The evolution of the building over time is clearly documented and strongly expressed in these characteristics.

The exterior form and massing of the building is comprised of a series of connected, various slope, gable-roofed blocks situated in a north-south or east-west orientation and shed-roofed additions to them. Each contributes to the complex massing and the evolutionary character of the building. Clerestories, wood and metal ventilators, cat-walks, chimneys of various designs and the variety of roof and wall finish materials (shingles, corrugated iron, cove siding and plain and corrugated asbestos-cement board) contribute to the varied composition of the exterior of the complex.

On the interior the evolutionary character of the building is expressed in the variety of spaces within it. These features are more strongly expressed in some areas of the building than in others and are particularly evident in areas where the various components of the building meet and in the visible variations in their construction, structure and finishes. Alterations should only be undertaken after careful analysis of these characteristics to ensure their protection. On the exterior the colour scheme and on the interior the consistent use of wood frame construction provide the main unifying elements of the design.

The complex has a high degree of visual and physical integrity. The first priority of any property management activity must be to retain and protect the building's documentary characteristics as evident in its complexity and layering.

The construction of the cannery, both materials and structure, contribute to its functional, utilitarian character. The wharf on which the building rests is constructed in round timber posts and heavy timber beams and lateral bracing. The building is also constructed entirely in timber - light framing for roof, wall and floor framing, heavy timber for posts, beams and mezzanine supports. All elements are sawn sections. Lateral stability is provided by diagonal bracing at post tops. Although steel is used for bolts, fasteners, tension rods and spreader-plates, structural steel sections form no part of the building's structure. Although well and carefully built, the structure is vernacular rather than highly engineered in its conception.

The interior fabric contains a rich patina in the form of script, temporary fasteners, dirt, oil and fish-scale deposits and patterns or wear. These testify to its prior use and warrant careful protection.

.../3

In its basic design the building is characterized by the arrangement of self-contained and interconnected spaces. Some spaces accommodated specific functions while others are not specific. The activities carried out in some areas changed over time depending on the requirements of different industrial processes and the volume of production in a specific year. To meet some requirements (boiler room, office), enclosed space is created by insertion of rooms within the larger volumes of the building. Several spaces contain physical evidence of prior use in their configuration (for example the canning line), furnishings (locker rooms), and equipment (ice house and herring reduction plant). These features are important documentary references to prior use and should be respected and incorporated in any development proposals.

As a utilitarian, industrial building the cannery is internally oriented - access is achieved from a limited number of points from both the land and water sides and fenestration is very limited. The introduction of multiple entry points and extensive glazing would seriously alter the character of the building and should be resisted.

If alterations, structural reinforcement, and additions are necessary the design of these should be based on a single, consistently applied design approach and material vocabulary which are compatible with the character of the building and draw on its precedents. Strongly contemporary or "high-tech" solutions would be inappropriate here. If adaptation of the building to changing or new uses becomes necessary, every effort should be made to take advantage of existing volumes, spaces, plan features and circulation routes to accomplish objectives.

The site is an irregularly shaped property which conforms to the configuration of the plant and several outbuildings. The physical relationship of the building to navigable water is central to its historic function and should not be weakened, particularly by the addition of circulation routes. Less obvious, but of considerable importance, is the relationship of the cannery to the land. As an industrial property the features and materials of the site are functional and utilitarian. Any development of the site should be undertaken with restraint and its qualities respected to ensure its connection with its industrial past is not weakened. All attempts to "prettify" the approach to the property in response to the increasingly tourist oriented main street of Steveston should be resisted.

Revised
1996.01.25

For further guidance, please refer to the *FHBRO Code of Practice*.

APPENDIX D

Canadian Heritage | Patrimoine canadien

Gulf of Georgia Cannery

NATIONAL HISTORIC SITE

COMMEMORATIVE INTEGRITY STATEMENT

Canada

Gulf of Georgia Cannery National Historic Site

Commemorative Integrity Statement

Approved:

Tom Lee, Assistant Deputy Minister, Parks Canada

Recommended:

Christina Cameron, Director General,
National Historic Sites Directorate

Alan Latourelle, Director General,
Western Canada

Jim Barlow, Field Unit Superintendent
Coastal B.C. Field Unit

Anne Landry, Superintendent
Gulf of Georgia Cannery National Historic Site

Bruce Livingston, Chairperson
Gulf of Georgia Cannery Society

NOVEMBER 1997

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FIGURES

APPENDICES

1.0 INTRODUCTION[1]

This document is a Statement of Commemorative Integrity for the Gulf of Georgia Cannery National Historic Site in Richmond, British Columbia. “Commemorative integrity” is the realization of the commemorative intent for a national historic site. It speaks to the health or wholeness of the site, ensuring that the reasons for national designation are respected in all actions relating to the protection and presentation of such places. A site is said to possess commemorative integrity when the resources that symbolize its importance are not impaired or under threat, when the reasons for its significance are effectively communicated to the public, and when the heritage value of the historic place is respected by all persons whose decisions or actions affect the site.

The designation of the Gulf of Georgia Cannery as a national historic site is a means by which Canada gives official recognition to the site’s national historic significance. The objectives prescribed for all national historic sites are to:

- foster knowledge and appreciation of Canada’s past through a national program of historical commemoration;
- ensure the commemorative integrity of national historic sites administered by Parks Canada by protecting and presenting them for the benefit, education, and enjoyment of this and future generations, in a manner that respects the significant and irreplaceable legacy represented by these places and their associated resources; and,
- encourage and support the protection and presentation by others of places of national historic significance that are not administered by Parks Canada. *Guiding Principles and Operational Policies,* Parks Canada 1994

Using the elements of commemorative integrity as described above, the purpose of a commemorative integrity statement for a national historic site is to:

- focus the management of the site on what is most important;
- ensure that there is a focus on the whole site, not just its parts;
- provide a statement of accountability; and,
- provide a basis for reporting to Canadians on the state of the site.

---

[1] Note: for this document, references to “The Society” refer to the Gulf of Georgia Cannery Society, a community-based registered non-profit society, which has played an instrumental role in early and continuing efforts to conserve and present this site.

What follows, then is a document to provide a framework for implementation of commemorative integrity in the future management of the Gulf of Georgia Cannery National Historic Site. The components of the statement include:

- the intent of the site's commemoration as a national historic site;
- associative and physical values integral to the commemorative integrity of the site;
- objectives for protection and presentation of the site's commemorative values; and,
- other site values and objectives, beyond commemorative values and objectives, to be respected in all decisions and actions affecting the site.

Figure 1.0 Regional Setting

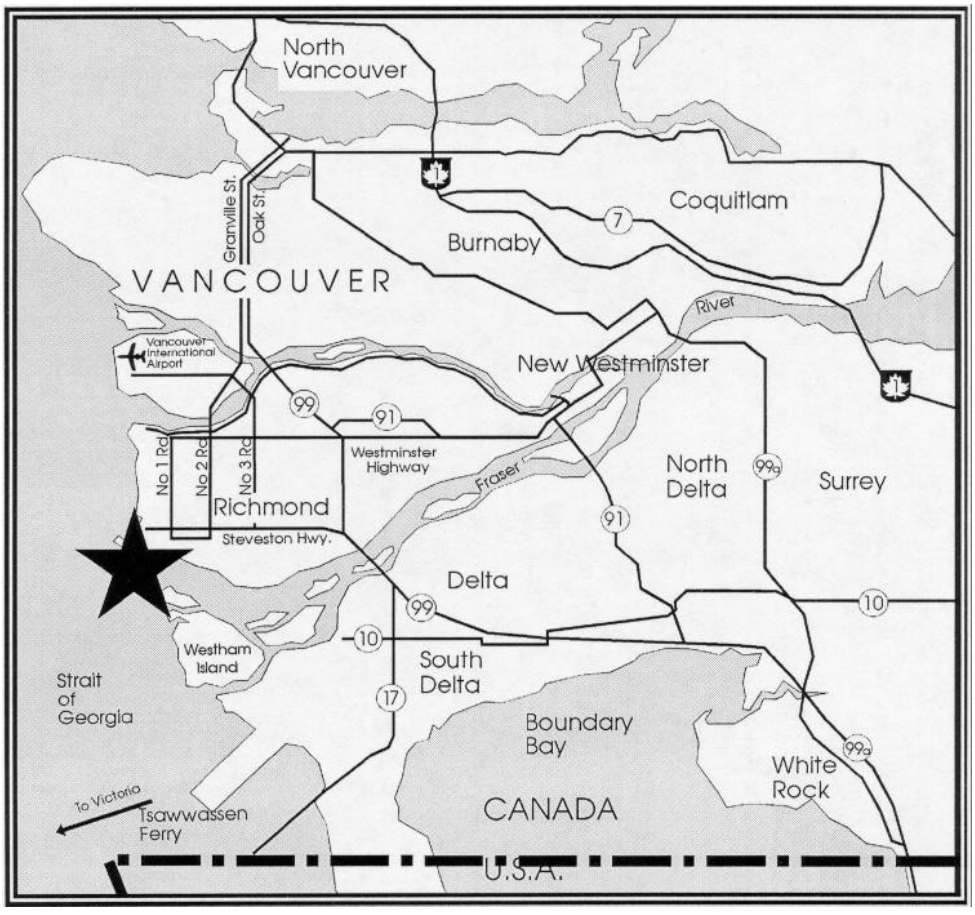
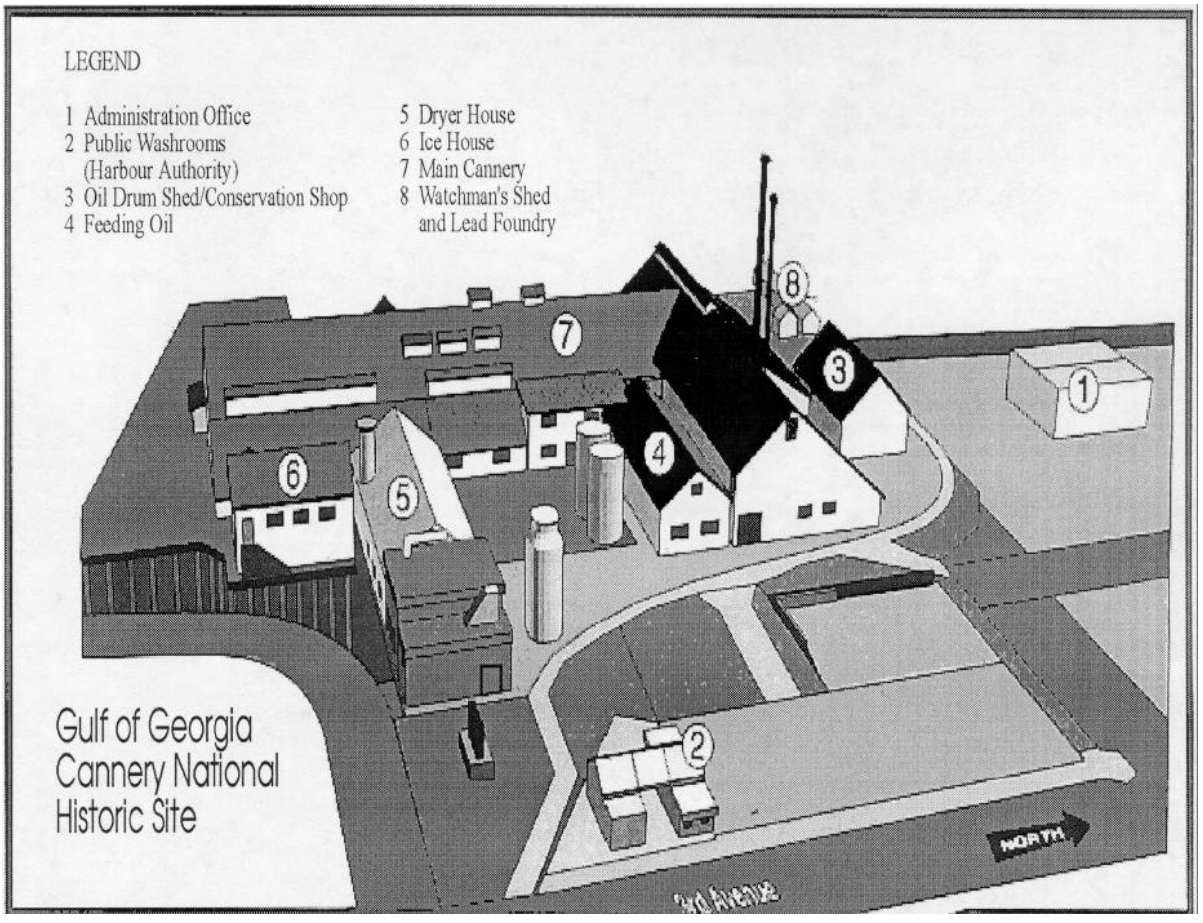


Figure 2.0 Historic Site



2.0 HISTORICAL CONTEXT

For thousands of years the West Coast fishery has been essential to Aboriginal peoples and remains a fundamental aspect of their culture. B.C. fish became a commercial export commodity in the 1830s when the Hudson's Bay Company purchased salmon from Native fishers, and salted it for export, primarily to Hawaii.

In 1871, practical factory canning of salmon for export began on the Fraser River. It was initiated to exploit the enormous salmon runs in the river, which through canning could be preserved for sale in the growing market in industrial Britain. This development was made possible by a number of factors. The first was the presence of merchant capitalists in Victoria, with strong linkages to Britain, to fund the ventures and provide access to markets. Next was the introduction of canning technology from other fisheries in North America and Europe. Finally, the Victoria merchants had access to inexpensive Chinese contract labour, to process the fish during the short but intense season created by the salmon "runs".

The industry grew rapidly over the next decade, expanding to the rivers of the northern and central coast. Through the 1880s it rose and fell in response to market conditions in Britain, and to competition with other producing countries. In the 1890s the industry boomed, owing to the introduction of limited liability companies, and other new sources of capital. The building of the Gulf of Georgia Cannery coincided with this development.

In the early twentieth century, the salmon canning industry was dominated by new conglomerates, such as B.C. Packers, which assembled existing plants and built new ones. The corporate strategies of these firms have determined the response of the industry to changes in resources, labour, and markets ever since. The booming demand for B.C. fish in both World Wars, and the shortage of capital during the Depression both exerted a profound impact on the evolution of the industry.

The introduction of new fishing and processing techniques also has affected the shape of the industry. These technological changes, intended to allow the exploitation of new resources, and to cut the cost of production through eliminating workers, have changed the social system of production as well. A good example was the introduction of the Smith Butchering Machine. Performing the tasks of splitting, cleaning and washing the fish, two of these machines operated by six workers, replaced 30 manual workers. It was for its role in displacing Chinese workers that the machine became known by the notorious appellation "Iron Chink," the name reflective of racist attitudes prevailing at the time.

In the twentieth century the evolution of the industry has been determined to a large extent by government regulation, intended to protect the resources. Although salmon

has remained the central focus of the fishing industry, other species have played a significant part, particularly halibut and herring. Changing labour requirements and practices created a diverse, and constantly changing workforce, including First Nations, Chinese, Japanese, and European people. As well as shaping social systems of production, the evolution of the industry has affected the physical development of processing plants. This impact extends to fishing towns, such as Steveston, with particular implications for the settlement of cultural communities. All these changes are reflected in the physical structure and history of the Gulf of Georgia Cannery.

Gulf of Georgia Cannery - Evolution of the Site

First built in 1894 as a salmon cannery, the Gulf of Georgia complex continued in this role until 1930, although it was modified several times in this period in relation to changing technology, fish supplies, and the available workforce. The original building was an “L” plan cannery, consisting of a rectangular canning factory built perpendicular to and jutting out into the river. A wing on the west side of the canning structure, parallel to the river, contained the hand butchering operations, and allowed space for fish to be unloaded from river or ocean vessels. In 1897 a north addition was constructed to enable the establishment of three canning lines, along with the installation of another boiler and a can loft for storage.

With introduction of mechanical butchering, the hand butchering became obsolete, and the short leg of the “L” was devoted to storage and a netloft. At this time, a south addition was built on the main Cannery structure, extending 50 feet over the water. The wharf was extended farther out into the river in a staggered configuration. In 1927 the west wing was partially demolished to enable the construction of a driveway on the west side, enabling ice deliveries from Vancouver, and the collection of fresh fish from the Cannery.

In 1930 the salmon cannery closed, and the interior was adapted to its new role as a raw fish depot. The balance of the west wing was demolished at this time, the result of structural integrity problems associated with the 1927 alterations, and damage from a winter storm, while most of the south wharf and fish bins housed in this location were lost in the storm.

In the 1930s the complex housed a small fresh fish buying operation to supply the Canadian Fishing Company’s Home Plant Cannery at the foot of Gore Avenue on the Vancouver waterfront, but its principal function was to serve as a netloft, boat repair and storage facility, primarily for Canadian Fishing Company gear and boats.

In 1939-40 the complex was reactivated as a herring cannery. There was a need for cheap protein for the war effort after the traditional European supply of herring from the North Sea was disrupted. At this time, the southeast wall of the complex was raised

and extended to accommodate the large-scale machinery which was installed for herring canning and reduction. Also in 1939, the Canadian Fishing Company constructed the net loft building to the west of the main Cannery building. This structure is still extant, and is managed by the Department of Fisheries and Oceans. The wharf was extended at this time to accommodate a new unloading system.

When the war ended the Gulf became a reduction plant for herring and other fish. In 1948 another addition to the main Cannery structure was undertaken to house the herring reduction function, and the associated heavy equipment was installed. Another structural change in this period was the addition of the Feeding Oil Plant on the east side of the complex, immediately south of the north addition. This structure served to house the processing of herring oil for cattle and poultry feed. A roofed extension was also built over the fish bins on the south side of the main Cannery building. From 1940-43 the Tank Farm Deck was constructed in stages to meet the need for storing the reduced herring and byproducts. In 1940 four oil tanks were installed on the northern end, four tanks in the centre, with another tank on the south end, later expanded to three tanks. In 1941 the Oil Drum Shed was constructed at the north end of the Cannery.

The Ice House was added in 1943 to the southeast side of the Cannery to provide ice for the Canadian Fishing Company fleet, as well as for the fresh salmon receiving and shipping function, while the Watchmen's Shed, a structure for security, was installed the following year.

The Dryer Shed, a long (83') annex required for the drying of herring products, was built perpendicular to the main building on the east side in 1948. A further extension to this wing was added in 1964 to accommodate the functions of grinding and sacking fish meal. Sheathed with corrugated iron, this extension was covered with a flat roof.

In 1967 the Gulf of Georgia Cannery ceased functioning as a reduction plant due to the closure of the herring reduction fishery. In 1972 it reopened at a lessened production capacity to reduce the by-products of the roe herring fishery and non-herring offal from other Canadian Fishing Company plants. In 1979 the reduction plant was shut down completely, although the Cannery continued to function as a gear storage area and netloft facility, even after the acquisition of the Cannery by the Government of Canada for operation as a national historic site.

In conjunction with the construction of and additions to the main processing plant and its ancillary buildings, the Canadian Fishing Company also constructed non-processing buildings and structures on the backlands behind the dike. These included company dwellings for the plant's employees and fishermen, buildings for administration, and other functions. The housing units provided shelter for company fishermen, netmen, labourers, and others. This building activity was particularly intense in the 1939-42

period when a large influx of processing plant workers into the Steveston area created a housing shortage. These assorted structures have not survived.

Over its 100 year history, then, the Gulf of Georgia Cannery has in turn been a leading independent salmon cannery, part of a small combine, and one component in a corporate conglomerate. Its function has changed from salmon cannery to fresh fish receiving plant and netloft, to herring cannery, and finally to herring reduction plant. All of these changes in use are reflected in the present facility.

3.0 COMMEMORATIVE INTENT

3.1 Background

The reasons for the national historic significance of the Gulf of Georgia Cannery are found in the intent of its designation as a national historic site. They are based on the Historic Sites and Monuments Board of Canada (HSMBC) discussions and recommendations for the site and approved plaque inscriptions (Appendix A) where the inscription communicates the commemorative intent of the site.

In the case of the Gulf of Georgia Cannery, the recommendation to designate the Cannery derived initially from the HSMBC's recommendations regarding the thematic commemoration of the theme of salmon fishing in British Columbia. In this regard, the Cannery was selected as the most suitable location at which to commemorate this theme, as is indicated in a recommendation of the HSMBC from June 1976:

> *"Salmon fishing in British Columbia"*
>
> *"The Board recommended that an appropriate p/ace to commemorate the salmon fishing industry in B.C. would be at Steveston if suitable arrangements can be made, and further, that an effort be made to preserve the old fishing structures still standing at Garry Point. "*

In June 1977, the Board reaffirmed its earlier recommendation and expanded the commemoration to encompass the entire fishing industry by removing reference to "salmon" and substituting the term "West Coast Fishing Industry". Further, the Board reaffirmed:

> *"That Garry Point, Steveston, B. C., is an appropriate site for the interpretation of this industry; that on historical grounds Steveston was and is the most important fishing village; that the building as described in the Agenda Paper 1977-30 is appropriate for interpretation and the site is accessible. "*

The HSMBC made several additional recommendations in 1982, 1984, 1985 and 1986 relating to concerns about the stabilization of the Cannery.

While the 1976 and 1977 recommendations do not provide any further details as to the reasons why this particular site was selected, the agenda paper reviewed by the Board at that time indicated that historically Steveston was the centre of the lower Fraser River fishing industry, beginning in the late 1800s. The paper referred to the fact that with the closing of most of the smaller canneries in the province, Steveston increased in importance as a centre of fish processing. At the time of the thematic designation in the 1970s, 30 percent of the British Columbia catch was processed in this community.

The emphasis of the Ministerially-approved designation for the Gulf of Georgia Cannery appears therefore to have been on the development of the commercial fishing industry on the West Coast of Canada, on the Cannery's location in Steveston, the most important fishing village of the area, and on its extant resources. In 1994, the plaque text to commemorate the West Coast Fishery was approved by the HSMBC and the Minister. It sheds additional light on the reasons for the site's national significance.

> *WEST COAST FISHERY*
>
> *For thousands of years the fishery has been vitally important to people on Canada's west coast. It provided food for Aboriginal peoples and is still an essential element of their culture. Commercial fishing began in the 1830s when the Hudson's Bay Company salted salmon for export in barrels. More efficient fishing methods, new canning and freezing technologies, and access to remote markets by ship and railway fostered an industry which has for generations employed men and women of many origins. The Gulf of Georgia Cannery, built in 1894, serves as a symbol of this history.*

The details of this text provide essential contextual information linked to the commemorative intent of the site. There is in effect an acknowledgement of the earlier Aboriginal fishing practice and of the processing and export practices of the Hudson's Bay Company in the 1830s. The plaque text also refers to the evolving technologies in the industry and to the employment of men and women of many origins, which included workers of Chinese, Japanese, Aboriginal, European and other cultural backgrounds. All of these contextual elements are essential to understand the site's national significance.

More importantly, while the text refers to the sweep of the history of fishing, the clear emphasis is on the development of industrial fishing in the late 19th and 20th centuries. The Gulf of Georgia Cannery, it states, "serves as a symbol of this history". It is therefore determined that the period covered by the site's designation should begin with the large-scale industrialization after 1870, continuing to the modern era.

3.2 Statement of Commemorative Intent

On the basis of the foregoing, the statement of commemorative intent for the Gulf of Georgia Cannery National Historic Site is:

> **The Gulf of Georgia Cannery is nationally significant because of its association with the West Coast Fishing Industry, from the 1870s to the modern era; its location in Steveston, historically the most important fishing village on the West Coast; and the Cannery buildings and extant resources which reflect the industry's development.**

4.0 PROTECTION OF CULTURAL RESOURCES

Commemorative Integrity

The following sections describe each of the elements of commemorative integrity. For each element there are statements of value and prescribed objectives to maintain the integrity of the site. The statements of value serve to describe what must be protected and presented at the site. Objectives provide targets against which the state of the site's commemorative integrity can be measured. These values and objectives will serve, through subsequent management and business planning, to identify:

- threats/impairments to the commemorative integrity of the site;
- actions and associated costs required to counter any threats;
- provide a measure for the effectiveness of management actions; and,
- provide a means on which to base state of the site reports.

Level I Cultural Resources

Cultural resources that are directly connected to the commemorative intent (i.e. the reasons for the commemoration of the Gulf of Georgia Cannery as a national historic site), and which specifically belong to this site (i.e. in situ resources) are referred to as level I cultural resources. These resources are directly tied to the messages which have been designated as of national importance. The resources are valued for both their physical and associative attributes; together these qualities form the basis of their historic value. The cultural resources discussed in the following pages must not be threatened or impaired.

Level II Cultural Resources

Cultural resources with historic significance that are associated with the commemorated theme, but which are not directly associated with the site, are considered level II cultural resources.

4.1 HISTORIC PLACE

The Gulf of Georgia Cannery National Historic Site is located in the historic village of Steveston, B.C., between Bayview Street and the foot of Moncton Street. Steveston is situated on the north bank of the south arm of the Fraser River at the river's mouth on the Gulf of Georgia (figure 1). Developed as a farming community and then a fishing village, Steveston played an important role in the fishing industry as a major fishing harbour, and a large part of the waterfront is still devoted to the industry.

The historic place, that is, the area encompassed by the commemoration, consists of a complex of buildings associated with fish processing and canning, encompassing the fish processing structure and adjacent outbuildings. All structures are built on wharf structure, consisting of heavy timber piles driven into the riverbank, with heavy timber dimension beams, wood joists, and wood decking. The superstructure consists of heavy timber column and beam structures, and oversized wood joists and decking. The scale of the complex is very large, with ground floor footprint of 3580 m^2, and loft or mezzanine level of 1790 m^2. In legal terms, the historic place is defined as Plan 7736, New Westminster Land District, .954 AC Leased PTN of BLK C, Set 10 BLK3N RG&W PL 7736.

The Cannery complex (figure 2) of buildings was constructed between 1894 and 1964, its physical changes dictated by changing industrial requirements in the industry. They include the main Cannery building, Ice House, Feeding Oil Plant, Oil Drum Shed, Watchman's Shed, Lead Foundry, Tank Farm Deck, Oil Drum Cradles, and three metres of the South Dock immediately adjacent and parallel to the Cannery. The structures are of wood frame and heavy timber construction and are for the most part supported by wooden pilings.

The Cannery's setting in the village of Steveston is part of a rich cultural landscape shaped by development of the fishing industry. The Cannery and other site buildings are part of a larger complex of structures which are both historically and thematically related. These structures, which are not part of the property managed by the site, nevertheless are part of the historic place, and include the seine loft, gillnet loft, the driveways and front wharf.

The richness of this historical context contributes to the values and significance of the Gulf of Georgia Cannery National Historic Site. Key features of this landscape include the dike, historically situated on the northeast side of the Cannery; adjacent fishing industry structures and activities such as boat moorage; the Cannery's physical relationship to the village and the river; and the industrial nature of Steveston.

4.1.1 Historic Place - Values

Associative:

- the Cannery is associated with the development of Steveston, a fishing village at the mouth of the Lower Fraser River, and the most important centre of the fishing industry in the late 19th century and much of the 20th century;
- it is also directly linked with the Fraser River fisheries, historically the largest salmon fishery on Canada's West Coast;
- the Cannery forms part of Cannery Channel and a larger complex of structures at Steveston which are historically and thematically related, including the Canfisco Netloft immediately to the west of the Cannery Complex;
- it is a complex of buildings constructed between 1894 and 1964, reflecting the changing needs of the industry and its technological character;
- adjacent fishing operations illustrate the continuity of the fishing industry at this location and in British Columbia;
- the fact that the Cannery is on pilings over water.

Physical:

- the physical structure of the Cannery buildings, and their orientation to one another, document the function of this complex as a fish processing plant;
- the siting of the Cannery on the Fraser River documents its relationship to the river and its fishery, to historical patterns of unloading fish for processing, and the shipping of canned fish to markets;
- the location of the Cannery in Steveston documents the historical relationship of the Cannery to this historical centre of the West Coast Fishing Industry.

4.1.2 Historic Place - Objectives

The historic place will be safeguarded when:

- the site as a cultural resource has been recorded, preserved, maintained, and is being monitored;
- site managers are working with the Gulf of Georgia Cannery Society to maintain the heritage character of the structures;
- site managers are working with the owners and operators of the Canfisco Netloft and other fishing buildings in the immediate vicinity of the complex to maintain the heritage character of the structures;
- the site is working with local residents, the Gulf of Georgia Cannery Society, the City of Richmond, the Steveston business community, and other interested groups to maintain the heritage character of the Village of Steveston;
- site managers are working with the Steveston Harbour Authority, the Department

of Fisheries and Oceans, and other land owners to maintain the fishing industry character of the immediate area;
- site managers are working with the owners of the Canfisco Netloft to encourage the application of the Federal Heritage Buildings Policy in defining and protecting the heritage character of this building;
- the historic siting/ orientation of the existing historic structures is maintained;
- the historic significance of the immediate and larger landscape is revealed through the presentation of the site;
- unobstructed views from the dock to the buildings, from the site to the village of Steveston, from Moncton Street to the Cannery, and the site to Cannery Channel is maintained;
- contemporary development respects the commemorative values of the site.

4.2 BUILT HERITAGE RESOURCES

4.2.1 Built Heritage Resources -Values

Cannery Building (1894)

This structure is the much modified Gulf of Georgia Cannery of 1894, originally built to contain the industrial processes required to process sockeye salmon into a canned commodity suitable for export. Adaptations were made to the building in accordance with changing industrial requirements over the years. Subsequent additions include the herring reduction addition of 1948, the dryer shed addition, built in 1956, the raising of the roof for the evaporator room equipment, and the second dryer shed extension added in 1964.

Associative:

- the Cannery building symbolizes the evolution of the West Coast Fishing Industry over 100 years;
- its extensions and alterations reflect changing patterns of industrial production;
- the exterior form, interior volumes, constructional practice, and variety of finishes document its changing functions over time;
- the size and presence of the building reflects the large scale of the industrial fishing era it represents;
- the Cannery building is representative of large-scale fish processing and its role in the development of the industry and the economic development of a major region of Canada;
- the utilitarian structure and materials of the Cannery symbolize the profit-oriented nature of the industry;
- the building’s physical prominence within Steveston reflects the importance of the industry within the community.

Physical:

- the Cannery is a large wooden-frame building situated on a wharf projecting over the Fraser River;
- the exterior colour scheme provides the main unifying element of the design;
- the exterior structure is characterized by a gable roof, with vents on each side;
- the basic design is characterized by the arrangement of industrially-determined spaces;
- the building's structure reflects its internal orientation, as access is achieved from a limited number of points, and with very few window openings;
- the physical relationship of the building to navigable water is central to its historic function;
- the features and materials of the site are functional and utilitarian.
- the spaces (canning line), furnishings (in locker rooms), level 1 artifacts and equipment (ice house and herring reduction plant), graffiti, fasteners, dirt, oil, signs, fish scale deposits and patterns of wear testify to the previous use of the Cannery.

Oil Drum Shed (1941)

This building was erected in 1941 to serve as a storage area for fish oil drums. It was installed to hold the fish oil products of the herring reduction plant.

Associative:

- this building illustrates changes in the fishing industry and the industrial role of the Gulf of Georgia Cannery building in particular, especially the development of fish oil products during and after the Second World War
- the exterior form and massing, interior volumes and construction and utilitarian finishes document the further evolution of the building and site
- the massing and size are reflection of its function as a storage facility

Physical:

- the interior has an industrial character: unfinished; exposed structure; one volume open to the roof;
- the building's structure is supported on round timber posts and heavy timber beams; gable roof with metal cladding;
- the painted wood siding is identical to the cladding of the main Cannery building in type and colour, a unifying element of the site;
- the timber plank floors are functional and utilitarian;
- organization of the building's spaces is related to its function, including the siting of a ramp on the west side, and a small one-person door on the east side.

Oil Drum Cradles (1941)

These structures were built as the supports for large fish oil tanks adjacent to the Oil Drum Shed, and were therefore part of the infrastructure installed to support the herring reduction plant operation.

Associative:

- the form and massing, materials and structure of the cradles Further document the development of fish oil products, as part of the evolution of the structure and site;
- the cradles are associated with the role of the Cannery as a herring reduction plant after 1939.

Physical:

- the cradles consist of a timber structure supported by timber beams and posts;
- the overall physical character is unfinished and utilitarian;
- location of the cradles on the east side of the Oil Drum Shed reflects their function, as they were sited in proximity to the adjacent reduction processing within the Cannery.

Feeding Oil Plant (1940)

This building was constructed to house the storage, refining, and blending of fish oils, primarily from herring, as part of the reduction function. It is associated with the changing requirements of fish products; in this case, the demand for cheap protein generated by the Second World War, led to the canning of herring and herring reduction as a secondary process. Following the war, reduction became the primary focus of the Cannery.

Associative:

- this later addition to the site reflects changes in the fishing industry associated with the development of fish reduction technologies and plants, and their byproducts;
- the exterior form and massing, interior volumes and construction and utilitarian finishes document the evolution of the site and building;
- the utilitarian structure and materials of the shed reflect the cost-consciousness of the company.

Physical:

- the form and fabric is consistent with main the Cannery building, including wood frame structure, gable roof with wood shingles; wood plank floor supported by heavy timbers on timber posts;
- the exterior siding matches that of the main Cannery in style and colour, providing the unifying element;
- the interior shows evidence of prior use; floors and walls insulated with wood shavings; thick insulated door on the interior to keep tank rooms cool the tanks in the tank rooms and the oil press are extant cultural resources;
- the functional organization of space reflects the historic function, with four tank rooms located adjacent to a central processing area;
- the siting of the building and sliding door in proximity to the exterior Tank Farm Deck illustrates the need for easy access;
- the exterior form reflects that of the main Cannery building.

Tank Farm Deck (1940-43)

This structure served as a platform to provide storage for the oil byproducts of herring reduction and canning.

Associative:

- this later addition to the site reflects the evolution of the fishing industry and the Cannery, i.e. the switch to herring reduction and fish oil byproducts;
- the construction materials and finishes are consistent with the main Cannery building -- unfinished and utilitarian;
- the open the deck area built in stages to reflect storage demands;
- the tanks on the deck reflect the historic use of the structure.

Physical:

- it is a wood plank deck supported on heavy timber beams and round wood posts;
- an integral feature is the ramp connecting the deck to land;
- two of the oil tanks of the original tank farm deck are still *in situ.*

South Dock (original - 1906; reconstruction and addition - 1942)

This structure served as a fresh fish receiving wharf, as a loading and unloading area for Cannery supplies, as a boat storage area, and as a bluestone tank holding area. The bluestone (copper sulphate) was used in treating nets. The dock was reconstructed again in the mid 1980s as part of the Cannery's stabilization project.

While not a cultural resource per say, the reconstructed dock emulates the form and materials of the earlier docks and is therefore important to the historical documentation and sense of place of the Cannery.

Associative:

- the dock provides a direct link to the Cannery's historical relationship with the river and its fishery, and the role played by the adjacent wharf in the unloading of fish for processing at the Cannery;
- the form and materials of the structure illustrate its utilitarian character;
- the structure is associated with the historical functions of unloading fish for processing.

Physical:

- the form and fabric have changed over time, but are consistent with early dock construction;
- the structure consists of wood plank decking supported on heavy timber beams and timber posts;
- the materials are unfinished and utilitarian.

Watchman's Shed (1944)

This building served as the post for a watchman, to ensure security of the complex.

Associative:

- a later addition to the site, the watchman's shed reflects changes in the fishing industry; in particular enhanced security requirements during the war;
- the exterior form and massing, interior volumes and construction, and, interior finishes reflect the evolution of the building and site;
- the location of the shed at the entrance to the Cannery complex reflects the watchman's function.

Physical:

- the form and fabric is consistent with the main Cannery building, including a wood plank floor, timber joists; timber floor beams, and gable roof with cedar shingles;
- the structure is supported on timber posts and heavy timber beams;
- a higher level of interior finishes, than the main Cannery, reflect the use of the building, including painted floor, walls and ceiling, panel door, base boards, desk, and storage cupboard;

- the exterior siding matches that of main Cannery in style and colour; provides unifying element;
- the materials and structure contribute to its utilitarian character.

Lead Foundry (1940)

Until the 1960s, this building was used as a foundry for the lead weights used in fish nets, which were housed in the adjacent Canfisco seine loft building. It was also used as a storage shed.

Associative:

- this later addition to the site reflects changes in the fishing industry;
- the exterior form and massing, interior volumes, construction type, and level of finishes document the evolution of the site;
- the basic construction of the building, both materials and structure, illustrate its utilitarian character;
- the interior, including two storage areas and one workshop area, reflects the function of the building.

Physical:

- the structure is supported on heavy timber beams and posts;
- the form of the foundry is similar to the main Cannery, i.e. as a gable roof with wood shingles;
- the interior finishes, including wood shelves in the storage area, concrete flooring in the workshop; wood plank floor in the storage area, brick chimney, sliding door from workshop area, and unfinished walls, reflect the building's function;
- the exterior siding matches that of the main Cannery in style and colour; providing a unifying element.

Ice House (1943)

This structure was built to provide ice for the Canadian Fishing Company fleet. Ice made at the Canadian Fishing Company Home Plant, was shipped to the Cannery, where it was crushed and loaded onto boats, as well as used for the fresh salmon receiving and shipping function.

Associative:

- the exterior form and massing, interior volumes, structure and finishes document the evolution of the site. In this case, it relates to the development of domestic markets for fresh fish;

- the construction of the building, both its materials and structure, illustrate its utilitarian character.

Physical:

- the location of the building over water and adjacent to the waterfront for easy access to ice by the fishing fleet reflects its historic function;
- the form and fabric of this building are consistent with the main Cannery building, i.e. as a wood frame structure and gable roof with wood shingles, supported on pilings over the water;
- the exterior siding matches that of the main Cannery in style and colour, providing a unifying element;
- the interior shows evidence of prior use, including such features as freezer coils and a heavy insulated door, tall doors on the second level to bring ice into the building from deck level, concrete and wood plank flooring, and walls insulated with wood shavings;
- the structure is utilitarian and unfinished.

4.2.2 Built Heritage Resources - Objectives

The built heritage resources will be safeguarded when:

- heritage defining features of the in situ resources are identified' recorded, protected and presented appropriate to their national significance;
- documented value of historic structures is realized through full heritage recording and monitoring;
- associative values of historic structures are revealed through presentation of the site;
- location, orientation, design, style and scale of the historic resources are maintained;
- physical evidence documenting the evolution of the building is protected;
- internal and external visual perspectives to the massing and size are maintained;
- original fabric, form, construction, and elements providing evidence of function are documented and maintained in accordance with accepted conservation practices.

4.3 MOVEABLE CULTURAL RESOURCES

The Gulf of Georgia Cannery collections include the herring reduction plant, boilers, fish handling and processing equipment, fixtures, industrial/ mechanical parts and fittings, and archival materials. Artifacts stored at the Cannery are composed of two collections: objects owned by the Gulf of Georgia Cannery Society and another collection owned by Parks Canada. These objects include herring reduction plant machinery, boilers, fish

handling and processing equipment, fishing gear, industrial/mechanical parts and fittings, and archival materials. Both collections are comprised of both level I and II moveable resources (see Appendix B). Parks Canada has an obligation to inventory, evaluate, and manage its collections to provide for their conservation and presentation for the benefit of this and future generations.

4.3.1 Movable Cultural Resources - Values

Associative:

- the herring reduction plant consists of machinery installed at the Gulf of Georgia Cannery -- technologies which responded to changes in the industry;
- the herring reduction plant is typical of reduction plant technology, which uses a system of cookers, presses, conveyors, and dryers to process herring into fish oil and meal products;
- variations in colour and design of equipment reflected the nature of the industrial activity; form followed function;
- the artifact collection consists of objects that relate to fishing equipment, gear, and associated documentation collected by Parks Canada and the Society to honour the community;
- the variety of materials and fabrication techniques shown by the artifact collection exhibits the diversity and complexity that the industry required to function efficiently;
- the large-scale of objects itself communicates the scope and scale of an industrial fishing operation.

Physical:

- the majority of the herring reduction plant is composed of ferrous metal;
- smaller moveable objects are composed of ferrous metal, wood, cotton and linen;
- the placement of the herring reduction equipment within the Cannery reflects its utilitarian function when it was in use, as well as the appropriation of technology from other industries;
- many artifacts and equipment show an adaptation of function by showing additions or modifications of existing machines which improved functioning or eased operation (eg. handwheel located 15ft. overhead was modified with a welded extension so that it could be turned on or off without using the overhead catwalk);
- patterns of wear, added improvements to the function of the object, graffiti, use of varied materials and finishes show the industrial nature of the site.

4.3.2 Movable Cultural Resources - Objectives

The movable cultural resources will be safe guarded when:

the artifacts, moveable objects, collections, and records, owned and managed by Parks Canada and the Society are inventoried, evaluated, managed, maintained, and presented according to currently accepted conservation practices and in accordance with Parks Canada's Cultural Resource Management Policy and other relevant policies or agreements; and,
historic objects from both collections are presented, appropriate to their values, and access is ensured for research and interpretation.

REASONS FOR NATIONAL HISTORIC SIGNIFICANCE

The second element of commemorative integrity focuses on the effective communication of the reasons for the site's national historic significance. Each of the elements of commemorative intent forms an important component of the messages of national significance which must be delivered if the site is to have commemorative integrity. Messages based on the commemorative intent are referred to as level 1 messages. Level 1 messages must be effectively communicated to the public to ensure their appreciation and understanding of the site's values and their support for its preservation.

5.1 Nationally-Significant Messages

The nationally significant messages for the Gulf of Georgia Cannery National Historic Site flow directly from its statement of commemorative intent. Integral to the understanding of these key messages are a number of supporting components. Generally, this site commemorates the development of Canada's West Coast Fishing Industry from the 1870s to the modern era. The Cannery complex is the specific site through which the messages pertaining to the industry's development are to be achieved. Aspects of the messages which will need to be communicated to interpret the spirit of the commemoration include the following messages of national historic significance:

- **Canada's West Coast Fishing Industry from the 1870s to the modern era is a theme of national historic significance:**

  - an industry that exerted a marked impact on Canada's economic development;
  - an industry closely identified with the emergence of British Columbia as a major province and region of Canada;

- an industry with a far-reaching impact on the economic and social life of the people of British Columbia, and on the province's cultural landscape.

- **Steveston was an important centre of the West Coast Fishing Industry:**

  - the strategic siting of Steveston at the mouth of the Fraser River, the largest of B.C.'s salmon runs;
  - the life cycle of the salmon in the Fraser River and its relationship to the establishment of Steveston and the Cannery;
  - the development of Steveston as a major centre of fish processing activity in the late 19th and 20th centuries;
  - the physical and historical relationships of Steveston to ocean transport for overseas markets, and land transport to markets in the Lower Mainland and Canada;
  - Steveston, both as a distinctive and as a representative fishing community, illustrative of the experience of other fishing towns up the B.C. coast.

- **The physical structure of the Cannery complex well illustrates the development of the West Coast Fishing Industry:**

  - the Cannery's original layout and physical form as representative of the form of hundreds of canneries up and down the coast;
  - the Cannery's role in salmon processing and the relationship of the physical structure to this role, i.e., the original "L" shaped form for salmon canning, and changes to the physical structure to accommodate increased demand for salmon products (i.e. 1897 and 1906 additions);
  - further changes in the physical structure in the 1940s to accommodate the herring reduction function.
  - the Cannery's establishment was typical of the establishment of numerous canneries in the context of the West Coast Fishing Industry in the late 19th century;
  - the species of fish processed at the Cannery, i.e. salmon and herring, and its industrial processing infrastructure were representative of the canning practices at other canneries on the B.C. coast.

5.2 Contextual Messages

Beyond the key, nationally-significant messages, a number of valued complementary or contextual messages are integral to the understanding of why the Gulf of Georgia Cannery is of national historic significance. To this end, the following contextual messages have been developed:

- **The evolution of fishing methods and processing technologies was integral to the development of the West coast Fishing Industry:**

  - changing methods and associated technologies and material of West Coast fishing, 1870 to the present;
  - changing technologies of canning and processing, and their specific impacts on the labour force;
  - the impact of external developments and markets are reflected in changes to the complex, its technologies, and workforce.

- **The contributions by men and women of many origins were central to the West Coast Fishing Industry:**

  - the long-term role of First Nations people in the West Coast fisheries in the pre-industrial era; in fishing for industrial canneries; and in labouring in the canneries;
  - the role of the Chinese workers in processing plants;
  - the role of the Japanese as boat builders, in fishing and processing;
  - the role of persons of European origin in the fishing industry;
  - the role of women of various cultural communities in the West Coast Fishing Industry, the gender-tying of particular tasks;
  - the hiring of women to replace male workers during the two World Wars.

5.3 Messages - Learning Objectives

- **Canadians will know that Canada's West Coast Fishing Industry from the 1870s to the modern era is a theme of national historic significance;**

- **Canadians will understand the particular role of Steveston as an important centre of the West Coast Fishing Industry;**

- **Canadians will know that the physical structure of the Cannery complex well illustrates the development of the West Coast Fishing Industry;**

- **Canadians will know and understand the evolution of fishing methods and processing technologies in the development of the West Coast Fishing Industry;**

- **Canadians will know the contributions made by men and women of many origins to the West Coast Fishing Industry.**

5.4 Messages - General Objectives

The learning objectives outlined in the preceding section will be further met when a number of general objectives for the delivery of nationally significant messages are achieved, including:

that Canadians and visitors understand the key components of commemorative intent, and their supporting components;
the public understands the context and national significance of the site, and the geographic and historic relationships of the site to the West Coast Fishing Industry;
messages of national significance are not overwhelmed by other messages at the site;
messages and the site's resources are presented with integrity, conjectural information is acknowledged and authentic and recreated resources are distinguished;
community support for participation in events and activities directly and indirectly related to the messages of national significance are encouraged;
when appropriate and effective means have been identified for delivery of the messages to target audiences;
when site visitors have a full experience and understanding of the site's values and importance;
when Parks Canada and the Gulf of Georgia Cannery Society are cooperating with stakeholders to present the nationally significant values/messages of the Gulf of Georgia Cannery.
when visitors to the site have physical access to key vantage points of the Cannery and its physical context eg. South Dock

6.0 OTHER HERITAGE VALUES

In pursuit of ensuring the site's overall integrity, other values will be respected by all those whose decisions or actions affect the site. These include: i) complementary messages, which are of value but not of national historic significance, known as a level II messages; ii) cultural resources, which are of value but not of national historic significance, known as a level II resources; and iii) other values, such as a the role of the local community in the protection/presentation of the site, the collection of research materials and documentation on site, and the site's membership in the larger family of national historic sites.

6.1 Other Heritage Values -Values

Level II Cultural Resources

- objects historically used in the West Coast Fishing Industry, which are not site-

specific to the Gulf of Georgia Cannery, such as a the fishing and canning equipment selected for the canning line exhibit, and fishing equipment acquired for the site, assist in the interpretation of the West Coast Fishing Industry, and the function and purpose of individual structures.

Level II Messages

- the challenges posed by conservation of a large industrial site;
- the relationship of this site to the larger family of national historic sites;
- the relationship of this site to other sites sharing similar messages and mandate;
- the site contributes thematically to the national commemoration program and the identity of Canada;
- continuing change in the fishing industry;
- the conservation of the fishery;
- the natural history of the fishery (ie. salmon, herring);
- the impact of humans on the fishery (ie. fishing, pollution, habitat loss);
- other B.C. fisheries, eg. halibut.

Site Research Materials

- recorded oral history interviews, original photographs and copies of photographs, documentary research materials/ copies of maps, blueprints/ charts/ site plans/ and architectural and engineering reports, videos, books, manuals, and manuscript reports, which demonstrate a shared history of the community, provide a significant information base for interpretation and decision making for the preservation of the site; and provide a record of the changes and evolution of the site.

Community

- active in the protection and presentation of cultural heritage;
- initiated the protection of the site and continues to support and participate in the protection and presentation of the site;
- recognizes the site as a local/ regional tourist attraction and educational resource; and,
- the role of the Society in the development and continuing operation of the site.

6.2 Other Heritage Values - Objectives

Level II Cultural Resources

- level II resources have been inventoried, evaluated, and are being maintained and monitored.

Level II Messages

- level II messages are presented with integrity, do not overwhelm messages of national significance, conjectural information is acknowledged and authentic and

recreated resources are distinguished.

System of National Historic Sites

- the public are presented with and understand the role the Gulf of Georgia Cannery plays in the system of national historic sites, the protected areas of Canada and the identity of Canada.

Site Research Materials

- the value of site research materials are revealed through the presentation of the site and authentic and recreated resources are distinguished;
- site research materials are documented and protected.

Community

- the community and the site share an understanding of the site's values and they are respected in all decisions affecting the site.

Appendix A: List of HSMBC Recommendations for the Gulf of Georgia Cannery NHS

June 1976 - [Salmon Fishing in British Columbia] “that an appropriate place to commemorate the salmon industry in B.C. would be at Steveston if suitable arrangements can be made, and further, that an effort be made to preserve the old fishing structures still standing at Garry Point.”

June 1977 - “The Board reaffirmed its June 1976 recommendation to commemorate the fishing industry and agreed to suppress the word “salmon” and add “West Coast Fishing Industry” “that Garry Point is an appropriate site for the interpretation of the industry; that on historical grounds Steveston was and is the most important fishing village; that the building as described in Agenda paper 1977-30 is appropriate for interpretation and the site is accessible,”

June 1982 - “The Minister write to his colleague, the Honourable Romeo Leblanc requesting that the activities currently underway, which are seen to jeopardize the interpretive potential of the Cannery be stopped;” and that “the Minister seek the removal of those piles which have been driven in front of the Ice House, associated with the Cannery, and which clearly compromise the security, stability, and integrity of the Complex.”

June 1984 - “it [the HSMBC] hoped the transfer of the former Gulf of Georgia Cannery to the Department would be finalized as quickly as possible and that the stabilization of the structures on the property which was required in order to prevent the loss of the resource would be carried out immediately following transfer.”

June 1985 - “With respect to the commemoration of the West Coast Fishing Industry, at Steveston, the Board urged the Minister to proceed with the stabilization of the Gulf of Georgia Cannery without delay. The Board also requested that the Minister write to his colleague the Honourable John Fraser and advise him of its continuing concern that work being carried out on the Steveston waterfront, by the Small Craft Harbours Directorate of Fisheries and Oceans, could compromise the integrity of the Cannery to such an extent that its interpretive potential would be lost. Finally, the Board suggested that, if the activities of the Small Craft Harbours Directorate which are so unsympathetic to the Cannery continue and it becomes clear that it is no longer an appropriate location at which to interpret the West Coast Fishing Industry, the Program might wish to consider additional involvement with the North Pacific Cannery. However, any further involvement at Port Edward should only be considered if the Program is unable to identify another structure or complex in Steveston associated with the industry which would be suitable for its interpretation.”

June 1986 - “In June 1977, the Board recommended that the former Gulf of Georgia Cannery, at Steveston, British Columbia, would be an appropriate location at which to

interpret the national significance of the West Coast Fishing Industry. In September 1984, the Cannery was transferred to Parks from the Department of Fisheries and Oceans in order that it could be developed into a national historic park. Unfortunately, despite the fact that both the Board (June 1984) and the Program have recognized that the resource required immediate stabilization if further deterioration was to be prevented, no work on the Cannery has yet been undertaken.

Dr. Humphries told the Board that, in early June, as a severe wind storm struck the Steveston area and the Cannery suffered further structural damage. Thus, the former Gulf of Georgia Cannery, which had been acquired for preservation and development by Parks, appears to be threatened with total collapse.

The Board was extremely upset to learn that, while its transfer to Parks has been effected more than 18 months ago, the Cannery had not been stabilized by the Service...in cases of special urgency...it viewed the situation at Steveston as being such a case and it asked Professor Symons to write to Mr. McMillan to inform him of its concerns in this matter and to request of him that he take the steps necessary to ensure that the stabilization of the Cannery begins immediately."

November 1993 - The following [inscription was] approved by the Board:

West Coast Fishery [Steveston, B.C.]

For thousands of years the fishery has been vitally important to people on Canada's west coast. It provided food for Aboriginal peoples and is still an essential element of their culture. Commercial fishing began in the 1830s when the Hudson's Bay Company salted salmon for export in barrels. More efficient fishing methods, new canning and freezing technologies, and access to remote markets by ship and railway fostered an industry which has for generations employed men and women of many origins. The Gulf of Georgia Cannery, built in 1894, serves as a symbol of this history.

Appendix B: Moveable Cultural Resources

RESOURCE	TYPE OF OBJECTS	HISTORIC EVALUATION
herring reduction plant	cookers, presses, dryers, separators, tanks, motors, evaporators, and other objects associated with the herring reduction function	level 1
boilers	2 horizontal return tube boilers, 1 scotch dryback boiler	level 1
Truimph Ice Machine (associated with Ice Making from CANFISCO's Home Plant)	flywheel, compressors, motor, shafting etc.	level 2
Stinkeroo	odour control unit	level 1
canning line equipment (machinery associated with salmon and herring canning)	iron butcher, filler, can washer, box nailer, labeller, reform line, etc.	level 2
building furnishings	tables, work benches, desks, light fixtures, chairs	level 1 and level 2
mechanical tools and equipment (associated with herring reduction operation or canning line machinery)	wrenches, crowbars, hammers, saws, brushes, etc	level 1 and 2
fishing and trapping tools and equipment	gillnets, rope, peughs, trolling gurdy, hooks, prawn traps, etc.	level 1 and 2
documentary artifacts	machinery manuals, receipts from herring operation, calendars, time clock cards, etc.	level 1 and 2
communication objects	company flags, radios, telephones	level 1 and 2
containers	salmon and herring cans, crates, boxes	level 1 and 2
transportation equipment	front end loader, net carts, hand trucks, seine boat and gillnet boat components	level 1 and 2
archaeological collection	ceramic, glass, faunal collection	level 1
personal objects	boots, oilskin jackets, aprons, uniforms, etc.	level 1 and 2

GLOSSARY

Canadian History

The record of the entire human past in what is now Canada.

Commemoration

Ministerial recognition of the national significance of specific lands or waters by acquisition or by agreement, or by another means deemed appropriate within the Minister's authority for purposes of protecting and presenting heritage places and resources, erection of a plaque or monument.

Commemorative Integrity

An historic place (national historic site, heritage railway station, federal heritage building, etc.) may be said to possess commemorative integrity when the resources that symbolize or represent its importance are not impaired or under threat, when the reasons for its significance are effectively communicated to the public, and when the heritage value of the place is respected.

Cultural Resource Management

Generally accepted practices for the conservation and presentation of cultural resources, founded on principles and carried out in a practice that integrates professional, technical and administrative activities so that the historic value of cultural resources is taken into account in actions that might affect them. In Parks Canada, Cultural Resource Management encompasses the presentation and use, as well as the conservation of, cultural resources.

Cultural Resource

A human work or a place which gives evidence of human activity or has spiritual or cultural meaning, and which has been determined to have historic value.

Heritage Area

A generic term used to signify those geographical areas which are included within the Parks Canada Program. These include National Parks, National Marine Conservation Areas, National Historic Sites and Historic Canals.

Heritage Resources

A Heritage Area, or any natural or cultural features associated with Heritage Areas or potential areas.

Historic Value

A value assigned by Parks Canada to a resource, whereby it is recognized as a cultural resource. All resources have historical value; only those which are considered to have importance over and above the historical, have historic value.

Historical

Of, relating to, or of the nature of, history, as a opposed to fiction. “Historical” refers more broadly to what is concerned with history, whereas the term “historic” refers to having importance in, or influence on, history.

Management Plan

A document that constitutes the local expression of the general policies of the department and approved by the Minister following extensive public participation. This plan directs the long-term development and operation of a national park, national historic site or canal. It constitutes a framework within which subsequent management, implementation and detailed planning will take place.

National Historic Site

Any place declared to be of national historic interest or significance by the Minister responsibl e for Parks Canada.

Presentation

Activities, services and facilities that bring the public into direct or indirect contact with national historic sites, national parks and historic canals, and the resources associated with them.

Protection

With respect to ecosystems, it means regulatory, resource management and public education programs aimed at ensuring they are maintained in as natural a state as possible. In the context of cultural resources, protection has a range of meanings. It may refer to the basic maintenance of a resource, often preliminary to other work; it may be used as a synonym for preservation or conservation, or it may refer to an administrative regime under which a site/resource is managed or protected.

Protected Heritage Areas

Protected heritage areas are:

a) areas that have been accorded “protected” status, because of their natural or cultural qualities, through acquisition or application of land-use controls;
b) as a well as areas that have been recognized as having natural or cultural heritage value and which require some form of protected status in order to ensure their long-term protection.

In the former case, management practices flow from the protected status; in the latter, management focuses on the need to devise an appropriate form of protection status.

Recognition

A term used to indicate that a heritage resource (natural or cultural) has significance to all Canadians and warrants protection and presentation, either directly or indirectly, through one of the Parks Canada programs.

APPENDIX E

JECTH Consultants Inc.
Geotechnical & Environmental Engineers

GEOTECHNICAL ENGINEERING REVIEW AND ASSESSMENT
GULF OF GEORGIA EXTERIOR GENSET FOUNDATION

AT
12138 FOURTH AVENUE,
RICHMOND, BC

FOR

GULF OF GEORGIA CANNERY
C/O CWMM CONSULTING ENGINEERS LTD.

PREPARED BY

JECTH CONSULTANTS INC.
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OUR FILE NO.: 215P554A

DATE: APRIL 11, 2018
UPDATED: APRIL 30, 2018

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JECTH Consultants Inc.
Geotechnical & Environmental Engineers

Client: CWMM Consulting Engineers Ltd.
Date: April 30, 2018
Our File No.: 215P554A

GEOTECHNICAL ENGINEERING REVIEW AND ASSESSMENT
GULF OF GEORGIA - EXTERIOR GENSET FOUNDATION
12138 FOURTH AVENUE, RICHMOND, BC

1.0 INTRODUCTION

1.1 AUTHORIZATION

As authorized by of CWMM Consulting Engineers Ltd. on behalf of Public Works of Canada on March 23, 2018 regarding the Foundation Design and Construction for the proposed Exterior Genset Foundation at the subject site, JECTH Consultants Inc. (JCI) had carried out a Geotechnical Engineering Review for the proposed Exterior Genset Foundation at the subject site.

1.2 METHODOLOGY

The Geotechnical Engineering Assessment and Review includes:

- Reviewed of available site plan and Structural Drawing.
- Obtained the Geological Map from The Geological Survey of Canada and reviewed previous site observations and foundation subgrade
- Review Liquefaction Hazard Map of Richmond from BC Geological Survey of Canada.
- Conducted site Reconnaissance on March 29, and April 8, 2018
- Conducted Site Review for existing ground condition
- Reviewed available Historical Record for the Site in regard in past construction activities.
- Utilized our previous experience to access subsurface ground conditions from nearby projects.
- Communicated with Designers.
- Prepared the Geotechnical Report Based on the above information

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1.3 OBJECTIVE

This Geotechnical Engineering Report summarizes our findings and provides Geotechnical Engineering Comments and Recommendations for the foundation design of proposed Exterior Genset Foundation as required by BC Building Code (2012) - Schedule "B" (Geotechnical) and 2015 National Building Code.

The report also provides Geotechnical comments and recommendation for the proposed Exterior Genset Foundation structure plan provided by CWMM.

1.4 BUILT DRAWING

This report is prepared based on the information and Drawings provided by CWMM Consulting Engineers Ltd. on March 26, 2018.

2.0 SITE AND SITE CONDITION

The Cannery Museum Site is located at the river bank at the south end of 4th Avenue, Richmond, BC as shown in Figure 1 – Site Location Plan and Figure 2 – Site Air Photo Plan.

The Gulf of Georgia Cannery building compound is bounded by Moncton Street to the north and a footpath to the east. There are 2 dykes observed to the east and to the west of the existing Cannery Museum building compound. The 2 dykes are joined by an old dyke along the east perimeter (footpath), north perimeter and part of the west perimeter of the Museum building compound.

The proposed Exterior Genset Foundation is located along the north site perimeter (See Figure 1 A and 1B) adjacent (to the west) to the Maintenance building (Part of the Museum Complex). In general, the Exterior Genset Foundation consists of (see Figure 5 and 6) the followings:

- The Exterior Genset Foundation has a dimension of about 2.1 m. (width) by 3.5 m. (length).
- The weight of the proposed Exterior Genset Foundation is about 25.6 kN (approximately 5,800 lb.)
- Proposed concrete foundation for the proposed Exterior Genset Foundation is about 2.4 m. (width) by 3.8 m. (length).
- The concrete foundation of the Exterior Genset Foundation will be protected by a concrete slab perimeter (approximate 750 mm. wide)
- The proposed depth of the foundation system is about 450 mm.

Locations of the area under consideration are shown in Figure 2.

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4.0 FIELD INSPECTION AND OBSERVATION

Field work includes site reconnaissance on March 26, 2018 and inspection on April 8, 2018. Our site reconnaissance identify the proposed Exterior Genset Foundation is situated on the north dyke or path as shown in Photo No. 1.

Photo No. 2 and No. 3 shows the proposed location and vicinity area where the proposed Exterior Genset Foundation area will be situated.

In addition, there is no obvious ground movement and settlement as well as cracks on the existing asphalt pavement for the existing ground surface at the location of the proposed Exterior Genset Foundation area. (Photo No. 4)

Based on our previous inspection, the dyke FILL should be composed of a brown, compact to dense, dry fine to medium SAND with some gravel and trace of SILT. This was confirmed from previous construction that the subgrade should consist of Pit-run Sand and Gravel. It is, therefore, anticipated that the subgrade at the proposed location will be suitable for the proposed Exterior Genset Foundation system.

5.0 SUBSURFACE SOIL CONDITIONS

Based on Geological Map as shown in Figure 3 – Geological Map, the Site should be underlain by 1.82 m. ± (6 ft. ±) of silty clay loam overlain fine to medium SAND of the Fraser River sediments deposit. The area is identified as moderate to high liquefaction potential as shown in Figure 4 – Liquefaction Map of Richmond. Accordingly, it is assumed that the Site is underlain by the dyke fill which follows by SILT deposit and further underlain by loosed, fine to medium River SAND.

6.0 FOUNDATION RECOMMENDATION ON THE DYKE

It is recommended that the Exterior Genset Foundation structure will be founded on conventional shallow foundation as a mat or spread footing. The exposed dyke FILL should be composed of compact Pit-run SAND and Gravel and is suitable for the Exterior Genset Foundation Subgrade.

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Based on the available drawing, the proposed Exterior Genset Foundation will consist of a mat foundation system with a dimension of about 2.4 m. ± by 3.8 m. ± with a concrete slab perimeter. It is confirmed that mat foundation is suitable for the anticipated foundation subgrade. **JCI recommends an Allowable Bearing**

Capacity of 100 kN/m^2 psf. for SLS Design and 150 kN/m^2 for ULS Design for the Exterior Genset Foundation Design.

7.0 SEISMIC DESIGN CONSIDERATION

The existing dyke is probably found on a few feet of SILT and further underlain with liquefiable fine SAND. The Site Classification within liquefiable region should be Class F that require site specific evaluation. However, due to presence of assumed 1.2 m. ± (4 ft. ±) non-liquefiable SILT at bottom of dyke and close to 3.0 m. ± (10 ft. ±) of dyke FILL composed of granular Pit-run Sand and Gravel, the foundation on Dyke FILL can be re-classified as Class E for soft soil.

The following table is a Site Class C spectral acceleration for firm ground as recommended by NBC 2015 for the Site with co-ordinate at Latitude N 49.125° and Longitude W 123.187°. The information is obtained from website of Natural Resource Canada.

Sa (0.2)	Sa (0.5)	Sa(1.0)	Sa(2.0)	PGA
0.925 g	0.828 g	0.462 g	0.278 g	0.401 g

A print table is attached in Appendix "A" – Seismic Design Criteria for ease of reference. The above value can be interpreted by interpolation by Table 4.1.8.4B and 4.18.4C of the 2012 BC Building Code (and all other requirements specified by the 2015 National Building Code) to obtain spectral acceleration value for a Class E site for Structural Design.

8.0 CONCLUSION

Based on the above Geotechnical Review, it is our professional opinion that the proposed Exterior Genset Shallow Foundation design is Geotechnically acceptable.

9.0 CLOSURE

We trust this report meets your immediate requirements. If you have any questions regarding this report, please do not hesitate to contact the undersigned.

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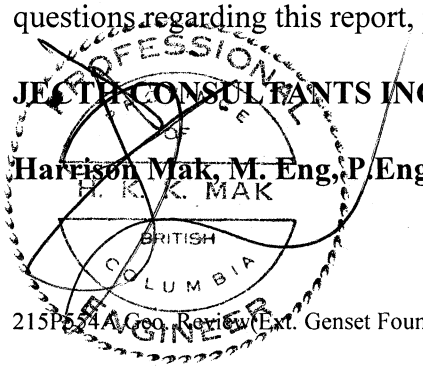

Attachments: **List Of Figures**

Figure 1 – Site Location Plan
Figure 1A – Site Layout Plan (Genset)
Figure 1B – Genset Location Plan
Figure 2 – Site Air Photo Plan
Figure 3 – Geological Map
Figure 4 – Richmond Liquefaction Hazard Map
Figure 5 – Structural Plan (Genset Foundation)
Figure 6 – Typical Section and Layout Of Genset

List Of Site Photographs

Site Photographs No. 1 to No. 4

List Of Appendixes

Appendix "A" – Seismic Design Criteria

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APPENDIX F

COMMISSIONAIRES

Request for Service / Change of Service

☐ Fed Gov ☐ Other Gov ☐ Commercial

☐ New ☐ Change ☐ Cancellation

Please Email Orders To: operationscentre@commissionaires.bc.ca

				Order Date:	
Site Number:		**RFS #:**		**Originator:**	
Ordered By:			**Client Company:**		
Client Phone:			**Client Email:**		

Location:	
Address:	**City:**

Dates Required	Times	# of CMRES	Commissionaire(s)

48 Hours Notice Required for Request for Service / Shift Minimum: 4 Hours / 24 Hours Notice required for any cancellation or full shift will be billed.

Overtime rates will apply for any shifts over 8 hours / If equipment required is to be picked up offsite, travel time must be built into shift times

Duties:	
Comments:	

Meeting Point:			
Contact:		**Contact Phone:**	
Equipment:		**Equipment Location:**	
Safety Line:		**Safety Line Phone:**	
Contractor:		**Contractor Phone:**	
Emrg Contact:	**Commissionaires Operations Centre**	**Emergency Phone:**	**Lml: 604-646-3333 / Int: 1- 866-915-4404**
Client Emerg #:			

Billing Information - Please Confirm for All Orders

operationscentre@commissionaires.bc.ca

PO #		**PW # / Project #**	
Name/Company			
Address:			
City:		**Postal Code:**	
Telephone #		**Fax #**	
Email:			
ATTN To / Other Info:			
Bill Rate:		**Spec Level:**	

Service & Response Coordinator (Composed by)		Initial:		Date:	
Service & Response Coordinator (Checked by)		Initial:		Date:	
Email Confirmation Sent By:		Date:			

APPENDIX G

PHOTO #1

PHOTO #2

PHOTO # 3


PHOTO #4

PHOTO #5

PHOTO #6

PHOTO #7

PHOTO #8

PHOTO #9

PHOTO #10

PHOTO #11

PHOTO #12

PHOTO #13

SUBSTRUCTURE PHOTO #1

SUBSTRUCTURE PHOTO #2

SUBSTRUCTURE PHOTO #3