



# Public Works and Government Services Canada

Requisition No: EZ899-220690/A

DRAWINGS & SPECIFICATIONS  
for

WHI - Sewer System Upgrade and Rehabilitation, William Head  
Institution, Metchosin, BC

Project No.: R.098006.001  
March 2020

**APPROVED BY:**  
**Robertson, Ian**

Digitally signed by: Robertson, Ian  
DN: CN = Robertson, Ian C = CA O = GC OU = PWGSC-TPSGC  
Date: 2021.03.22 08:04:24 -07'00'

\_\_\_\_\_  
Regional Manager, AES Date

Digitally signed by: Kingsley, Jeff  
DN: CN = Kingsley, Jeff C = CA O = GC OU = PWGSC-TPSGC  
Date: 2021.04.01 18:05:04 -07'00'

\_\_\_\_\_  
Kingsley, Jeff Date  
Construction Safety Coordinator

**TENDER:** **Lu, Calvin** Digitally signed by: Lu, Calvin  
DN: CN = Lu, Calvin C = CA O = GC OU = PWGSC-TPSGC  
Date: 2021.06.15 12:49:56 -07'00'

\_\_\_\_\_  
Project Manager Date

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2021-07-07

**PART 1– GENERAL**

1.1 CODES, BYLAWS, STANDARDS

- .1 Comply with applicable local bylaws, and all William Head Institution rules and regulations enforced at the location concerned.
- .2 Meet or exceed requirements of Contract documents, specified standards, codes and referenced documents.
- .3 In any case of conflict or discrepancy, the most stringent requirements shall apply.
- .4 Contractor shall apply and obtain any work permits required by authorities having jurisdiction.

1.2 DESCRIPTION OF WORK

- .1 The work is located within the grounds of William Head Institution, a Corrections Canada minimum security facility, at 6000 William Head Road, Metchosin, BC.
- .2 Work to be performed under this Contract includes, but is not limited to, the following items covered further in the Contract documents:
  - .1 Rehabilitation of asbestos cement sanitary pipes using cured-in-place piping (CIPP).
  - .2 Removal and replacement of sanitary manholes.
  - .3 Rerouting and installation of several storm service connections by open-cut excavation.

1.3 CONTRACT METHOD

- .1 Construct work under lump sum contract.

1.4 CONTRACT DOCUMENTS

- .1 The Contract documents, drawings, and specifications are intended to complement each other, and to provide for and include everything necessary for the completion of the work.
- .2 Drawings are, in general, diagrammatic and are intended to indicate the scope and general arrangement of the work.
- .3 If there is any inconsistency or conflict between the provisions of the Contract Documents the:
  - .1 The Contract Documents shall govern and take precedence in the following order with the Agreement taking precedence over all other Contract Documents:
    - .1 Agreement
    - .2 Addenda
    - .3 Supplementary Specifications
    - .4 Specifications
    - .5 Drawings
    - .6 Supplementary Detailed Drawings
    - .7 Standard Detailed Drawings
    - .8 Executed Form of Tender
    - .9 Instructions to Tenderers
    - .10 All other Contract Documents;
  - .2 Drawings at a larger scale shall govern over Drawings at a smaller scale.
  - .3 Figured dimensions on a drawing shall govern over scaled measurements on the same Drawing; and
  - .4 Documents of later date shall always govern a similar type of document of an earlier date.

1.5 OTHER CONTRACTS

- .1 Further Contracts may be awarded while this contract is in progress.
- .2 Cooperate with other Contractors on site in carrying out their respective works and carry out instructions from Departmental Representative.
- .3 Coordinate work with that of other Contractors.

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 govern.

1.7 TIME OF COMPLETION

- .1 Commence work immediately upon official notification of acceptance of offer and complete the project within sixteen (16) weeks after Contract Award.

1.8 HOURS OF WORK

- .1 Restrictive as follows:
  - .1 Schedule deconstruction, removal and construction work during normal weekday working hours of the William Head Institution. Normal weekday working hours are 0700 hours to 1900 hours Monday through Friday, excluding statutory holidays. Extended hours are available upon request. The contractor is to provide seven days notice for extension of hours on a case-by-case basis.
  - .2 Submit written request to Departmental Representative for authorization prior to working outside of normal working hours including weekends or holidays.

1.9 WORK SCHEDULE

- .1 Carry on work as indicated and as follows:
  - .1 Within 5 working days after Contract award, provide a Master Project Schedule, in the form of a bar chart, showing anticipated progress stages and final completion of the work within the time period required by the Contract documents. Schedule to 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 trade for each stage of work 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.
  - .3 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 to the approval of the Departmental Representative.

1.10 COST BREAKDOWN

- .1 Before submitting the first progress claim, submit a breakdown of the contract lump sum price in detail as directed by the Departmental Representative. After approval, the cost breakdown will form the basis of progress payments.

1.11 DOCUMENTS REQUIRED

- .1 Maintain one copy each of the following at the job site:
  - .1 Contract drawings.
  - .2 Contract specifications.
  - .3 Addenda to Contract documents.
  - .4 Copy of approved work schedule.
  - .5 Reviewed shop drawings.
  - .6 Change orders.
  - .7 Other modifications to Contract.
  - .8 Field test reports.
  - .9 Reviewed samples.
  - .10 Manufacturer's installation and application instructions.
  - .11 One set of record drawings and specifications for "as-built" purposes.
  - .12 Contractor's Health and Safety Plan and other Safety Related Documents.
  - .13 National Building Code of Canada 2015.
  - .14 Current construction standards of workmanship listed in technical specifications.
  - .15 WHMIS documents.
  - .16 Site Instructions.
  - .17 Request for Information (RFI).
  - .18 Contractor's Environmental Management Plan (including spill management plan).
  - .19 Other documents as specified.

1.12 OWNER OCCUPANCY

- .1 During the entire construction period, the owner (Corrections Canada) will occupy adjacent areas for execution of normal operations.

1.13 CONTRACTOR'S USE OF SITE

- .1 Refer to Section 01 14 10 Security Requirements.
- .2 The William Head Institution shall be assumed to be fully operational for the duration of the contract.
- .3 The Contractor will assume the role of Prime Contractor as per Section 118 of the Workers Compensation Act.
- .4 The use of Contractor's work site is exclusive and complete for the execution of contract work.
- .5 The Contractor shall:
  - .1 Assume responsibility for assigned premises for performance of the work.
  - .2 Coordinate all work activities on the Contractor's work site, including the work of other contractors engaged by Departmental Representative.
  - .3 Provide security of Contractor's work site and all Contractor's and Subcontractor's equipment and material. Secure Contractor's work site at the end of each work day.

- .4 Ensure the site is not unreasonably encumbered with material or equipment.
- .5 Do not enter any area of the William Head Institution property to which access is restricted by sign is a secured or restricted area and shall not be entered.
- .6 Do not obstruct access to property outside of the Contractor's work site. Maintain overhead clearances, keep roadways and walkways clear, and maintain routes for emergency response vehicles.

#### 1.14 EXISTING SERVICES

- .1 Notify Departmental Representative of intended interruption of services and obtain required permission. Where work involves breaking into or connecting to existing services, contractor shall submit a request to the Departmental Representative a minimum of 48 hours prior to the event. The contractor will not proceed until approval has been granted. The PWGSC Departmental Representative will make all reasonable efforts to accommodate the request; however, PWGSC will not accept delay charges should the request not be accepted.
- .2 Minimize duration of interruptions, and where required, provide temporary services to maintain critical systems.
- .3 Contractor to identify that all unknown services encountered to the Departmental Representative who will provide direction on how to proceed.
- .4 Protect, relocate or maintain existing active services. When inactive services are encountered, cap off in a manner approved by authorities having jurisdiction.

#### 1.15 WORK BY OTHERS

- .1 Co-ordinate work with that of other Contractors. If any part of the Work under this Contract depends for its proper execution or result upon work of another Contractor, report promptly to Departmental Representative, in writing, any defects which may interfere with proper execution of work.

#### 1.16 EXAMINATION

- .1 Examine site and be familiar and conversant with existing conditions likely to affect work.
- .2 Repair or replace portions of existing work which have been altered during construction operations to match existing or adjoining work, as directed by Departmental Representative.
- .3 At completion of operations the condition of existing work must be equal to or better than that which existed before new work started.
- .4 Protect existing work to prevent injury or damage to portions of existing work which remain.
- .5 Complete ground penetrating radar (GPR) to all excavation areas. Provide written report with findings to Departmental Representative prior to proceeding with any excavation activities

#### 1.17 CUTTING AND PATCHING

- .1 Cut existing surfaces as required to accommodate new work.
- .2 Remove items so shown or specified.
- .3 Except as noted on drawings, do not cut, bore, or sleeve load-bearing members.
- .4 Make cuts with clean, true, smooth edges. Make patches inconspicuous in final assembly.
- .5 Patch and make good surfaces cut, damaged or disturbed, to Departmental Representative's approval.

- .6 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 meters in ambient light.

#### 1.18 SETTING OUT OF WORK

- .1 Assume full responsibility for and execute complete layout of work to locations, lines, angles, and elevations indicated.
- .2 Provide devices needed to lay out and construct work.
- .3 Supply such devices as templates required to facilitate Departmental Representative's inspection of work.

#### 1.19 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 Departmental Representative. Commencement of work shall imply acceptance of prepared work or substrate surfaces.

#### 1.20 QUALITY OF WORK

- .1 Ensure that quality workmanship is performed through use of skilled tradesmen, under supervision of qualified journeyman.
- .2 In cases of dispute, decisions as to standard or quality of work rest solely with the Departmental Representative, whose decision is final.

#### 1.21 MEETINGS

- .1 Attend contract start-up meeting, progress meetings and all other meetings described herein including site meetings as directed by the Departmental Representative.

#### 1.22 WORKS COORDINATION

- .1 Coordinate work of subtrades:
  - .1 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.
  - .1 Provide each subcontractor with complete plans and specifications for Contract, to assist them in planning and carrying out their respective work.
  - .2 Develop coordination drawings where required, illustrating potential interference between work of various trades and distribute to affected parties.
- .3 Work cooperation:
  - .1 Ensure cooperation between trades in order to facilitate general progress of Work and avoid situations of spatial interference.
  - .2 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.
- .4 Ensure cooperation between trades in order to facilitate general progress of Work and avoid situations of spatial interference.
- .5 Ensure disputes between subcontractors are resolved.

- .6 Departmental Representative is not responsible for, or accountable for extra costs incurred as a result of Contractor's failure to coordinate Work.
- .7 Maintain efficient and continuous supervision.

#### 1.23 APPROVAL OF SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

- .1 In accordance with Section 01 33 00 – Submittal Procedures, submit the requested shop drawings, product data, MSDS sheets and samples indicated in each of the technical Sections.
- .2 Allow sufficient time for the following:
  - .1 Review of product data.
  - .2 Approval of shop drawings.
  - .3 Review of re-submission.
  - .4 Ordering of approved material and/or products - refer to technical Specifications.

#### 1.24 SECURITY CLEARANCES

- .1 Refer to 01 14 10 Security Requirements.
- .2 Personnel employed on this project will be subject to security check. Obtain requisite clearances, as instructed, for each individual required to enter the premises.
- .3 Personnel will need to obtain security clearance at start of project and be provided with a security badge which is to be worn and visible at all times while on the site.
- .4 Contractor shall be fully responsible for securing the premises and its contents throughout the construction period.

#### 1.25 TESTING AND INSPECTIONS

- .1 Particular requirements for inspection and testing to be carried out by testing service or laboratory approved by the Departmental Representative and paid for by the Contractor.
- .2 The Contractor will appoint and pay for the services of testing agency or testing laboratory as specified, and where required for the following:
  - .1 Inspection and testing required by laws, ordinances, rules, regulations or orders of public authorities.
  - .2 Inspection and testing performed exclusively for Contractor's convenience.
  - .3 Where tests or inspections by designated testing laboratory 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 to verify acceptability of corrected work.
  - .4 Contractor shall notify Departmental Representative in advance of planned testing.
  - .5 Contractor shall pay costs for uncovering and making good work that is covered before required inspection or testing is completed and approved by Departmental Representative.
  - .6 Provide Departmental Representative with 1 electronic copy of testing laboratory reports as soon as they are available.

#### 1.26 AS-BUILT DOCUMENTS

- .1 Refer to Section 01 78 30 - Closeout Submittals.



1.27 CLEANING

- .1 Conduct daily cleaning and disposal operations. Comply with local ordinances and anti-pollution laws.
- .2 Ensure cleanup of the work areas each day after completion of work.

1.28 DUST CONTROL

- .1 Provide control measures as specified in Section 01 35 43 - Environmental Procedures.

1.29 ENVIRONMENTAL PROTECTION

- .1 Refer to Section 01 35 43 - Environmental Procedures.

1.30 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 plans referred to in the Contract documents.
- .2 Upon request, Departmental Representative may furnish up to a maximum of 3 sets of Contract documents for use by the Contractor at no additional cost. Should more than 3 sets of documents be required, the Departmental Representative will provide them at additional cost.

1.31 SYSTEM OF MEASUREMENT

- .1 The metric system of measurement (SI) will be employed on this Contract.

1.32 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.

1.33 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.

**END OF SECTION 01 11 55**

**PART 1– GENERAL**

1.1 PURPOSE

- .1 To ensure that both the construction project and the institutional operations may proceed without undue disruption or hindrance and that the security of the Institution is maintained at all times.

1.2 DEFINITIONS

- .1 "Contraband" means:
  - .1 A phone, laptop, camera and chargers;
  - .2 An intoxicant, including alcoholic beverages, drugs and narcotics;
  - .3 A weapon or a component thereof, ammunition for a weapon, and anything that is designed to kill, injure or disable a person or that is altered so as to be capable of killing, injuring or disabling a person, when possessed without prior authorization;
  - .4 An explosive or a bomb or a component thereof;
  - .5 Currency over any applicable prescribed limit, \$25.00; and
  - .6 Any item not described in paragraphs (a) to (d) that could jeopardize the security of a Penitentiary or the safety of persons, when that item is possessed without prior authorization.
- .2 "Unauthorized smoking and related Items" means all smoking items including, but not limited to, cigarettes, cigars, tobacco, chewing tobacco, cigarette making machines, matches and lighters.
- .3 "Commercial Vehicle" means any motor vehicle used for the shipment of material, equipment and tools required for the construction project.
- .4 "CSC" means Correctional Service Canada.
- .5 "Director" means Director or Warden of the Institution as applicable or their representative.
- .6 "Construction employees" means persons working for the general contractor, the sub-contractors, equipment operators, material suppliers, testing and inspection companies and regulatory agencies.
- .7 "Departmental Representative" means the Public Works and Government Services Canada representative defined in General Conditions.
- .8 "Perimeter" means the fenced or walled area of the institution that restrains the movement of the inmates.
- .9 "Construction zone" means the area, as indicated in the contract documents, that the contractor will be allowed to work". This area may or may not be isolated from the security area of the institution. Limits to be confirmed at construction start-up meeting.

1.3 PRELIMINARY PROCEEDINGS

- .1 At construction start-up meeting:
  - .1 Discuss the nature and extent of all activities involved in the Project.
  - .2 Establish mutually acceptable security procedures in accordance with this instruction and the institution's particular requirements.
- .2 The Contractors' responsibilities:
  - .1 Ensure that all construction employees are aware of the CSC security requirements.
  - .2 Ensure that a copy of the CSC security requirements is always prominently on display at the job site.

- .3 Co-operate with institutional personnel in ensuring that security requirements are observed by all construction employees.

#### 1.4 CONSTRUCTION EMPLOYEES

- .1 The type of personnel security screening that an employee needs is determined by the requirements of each contract. Public Services and Procurement Canada's Contract Security Program can help get the required security screening for Contractor's personnel. For this contract, contractors require Reliability Status, OR a daily gate pass. See link for information on how to apply for Security Status, such as Reliability Status, <https://www.tpsgc-pwgsc.gc.ca/esc-src/personnel/information-eng.html>. Note, security clearances can take several months to be approved.
- .2 For a daily gate pass, the Contractor shall supply dates or visits and names of employees to PSPC Site officer with 72 hours notice to allow for processing. Employees will not be admitted to the Institution without a valid security clearance in place OR an approved Daily Gate Pass, with recent picture identification such as a provincial driver's license. Security clearances obtained from other CSC institutions are not valid at this institution except as approved otherwise.
- .3 The Director requires that ID cards be provided for all construction workers. ID cards will be provided at the principal entrance to be picked upon arrival at the institution and shall be displayed prominently on the construction employees clothing at all time while employees are at the institution.
- .4 When contractors leave the site for breaks, ie lunch, ensure tool supplies are taken out or secured. Contractors are required to sign in and out whenever leaving the institution.
- .5 In the event of an institutional emergency, commissioners and contractor should follow the correctional officer's instruction.
- .6 Entry to Institutional Property will be refused to any person there may be reason to believe may be a security risk.
- .7 Any person employed on the construction site will be subject to immediate removal from Institutional Property if they:
  - .1 appear to be under the influence of alcohol, drugs or narcotics;
  - .2 behave in an unusual or disorderly manner; and
  - .3 are in possession of contraband.

#### 1.5 VEHICLES

- .1 Vehicles shall be cleaned out prior to entry to institution, including all contraband: cell phones, chargers, lighters, cigarettes, and tools that are not included on an approved list.
- .2 All unattended vehicles on CSC property must have windows closed; fuel caps locked, doors and trunks locked and keys removed. The keys must be securely in the possession of the owner or an employee of the company that owns the vehicle.
- .3 The director may limit at any time the number and type of vehicles allowed within the Institution.
- .4 Drivers of delivery vehicles for material required by the project will require security clearances or daily gate passes and must remain with their vehicle the entire time that the vehicle is in the Institution. The director may require that these vehicles be escorted by Institutional staff or PWGSC Construction Escorts while in the Institution.
- .5 If the Director permits trailers to be left inside the secure perimeter of the Institution, the trailer doors must be locked at all times. All windows must be securely locked bars when left unoccupied. Cover all windows with expanded metal mesh. When not in use lock all storage trailers located inside and outside the perimeter. All storage trailers inside and outside the perimeter must be locked when not in use.

1.6 PARKING

- .1 The parking area(s) to be used by construction employees will be designated by the Director. Parking in other locations will be prohibited and vehicles may be subject to removal.

1.7 SHIPMENTS

- .1 To avoid confusion with the Institution's own shipments, address all shipments of project material, equipment and tools in the Contractor's name and have a representative on site to receive any deliveries or shipments. CSC or PWGSC staff will NOT accept receipt of deliveries or shipments of any material equipment or tools for the Contractor.

1.8 TELEPHONES

- .1 The installation of telephones, facsimile machines and computers with Internet connections is not permitted within the Institution perimeter unless prior approved by the Director.
- .2 The Director will ensure that approved telephones, facsimile machine and computers with Internet connections are located where they are not accessible to inmates. All computers will have an approved password protection that will stop an Internet connection to unauthorized personnel.
- .3 Wireless cellular and digital telephones, including but not limited to devices for telephone messaging, pagers, Blackberries, PDAs, telephone used as 2-way radios are not permitted within the Institution unless approved by the Director. If wireless cellular telephones are permitted, the user will not permit their use by any inmate.
- .4 The Director may approve but limit the use of 2-way radios.

1.9 WORK HOURS

- .1 Work hours within the Institution are generally 0700 hours to 1900 hours. Extended hours may be permitted on a case by case basis.
- .2 Work is permitted during weekends and statutory holidays with the permission of the Director. A minimum of seven days advance notice is required to obtain the required permission. In case of emergencies or other special circumstances, this advance notice may be waived by the Director.

1.10 OVERTIME WORK

- .1 Conform to Division 1.
- .2 Provide 48-hours advance notice to Director for all work to be performed after normal working hours of the Institution. Notify PSPC Site Officer and Director immediately if emergency work is required, such as to complete a concrete pour or make the construction site safe and secure.

1.11 TOOLS AND EQUIPMENT

- .1 Contractors will be given a tool check list by Public Works. This needs to be completed 72 hours prior to entry and approved by the institution. Contractors must list all tools (consumables are different) going in before entering institution. The tools that come in must come out. Hilti guns and shot strips require Warden's approval before being allowed on the site. A count of the shot strips entering and leaving the site must be undertaken. Contractors are to dispose of all shot strips offsite, including all sharp blades.
- .2 Throughout the construction project maintain up-to-date the list of tools and equipment specified above.
- .3 Keep all tools and equipment under constant supervision, particularly power-driven and cartridge-driven tools, cartridges, files, saw blades, rod saws, wire, rope, ladders and any sort of jacking device.
- .4 Store all tools and equipment in approved secure locations.

- .5 Lock all tool boxes when not in use. Keys to remain in the possession of the employees of the contractor. Secure and lock scaffolding when not erected and when erected Secure in a manner agreed upon with the Institution designate.
- .6 Report all missing or lost tools or equipment immediately to the Departmental Representative/Director.
- .7 The Director may ensure that the security staff members carry out checks of the Contractor's tools and equipment against the list provided by the Contractor. These checks may be carried out at the following intervals:
  - .1 At the beginning and conclusion of every work day or shift upon entering and exiting the Institution.
  - .2 At any time when Contractor is on Institution property.
- .8 Certain tools/equipment such as cartridges and hacksaw blades are highly controlled items. The contractor will be given at the beginning of the day, a quantity that will permit one day's work. Used blades/cartridges will be returned to the Director's representative at the end of each day. Maintain up to date inventory of all used blades/cartridges.
- .9 If propane or natural gas is used for heating the construction, the institution will require that the contractor supervise the construction site during non-working hours.

#### 1.12 KEYS

- .1 Security Hardware Keys:
  - .1 Arrange with the security hardware supplier/installer to have the keys for the security hardware to be delivered directly to Institution, specifically the Security Maintenance Officer (SMO).
  - .2 The SMO will provide a receipt to the Contractor for security hardware keys.
  - .3 Provide a copy of the receipt to the Departmental Representative.
- .2 Other Keys:
  - .1 Use standard construction cylinders for locks for his use during the construction period.
  - .2 Issue instructions to employees and sub-trades, as necessary, to ensure safe custody of the construction set of keys.
- .3 Upon completion of each phase of the construction, the CSC representative will, in conjunction with the lock manufacturer:
  - .1 Prepare an operational keying schedule.
  - .2 Accept the operational keys and cylinders directly from the lock manufacturer.
  - .3 Arrange for removal and return of the construction cores and install the operational core in all locks.
- .4 Upon putting operational security keys into use, the PWGSC construction escort will obtain these keys as they are required from the SMO and open doors as required by the Contractor. The Contractor shall issue instructions to his employees advising them that all security keys shall always remain with the PWGSC construction escort.

#### 1.13 SECURITY HARDWARE

- .1 Turn over all removed security hardware to the Director of the Institution for disposal or for safekeeping until required for re-installation.

1.14 PRESCRIPTION DRUGS

- .1 Employees of the contractor who are required to take prescription drugs during the workday may use lockers at the principal entrance.

1.15 SMOKING RESTRICTIONS

- .1 Smoking is not permitted inside correctional facilities or outdoors within the perimeter of a correctional facility and persons must not possess unauthorized smoking items within the perimeter of a correctional facility.
- .2 Persons in violation of this policy will be requested to immediately cease smoking or dispose of any unauthorized smoking items and, if they persist will be directed to leave the Institution.
- .3 Smoking is permitted outside the perimeter of a correctional facility in an area designated by the Director.

1.16 CONTRABAND

- .1 Weapons, ammunition, explosives, alcoholic beverages, drugs and narcotics are prohibited on institutional property.
- .2 The discovery of contraband on the construction site and the identification of the person(s) responsible for the contraband shall be reported immediately to the Director.
- .3 Contractors should be vigilant with both their staff and the staff of their sub-contractors and suppliers that the discovery of contraband may result in cancellation of the security clearance of the affected employee. Serious infractions may result in the removal of the company from the Institution for the duration of the construction.
- .4 Presence of contraband including arms and ammunition in vehicles of contractors, sub-contractors and suppliers or employees of these will result in the immediate cancellation of security clearances for the driver of the vehicle.

1.17 SEARCHES

- .1 All vehicles and persons entering institutional property may be subject to search.
- .2 When the Director suspects, on reasonable grounds, that an employee of the Contractor is in possession of contraband, he may order that person to be searched.
- .3 All employees entering the Institution may be subject to screening of personal effects for traces of contraband drug residue.

1.18 ACCESS AND REMOVAL FROM INSTITUTION PROPERTY

- .1 Construction personnel and commercial vehicles will not be admitted to the institution after normal working hours, unless approved by the Director.

1.19 MOVEMENT VEHICLES

- .1 Escorted commercial vehicles will be allowed to enter or leave the institution through the vehicle access gate during the following hours:  
0700 hrs. to 1900 hrs.
- .2 The Contractor will advise the Director forty-eight (48) hours in advance to the arrival on the site of heavy equipment such as concrete trucks, cranes, etc.
- .3 Vehicles being loaded with soil or other debris, or any vehicle considered impossible to search, must be under continuous supervision by CSC staff or PWGSC construction escorts working under the authority of the Director.

- .4 Commercial vehicles will only be allowed access to institutional property when their contents are certified by the Contractor or his representative as being strictly necessary to the execution of the construction project.
- .5 Vehicles will be refused access to institutional property if, in the opinion of the Director, they contain any article which may jeopardize the security of the institution. Arrange with Director for parking of Contractor's vehicles at minimum security Institutions.
- .6 Private vehicles of construction employees will not be allowed within the security wall or fence of medium or maximum-security institutions without the authorization of the Director.
- .7 With the approval of the Director, certain equipment may be permitted to remain on the construction site overnight or over the weekend. This equipment must be securely locked, with the battery removed. The Director may require that the equipment be secured with a chain and padlock to another solid object.

#### 1.20 MOVEMENT OF CONSTRUCTION EMPLOYEES ON INSTITUTIONAL PROPERTY

- .1 Subject to the requirements of good security, the Director will permit the Contractor and his employees as much freedom of action and movement as is possible.
- .2 However, notwithstanding paragraph above, the Director may:
  - .1 Prohibit or restrict access to any part of the institution.
  - .2 Require that in certain areas of the institution, either during the entire construction project or at certain intervals, construction employees only be allowed access when accompanied by a member of the CSC security staff or PWGSC Construction Escort Officer.

#### 1.21 SURVEILLANCE AND INSPECTION

- .1 Construction activities and all related movement of personnel and vehicles will be subject to surveillance and inspection by CSC security staff members to ensure that established security requirements are met.
- .2 CSC staff members will ensure that an understanding of the need to carry out surveillance and inspections, as specified above, is established among construction employees and maintained throughout the construction project.

#### 1.22 STOPPAGE OF WORK

- .1 The director may request at any time that the Contractor, his employees, sub-contractors and their employees not enter or leave the work site immediately due to a security situation occurring within the Institution. The Contractor's site supervisor will note the name of the staff member giving the instruction, the time of the request and obey the order as quickly as possible.
- .2 The Contractor shall advise the Departmental Representative of this interruption of the work within 24-hours.

#### 1.23 CONTACT WITH INMATES

- .1 Unless specifically authorized, it is forbidden to come into contact with inmates, to talk with them, to receive objects from them or to give them objects. Any employee doing any of the above will be removed from the site and his security clearance revoked.
- .2 Digital cameras (or any other type) are not allowed on CSC property.
- .3 Notwithstanding the above paragraph, if the director approves of the use of cameras, it is strictly forbidden to take pictures of inmates, of CSC staff members or of any part of the Institution other than those required as part of this contract.

1.24 COMPLETION OF CONSTRUCTION PROJECT

- .1 Upon completion of the construction project or, when applicable, the takeover of a facility, the Contractor shall remove all remaining construction material, tools and equipment that are not specified to remain in the Institution as part of the construction contract.

**END OF SECTION 01 14 10**



## **PART 1– GENERAL**

### **1.1 ADMINISTRATIVE**

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

### **1.2 SHOP DRAWINGS**

- .1 The review of shop drawings by Public Works and Government Services Canada (PWGSC) is for sole purpose of ascertaining conformance with general concept.
  - .1 This review shall not mean that PWGSC approves detail design inherent in shop drawings, responsibility for which shall remain with Contractor submitting same, and such review shall not relieve Contractor of responsibility for errors or omissions in shop drawings or of responsibility for meeting requirements of construction and Contract Documents.
  - .2 Without restricting generality of foregoing, Contractor is responsible for dimensions to be confirmed and correlated at job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for co-ordination of Work of sub-trades

### **1.3 PROGRESS PHOTOGRAPHS AND FINAL PHOTOGRAPHS**

- .1 Submit electronic copy of colour digital photography in jpg format, standard resolution, monthly with progress statement and as directed by Departmental Representative.
- .2 Project Identification: Project name, project number, and date of exposure indicated.
- .3 Progress and Final Photographs to be submitted using an electronic file share platform acceptable to PWGSC.

- .4 Quantity: Provide sufficient number of photographs to adequately describe the work activities carried out during the reporting period. A minimum of two photographs taken from two viewpoints are to be provided for each clean-up/construction activity.
- .5 Submit final photographs with as-built documents.

**END OF SECTION 01 33 00**

### **PWGSC Update on Asbestos Use**

Effective April 1, 2016, all Public Works and Government Services Canada (PWGSC) contracts for new construction and major rehabilitation will prohibit the use of asbestos-containing materials. Further information can be found at:

<http://www.tpsgc-pwgsc.gc.ca/comm/vedette-features/2016-04-19-00-eng.html>

### **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 Purposes
  - .3 CSA S350-M1980 (R2003) Code of Practice for Safety in Demolition of Structure
  - .4 CSA Z1006-10 – Management of Work In Confined Space
- .4 National Fire Code of Canada 2010 (as amended)
  - .1 Part 5 – Hazardous Processes and Operations and Division B as applicable and required.
- .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 and Safety.
  - .2 Occupational Health and Safety Regulation

### **2. Related Sections**

- .1 Not Applicable.

### **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.

### **4. Compliance with Regulations**

- .1 PWGSC may terminate the Contract without liability to PWGSC where the Contractor, in the opinion of PWGSC, 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.

## **5. Submittals**

- .1 Submit to Departmental Representative submittals listed for review in accordance with Section 01 33 00.
- .2 Work effected by submittal shall not proceed until review is complete.
- .3 Submit the following:
  - .1 Site Specific 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 Copy of Contractors' Construction Safety Manual
  - .6 Emergency Procedures.
- .4 The Departmental Representative will review the Contractor's Site Specific Safety Plan and Emergency Procedures, and provide comments to the Contractor within 5 (five) days after receipt of the plan. Revise the plan as appropriate and resubmit to Departmental Representative.
- .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 Site Specific 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.

## **6. Responsibility**

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

- .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.

### **7. Health and Safety Coordinator**

- .1 The contractor shall appoint a Health and Safety Coordinator who shall:
  - .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.

### **8. General Conditions**

- .1 Provide safety barricades and lights 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 sites.
  - .1 Provide appropriate means by use of barricades, fences, warning signs, traffic control personnel, and temporary lighting as required.
  - .2 Secure site at night time or provide security guard as deemed necessary to protect work sites against entry.

### **9. Utility Clearances**

- .1 The Contractor is solely responsible for all utility detection and clearances prior to starting the work
- .2 The Contractor will not rely solely upon the Reference Drawings or other information provided for utility locations.

### **10. Project/Site Conditions**

- .1 Work at site will involve contact with:
  - .1 PWGSC and other Federal employees,
  - .2 CSC (federal) operational staff,
  - .3 Facility inmates (present but no contact required),
  - .4 Unpredictable weather conditions,
  - .5 Threat of tsunami and earthquake, and
  - .6 Confined space and restricted access space.

- .7 Work with hazardous substances.

### **11. Regulatory Requirements**

- .1 Comply with specified codes, acts, bylaws, standards and regulations to ensure safe operations at site.
- .2 In event of conflict between any provision of (.1) above, the authorities having 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 to be followed.

### **12. Work Permits**

- .1 Obtain specialty permits related to project before start of work.

### **13. Filing of Notice**

- .1 The Prime Contractor shall submit a Notice of Project to the Provincial authorities.
- .2 Provide copies of all notices to the Departmental Representative.

### **14. Site Specific Safety Plan**

- .1 Conduct a site-specific hazard assessment based on a review of Contract documents, required work, and all project work sites. Identify any known and potential health risks and safety hazards.
- .2 Develop, implement, and enforce the Site Specific 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 communication 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 Site Specific Safety 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 Site Specific Safety Plan as required, and re-submit to the Departmental Representative for review.
  - .5 Departmental Representative's review: the review of the contractors' Site Specific Safety Plan by Public Works and Government Services Canada (PWGSC) shall not relieve the Contractor of responsibility for errors or omissions in final Site Specific Safety Plan or of responsibility for meeting all requirements of construction and Contract documents.

**15. 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 other PWGSC staff as required.
- .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 which may be affected if the risk extends beyond the workplace.
  - .6 Notify Departmental Representative and PWGSC 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 a 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 At least once each year, emergency drills must be held to ensure awareness and effectiveness of emergency exit routes and procedures, and a record of the drills must be kept.
- .6 Revise and update emergency procedures as required, and re-submit to the Departmental Representative.

#### **16. 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 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.
  - .3 Provide adequate means of ventilation in accordance with NMS Sections as indicated in Section 000110 Specification Index.

#### **17. Off Site Contingency and Emergency Response Plan**

- .1 Prior to commencing Work involving handling of hazardous materials, develop off site Contingency and Emergency Response Plan.
- 2. Plan must provide immediate response to serious site occurrence such as explosion, fire, or migration of significant quantities of toxic or hazardous material from Site.
- 3. Notification of fire departments [4.17 – Worksafe BC Regulations Part 4 Buildings, Structures, Equipment, and Site Conditions]
  - (1) An employer having at a workplace hazardous products covered by WHMIS, explosives, pesticides, radioactive material, consumer products or hazardous wastes in quantities which may endanger firefighters, must ensure the local fire department is notified of the nature and location of the hazardous materials or substances and methods to be used in their safe handling.
  - (2) Subsection (1) does not apply to a workplace
    - (a) where materials are kept on site for less than 15 days if the employer ensures an alternative effective means for notification of fire departments is in place in the event of fire or other emergency, or
    - (b) which is not within the service area of a fire department.



[Amended by B.C. Reg. 30/2015, effective August 4, 2015.]

**18. Personal Protective Clothing and Equipment**

- .1 Work shall be performed in compliance with Part 8 - Personal Protective Clothing and Equipment, and Part 5 – Chemical Agents and Biological Agents, (as applicable) Worksafe B.C. OHS Regulations

**19. Asbestos Hazard**

- .1 Modifications to spray- or trowel-applied asbestos surfaces can be hazardous to health.
- .2 Removal and handling of asbestos will be performed as per Worksafe B.C. Regulations Part 6 Substance Specific Requirements Asbestos and all applicable regulations.

**20. PCB Removals**

- .1 Mercury-containing fluorescent tubes and ballasts which contain polychlorinated biphenyls (PCBs) are classified as hazardous waste.
- .2 When applicable, remove, handle, transport and dispose of as indicated in Section 000110 Specification Index.

**21. Removal of Lead-Containing Paints**

- .1 All paints containing TCLP lead concentrations above 5 ppm are classified as hazardous.
- .2 Carry out demolition and any other activities involving lead-containing paints in accordance with Worksafe B.C. Regulations Part 6 Substance Specific Requirements Lead and all applicable regulations.

**22. Silica**

- .1 Carry out work in accordance with Worksafe BC regulations

**23. 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.

- .3 Develop, implement and enforce a communication plan with Departmental representative and facility maintenance staff for all electrical work and lockout procedures.

#### **24. Electrical Lockout**

- .1 Develop, implement and enforce use of established procedures to provide electrical 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.

#### **25. Overloading**

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

#### **26. Falsework**

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

#### **27. 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.

#### **28. Confined Spaces**

- .1 Carry out work in confined spaces in compliance with Worksafe B.C. Part 9 Confined Spaces and CSA Z1006-10 Management of Work in Confined Space.

#### **29. Restricted Access**

- .1 Contractor shall perform a hazard assessment and develop an appropriate restricted access entry and emergency rescue plan in accordance with Worksafe B.C. regulations.

#### **30. Confined Space and Restricted Space Outside of Defined Work Site**

- .1 Carry out work in confined spaces in compliance with Worksafe B.C. Part 9 Confined Spaces and CSA Z1006-10 Management of Work in Confined Space. Coordinate all confined space entry work with PWGSC Departmental Representative through the contractor's confined space entry permit system.

- .2 Contractor shall perform a hazard assessment and develop an appropriate restricted access entry and emergency rescue plan in accordance with Worksafe B.C. regulations. Coordinate all restricted access space entry work with the Departmental Representative prior to entry.
- .3 The Contractor is required to provide a reasonable amount of time to the Departmental Representative for making arrangements for entry and/or access to Confined Space or Restricted Access spaces located outside the designated work site.

### **31. Powder-Actuated Devices**

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

### **32. Fire Safety and Hot Work**

- .1 Coordinate all hot work with Departmental Representative through the contractors' hot work permit system.
- .2 Obtain Departmental Representative's authorization before any welding, cutting or any other hot work operations can be carried out on site.
- .3 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.

### **33. 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.

### **34. Fire Protection and Alarm System**

- .1 Fire protection and alarm systems shall not be:
  - .1 Obstructed.
  - .2 Shut off.
  - .3 Left inactive at the end of a working day or shift.
- .2 Do not use fire hydrants, standpipes and hose systems for purposes other than firefighting.
- .3 Be responsible/liable for costs incurred from the fire department, the building owner and the tenants, resulting from false alarms.

### **35. 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.

### **36. Posted Documents**

- .1 Post legible versions of the following documents on site:
  - .1 Site Specific 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 Health and Safety Coordinator, 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.

### **37. Meetings**

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

### **38. 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 01 35 33**

## **PART 1– GENERAL**

### 1.1 REFERENCES

- .1 Species at Risk
  - .1 Protect all Species at Risk, including all federal, provincial, and municipal laws and regulation.
  - .2 Modify Work procedures, including stopping Work, as instructed by Departmental Representative to protect Species at Risk.
- .2 Contaminated Sites Section, Earthworks for Minor Works (Section 31 00 99)
- .3 Archaeological Resources Section, Earthworks for Minor Works (Section 31 00 99)

### 1.2 DEFINITION

- .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; 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.
- .3 Environmental protection plan to include:
  - .1 Names of persons responsible for ensuring adherence to Environmental Protection Plan.
  - .2 Names and qualifications of persons responsible for manifesting contaminated materials and hazardous waste to be removed from site.
  - .3 Names and qualifications of persons responsible for training site personnel.
  - .4 Descriptions of environmental protection personnel training program.
  - .5 Erosion and Sediment Control Plan which identifies type and location of erosion and sediment controls to be provided including monitoring and reporting requirements to assure that control measures are in compliance with Erosion and Sediment Control Plan, Federal, Provincial, and Municipal laws and regulations.
  - .6 Spill Control Plan: including procedures, instructions, and reports to be used in event of unforeseen spill of regulated substance.
  - .7 Non-Hazardous solid waste disposal plan identifying methods and locations for solid waste disposal including clearing debris.
  - .8 Air pollution control plan detailing provisions to assure that dust, debris, materials, and trash, do not become air borne and travel off project site.
  - .9 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.

- .10 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.
- .11 The contractor shall contain dust, debris and tailings from drilling/coring activities using wetting and HEPA vacuum.
- .12 Provide temporary dust tight screens or partitions to localize dust generating activities, and for protection of workers, finished areas of work and the public.
- .13 Historical, Archaeological, Cultural Resources, Biological Resources and Valued Habitat Protection identifying methods, means and sequences for preventing, monitoring, and controlling protection of historical, archaeological, cultural resources, biological resources and valued habitat. Include procedures if previously unknown historical, archaeological, cultural and biological resources are discovered during Work. Includes Species at Risk.

#### 1.4 FIRES

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

#### 1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Accomplish maximum control of construction waste to preserve environment and prevent pollution and environmental damage
  - .1 All disposal, recycling and waste manifests shall be provided to the Departmental Representative.
  - .2 Ensure proper disposal procedures in accordance with all applicable regulations.
  - .3 Contractor to provide all disposal certificates, receipts, and other applicable documentation for removal and disposal of existing hazardous materials in accordance with requirements
- .2 Identify opportunities for waste reduction, reuse, and recycling of materials.
- .3 Provide on-site facilities for collection, handling, and storage of anticipated quantities of reusable and recyclable materials.
- .4 Provide containers to deposit reusable and recyclable materials
- .5 Remove from site and dispose of all packaging materials at appropriate recycling facilities.
- .6 Collect handle, store on-site, and transport off-site, salvaged materials in separated condition.
- .7 Store materials to be reused, salvaged, and salvaged in locations as directed by the Departmental Representative.
- .8 Unless otherwise specified, materials for removal become Contractors property.
- .9 Separate non-salvageable materials from salvaged items. Transport and deliver non-salvageable items to licensed disposal facility.
- .10 Do not bury rubbish and waste materials on site.
- .11 Do not dispose of wastes into water courses, storm, or sanitary sewers.
- .12 Place materials defined as hazardous or toxic in designated containers.
- .13 Divert unused aggregate materials from landfill to facility for reuse as approved by Department Representative.
- .14 Dispose of unused paint and paint thinner materials at official hazardous material collections site as approved by Department Representative.
- .15 Fold up metal banding, flatten and place in designated area for recycling.

- .16 Do not dispose of unused paint thinner material into sewer system, into streams, lakes, onto ground or in other location where it will pose health environmental hazard.
  - .17 Divert unused asphalt from landfill to facility capable of recycling materials.
  - .18 Conduct daily cleaning operations as work progresses.
  - .19 Conduct Final cleaning when work is complete, prior to final inspection.
- 1.6 WORK ADJACENT TO WATERWAY
- .1 Do not dump waste material or debris in waterways.
- 1.7 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 Cover or wet down dry materials and rubbish to prevent blowing dust and debris.
- 1.8 NOTIFICATION
- .1 Departmental Representative will notify Contractor in writing of observed non-compliance with Federal, Provincial or Municipal environmental laws or regulations, permits, and other elements of Contractor's Environmental Protection plan.
  - .2 Contractor: after receipt of such notice, inform Departmental Representative of proposed corrective action and take such action for approval by Departmental Representative.
  - .3 Departmental Representative will issue stop order of work until satisfactory corrective action has been taken.
  - .4 No time extensions granted or equitable adjustments allowed to Contractor for such suspensions.
- 1.9 SPILLS OR RELEASE OF DELETERIOUS SUBSTANCES
- .1 Measures to be implemented to prevent, control or mitigate spills or release of deleterious substances:
    - .1 Contractor shall take due care to ensure no deleterious materials enter watercourses or any surface drainage pathways located in the project area.
    - .2 Emergency response procedure for spills of deleterious substances must be in place. In the event of a spill, the contractor will immediately implement their Spill Response Protocol.
    - .3 The Contractor is responsible for all costs associated with a spill or release as a result of their actions. This will include but not limited costs of spill response equipment and materials, associated sampling, analysis and any required restoration of the impacted area.
    - .4 Response equipment to be on site at all times (i.e. spill kits) and workers trained in their location and use. The resources on hand must be sufficient to respond effectively and expediently to any spill that could occur on site.
    - .5 All construction equipment brought onto the site will be clean and properly maintained.
    - .6 Any equipment maintenance must occur in a designated area and must be conducted away from any surface water drains or collection points.
    - .7 Any equipment remaining on site overnight shall have appropriately placed drip pans.
    - .8 Waste generated will be prevented from entering the environment.
  - .2 Prevent discharges containing asphalt, grout, concrete or other waste materials from reaching storm drains or the marine environment.

1.10 CLEANING

- .1 Conduct daily cleaning and disposal operations. Comply with local ordinances and anti-pollution laws.
- .2 Ensure cleanup of the work areas each day after the completion of work.
- .3 No washing out of concrete trucks is permitted on site.
- .4 Complete daily cleaning activities of all roadways and parking lot areas affected by work and by construction equipment traffic.

**END OF SECTION 01 35 43**



**PART 1– GENERAL**

**1.1 INSPECTION**

- .1 Allow Department Representative access to Work. If part of Work is in preparation at locations other than Work Site, 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 Work Site.
- .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 Department Representative will order part of Work to be examined if Work is suspected to be not in accordance with Contract Documents. If, upon examination such work is found not in accordance with Contract Documents, correct such Work and pay cost of examination and correction.

**1.2 INDEPENDENT INSPECTION AGENCIES**

- .1 Contractor shall engage and pay for Independent Inspection/Testing Agencies for the purposes of Quality Control to ensure that Work meets the requirements of the Contract Documents. Contractor shall submit the document of Independent Inspection/Testing Agencies to Departmental Representative for approval.
- .2 Provide equipment required for executing inspection and testing by appointed agencies.
- .3 Employment of inspection/testing agencies does not relax responsibility to perform Work in accordance with Contract Documents.
- .4 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 Department Representative at no cost to Department Representative. Pay costs for retesting and re-inspection.

**1.3 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.

**1.4 PROCEDURES**

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

**1.5 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 Department 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.

1.6 REPORTS

.1 Submit 2 copies of inspection and test reports to Department Representative.

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

**END OF SECTION 01 45 00**

## **PART 1– GENERAL**

### 1.1 GENERAL

- .1 Section 01 55 00 addresses general requirements for temporary vehicle movement, site access and parking not incorporated into the final or permanent work, as well as traffic control during construction. This section must be referenced to and interpreted simultaneously with all other sections pertinent to the works described herein.
- .2 During progress of the Work, make adequate provision to accommodate normal traffic along onsite roads immediately adjacent to or crossing the Works so as to minimize inconvenience to site operations.
- .3 Give minimum 48 h notice or as otherwise required by Departmental Representative to local police, fire departments, emergency services, and site operations staff prior to beginning construction on roadways and comply in all respects with their requirements.
- .4 Inform Departmental Representative and tenants where access is affected at least 24 hours in advance of proposed road and/or sidewalk closures.

### 1.2 SUBMITTALS

- .1 Make submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Contractor to submit traffic control plan to Departmental Representative for review and approval prior to construction.

### 1.3 TEMPORARY ACCESS ROADS

- .1 Provide and maintain temporary access roads at locations approved by the Departmental Representative.

### 1.4 TEMPORARY PARKING AREAS

- .1 Parking will be permitted within the contractor's work area only. Parking outside of the contractor's work area is not permitted.

### 1.5 TRAFFIC CONTROL

- .1 Comply with requirements of the "Traffic Control Manual for Work on Roadways", published by the British Columbia Ministry of Transportation, for regulation of vehicle and pedestrian traffic or use of roadways upon or over which it is necessary to carry out work or haul materials or equipment.
- .2 Regulate traffic in general accordance with William Head Institution requirements for uninterrupted access to all parts of this site except where specified otherwise and in compliance with specific requirements stipulated herein.
- .3 Provide and maintain access to corridors specified on Contract Drawings.
- .4 Provide and maintain reasonable road access and egress to tenants fronting along or in vicinity of work under contract unless approved otherwise by Departmental Representative.
- .5 One way alternating traffic will generally be permitted during work involving road crossings. Do not close any lanes of road or highway without prior approval of the Departmental Representative. Before re-routing traffic erect suitable signs and devices as approved by the Departmental Representative. Provide sufficient crushed gravel to ensure a smooth riding surface during work. Replace surface asphalt within one week of completing the trench backfilling.
- .6 Keep travelled way well graded, free of pot holes and of sufficient width that required number of lanes of traffic may pass.

- .7 When directed by Departmental Representative, provide well graded, graveled detours or temporary roads to facilitate passage of traffic around restricted construction area. Provide and maintain signs and lights and maintain roadway.
- .8 When working on travelled way:
  - .1 Place equipment in such position as to present a minimum of interference and hazard to the travelling public.
  - .2 Keep equipment units as close together as working conditions will permit and preferably on same side of travelled way.
  - .3 Do not leave equipment on travelled way overnight.
- .9 Traffic Control Informational and Warning Devices
  - .1 Meet with Departmental Representative prior to commencement of work to prepare list of signs and other devices required for project.
  - .2 Provide and maintain signs and other devices required to indicate construction activities or other temporary and unusual conditions resulting from project work which may require road user response.
  - .3 Supply and erect signs, delineators, barricades and other miscellaneous warning devices in accordance with Departmental Representative requirements.
  - .4 Place signs and other devices in additional locations as appropriate or as directed by the Departmental Representative.
  - .5 Continually maintain traffic control devices in use by:
    - .1 Checking signs daily for legibility, damage, suitability and location. Clean, repair or replace to ensure clarity and reflectance.
    - .2 Removing or covering signs which do not apply to conditions existing from day to day.
- .10 Control of Traffic Using Flaggers
  - .1 Provide flag persons, trained and properly equipped for the following situations:
    - .1 When facility operations traffic is required to pass working vehicles or equipment which may block all or part of travelled roadway.
    - .2 When it is necessary to institute one-way traffic system through construction area or other blockage where traffic signal system is not in use.
    - .3 When workers or equipment are employed on travelled way.
- .11 Provide and maintain suitable detours or temporary access routes for pedestrian traffic, complete with suitable warning and advisory signs.
- .12 Maintain existing conditions for traffic throughout period of contract expect that, when required for construction under contract and when measures have been taken as specified herein and approved by Departmental Representative to protect and control public traffic, existing conditions for traffic may be restricted.

**END OF SECTION 01 55 00**

**PART 1– GENERAL**

**1.1 SUBMISSION**

- .1 Prepare instructions and data by personnel experienced in maintenance of described products.
- .2 Revise content of documents as required before final submittal.
- .3 If requested, furnish evidence as to type, source and quality of products provided.
- .4 Defective products will be rejected, regardless of previous inspections. Replace products at own expense.

**1.2 FORMAT**

- .1 Organize data in the form of an instructional manual.
- .2 Binders: vinyl, hard covered, 3 "D" ring, loose leaf 219 x 279 mm with spine and face pockets.
- .3 Cover: identify each binder with type or printed title "Project Record Documents"; list title of project and identify subject matter of contents.
- .4 Arrange content by product under section numbers and sequence of Table of Contents.
- .5 Provide tabbed fly leaf for each separate product, with typed description of product and major component parts of equipment.
- .6 Text: manufacturer's printed data, or typewritten data.
- .7 Drawings: provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

**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 Departmental Representative and Contractor with name of responsible parties.
  - .4 Schedule of products, indexed to content of volume.
- .2 For each product, 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.

**1.4 AS-BUILT DOCUMENTS**

- .1 Contract drawings and shop drawings: legibly mark each item to record actual construction, including:
  - .1 Field changes of dimension and detail.
  - .2 Changes made by change orders.
  - .3 Details not on original Contract drawings.
  - .4 References to related shop drawings and modifications.

- .2 Contract Specifications: legibly mark each item to record actual "Workmanship of Construction", including:
  - .1 Manufacturer, trade name, and catalogue number of each "Product/Material" actually installed, particularly optional items and substitute items.
  - .2 Changes made by addenda and change orders.
- .3 As-built information:
  - .1 Record changes in red ink.
  - .2 On site "Red Line" As-Built documents to be reviewed with Departmental Representative at project meetings to ensure up-to-date and accurate As-Built documents at the end of the project.
  - .3 Mark on 1 set of drawings, specifications and shop drawings at completion of project and, before final inspection.
  - .4 Submit to the Departmental Representative.

#### 1.5 TEST RESULTS & 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 principals.
- .3 Obtain Test Result and 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.

#### 1.6 COMPLETION

- .1 Submit a written certificate that the following have been performed by the Contractor:
  - .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 as required.
- .2 Work is complete and ready for final inspection.

**END OF SECTION 01 78 30**

**PART 1- GENERAL**

1.1 RELATED REQUIREMENTS

- .1 Section 03 20 00 – Concrete Reinforcing
- .2 Section 03 30 00 – Cast-in-place Concrete

1.2 REFERENCE STANDARDS

- .1 American Concrete Institute (ACI):
  - .1 ACI 347, Guide to Formwork for Concrete.
- .2 Canadian Standards Association (CSA International)
  - .1 CSA-A23.1-14/A23.2-14, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
  - .2 CSA-O86-14, Engineering Design in Wood.
  - .3 CSA O121-08 (R2013), Douglas Fir Plywood.
  - .4 CSA O325-16, Construction Sheathing.
  - .5 CSA S269.1-16, Falsework and Formwork.
- .3 Underwriters' Laboratories of Canada (ULC)
  - .1 CAN/ULC-S701-11, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit shop drawings for formwork and falsework.
  - .1 Submit drawings stamped and signed by professional engineer registered or licensed in British Columbia, Canada.
- .3 Submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 35 33 – Health and Safety Requirements.
- .4 Indicate method and schedule of construction, shoring, stripping and re-shoring procedures, materials, arrangement of joints, special architectural exposed finishes, ties, liners, and locations of temporary embedded parts. Comply with CSA S269.1, for falsework and formwork drawings.
- .5 Indicate formwork design data: permissible rate of concrete placement, and temperature of concrete, in forms.
- .6 Indicate sequence of erection and removal of formwork/falsework as directed by Departmental Representative.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Store and manage hazardous materials in accordance with Section 01 35 33 – Health and Safety Requirements and Section 01 35 43 Environmental Procedures.
- .2 Waste Management and Disposal:
  - .1 Separate waste materials for recycling and reuse in accordance with Section 01 35 43 – Environmental Procedures.
  - .2 Place materials defined as hazardous or toxic in designated containers.
  - .3 Divert wood materials from landfill to a recycling, reuse, or composting facility as approved by Departmental Representative.
  - .4 Divert plastic materials from landfill to a reuse or recycling facility as approved by Departmental Representative.

- .5 Divert unused form release material from landfill to an official hazardous material collections site as approved by the Departmental Representative.

## **PART 2 - PRODUCTS**

### 2.1 MATERIALS

- .1 Formwork materials:
  - .1 For concrete without special architectural features, use wood and wood product formwork materials to CSA-S269.1, CSA-O121, and CAN/CSA-O86.
  - .2 For concrete with special architectural features, use formwork materials to CSA-A23.1/A23.2.
  - .3 Rigid insulation board: to CAN/ULC-S701.
- .2 Tubular column forms: round, spirally wound laminated fibre forms, internally treated with release material.
  - .1 Spiral pattern not to show in hardened concrete.
- .3 Form ties:
  - .1 For concrete not designated 'Architectural', use removable or snap-off metal ties, fixed or adjustable length, free of devices leaving holes larger than 25 mm diameter in concrete surface.
  - .2 For Architectural concrete, use snap ties complete with plastic cones and light grey concrete plugs.
- .4 Form liner:
  - .1 Plywood: medium density overlay Douglas Fir to CSA O121, square edge, 19mm thickness.
- .5 Form release agent: non-toxic, biodegradable, low VOC.
- .6 Form stripping agent: colourless mineral oil, non-toxic, biodegradable, low VOC, free of kerosene, with viscosity between 70 and 110s Saybolt Universal free at 40 degrees C, flashpoint minimum 150 degrees C, open cup.
- .7 Falsework materials: to CSA-S269.1.
- .8 Sealant: to Section 07 92 00 - Joint Sealants.

## **PART 3 - EXECUTION**

### 3.1 FABRICATION AND ERECTION

- .1 Verify lines, levels and centres before proceeding with formwork/falsework and ensure dimensions agree with drawings.
- .2 Obtain Departmental Representative's approval for use of earth forms not indicated on drawings.
- .3 Hand trim sides and bottoms and remove loose earth from earth forms before placing concrete.
- .4 Fabricate and erect falsework in accordance with CSA S269.1.
- .5 Refer to architectural drawings for concrete members requiring architectural exposed finishes.
- .6 Do not place shores and mud sills on frozen ground.
- .7 Provide site drainage to prevent washout of soil supporting mud sills and shores.
- .8 Fabricate and erect formwork in accordance with CSA-S269.1 to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CSA-A23.1/A23.2.



- .9 Align form joints and make watertight.
  - .1 Keep form joints to minimum.
- .10 Locate horizontal form joints for exposed columns 2400 mm above finished floor elevation.
- .11 Use 25 mm chamfer strips on external corners and/or 25 mm fillets at interior corners, joints, unless specified otherwise.
- .12 Form chases, slots, openings, drips, recesses, expansion and control joints as indicated.
- .13 Construct forms for architectural concrete, and place ties as directed by Departmental Representative.
  - .1 Joint pattern not necessarily based on using standard size panels or maximum permissible spacing of ties.
- .14 Build in anchors, sleeves, and other inserts required to accommodate Work specified in other sections.
  - .1 Ensure that anchors and inserts will not protrude beyond surfaces designated to receive applied finishes, including painting.
- .15 Clean formwork in accordance with CSA-A23.1/A23.2, before placing concrete.

### 3.2 REMOVAL AND RESHORING

- .1 Leave formwork in place for following minimum periods of time after placing concrete.
  - .1 3 days for walls and sides of beams.
  - .2 3 days for columns.
  - .3 1 day for footings.
- .2 Remove formwork when concrete has reached 67% of its specified concrete strength.
- .3 Provide necessary reshoring of members where early removal of forms may be required or where members may be subjected to additional loads during construction as required.
- .4 Space reshoring in each principal direction by design.
- .5 Maintain falsework supporting beams and slabs until concrete has reached at least 75% of its specified 28 day strength.
- .6 Keep falsework or reshoring in place for a minimum of 28 days unless longer time is required to reach the specified concrete strength.
- .7 Re-use formwork and falsework subject to requirements of CSA-A23.1/A23.2.

**END OF SECTION 03 10 00**

**PART 1- GENERAL**

1.1 RELATED REQUIREMENTS

- .1 Section 03 10 00 – Concrete Forming and Accessories
- .2 Section 03 30 00 – Cast-in-place Concrete

1.2 REFERENCE STANDARDS

- .1 American Concrete Institute (ACI)
  - .1 SP-66-04, ACI Detailing Manual.
- .2 ASTM International
  - .1 ASTM A143/A143M-07(2014), Standard Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement.
  - .2 ASTM A767/A767M-16 Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement.
  - .3 ASTM A775/A775M-16, Standard Specification for Epoxy-Coated Reinforcing Steel Bars.
  - .4 ASTM A1064/A1064M-16b, Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
- .3 CSA International
  - .1 CSA-A23.1-14/A23.2-14, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
  - .2 CAN/CSA-A23.3-14, Design of Concrete Structures.
  - .3 CSA-G30.18-09(R2014), Carbon Steel Bars for Concrete Reinforcement.
  - .4 CSA-G40.20/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
  - .5 CSA W186-M1990(R2012), Welding of Reinforcing Bars in Reinforced Concrete Construction.
- .4 Reinforcing Steel Institute of Canada (RSIC)
  - .1 RSIC-2004, Reinforcing Steel Manual of Standard Practice.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Prepare reinforcement drawings in accordance with SP-66 and RSIC Manual of Standard Practice.
- .3 Shop Drawings:
  - .1 Submittal of shop drawings is not required.
    - .1 Indicate placing of reinforcement and:
      - .1 Bar bending details.
      - .2 Lists.
      - .3 Quantities of reinforcement.

- .4 Sizes, spacings, locations of reinforcement and mechanical splices if approved by Departmental Representative, with identifying code marks to permit correct placement without reference to structural drawings.
- .5 Indicate sizes, spacings and locations of chairs, spacers and hangers.
- .2 Detail lap lengths and bar development lengths to CAN/CSA-A23.3, unless otherwise indicated.
  - .1 Provide Class B, unless otherwise indicated.
- .4 When Chromate solution is used as replacement for galvanizing non-prestressed reinforcement, provide product description for review by Departmental Representative prior to its use.

#### 1.4 QUALITY ASSURANCE

- .1 Submit in accordance with Section 01 45 00 - Quality Control and as described in PART 2 - SOURCE QUALITY CONTROL.
  - .1 Mill Test Report: Upon request, provide Departmental Representative with certified copy of mill test report of reinforcing steel, minimum 4 weeks prior to beginning reinforcing work.
  - .2 Upon request submit in writing to Departmental Representative proposed source of reinforcement material to be supplied.

#### 1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Specifications and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials off ground and in accordance with manufacturer's recommendations.
  - .2 Replace defective or damaged materials with new.
- .4 Develop Waste Reduction Workplan and Construction Waste Management Plan related to Work of this Section and in accordance with Section 01 35 43 Environmental Procedures.

### **PART 2 - PRODUCTS**

#### 2.1 MATERIALS

- .1 Substitute different size bars only if permitted in writing by Departmental Representative.
- .2 Reinforcing steel: billet steel, grade 400, deformed bars to CSA-G30.18, unless indicated otherwise.
- .3 Reinforcing steel: weldable low alloy steel deformed bars to CSA-G30.18.
- .4 Cold-drawn annealed steel wire ties: to ASTM A1064/A1064M.
- .5 Deformed steel wire for concrete reinforcement: to ASTM A1064/A1064M.
- .6 Welded steel wire fabric: to ASTM A1064/A1064M.
  - .1 Provide in flat sheets only.
- .7 Welded deformed steel wire fabric: to ASTM A1064/A1064M.
  - .1 Provide in flat sheets only.

- .8 Epoxy Coating of non-prestressed reinforcement: to ASTM A775/A775M.
- .9 Galvanizing of non-prestressed reinforcement: to ASTM A767/A767M, minimum zinc coating 610 g/m<sup>2</sup>.
  - .1 Protect galvanized reinforcing steel with chromate treatment to prevent reaction with Portland cement paste.
  - .2 If chromate treatment is carried out immediately after galvanizing, soak steel in aqueous solution containing minimum 0.2% by weight sodium dichromate or 0.2% chromic acid.
    - .1 Temperature of solution equal to or greater than 32 degrees and galvanized steels immersed for minimum 20 seconds.
  - .3 If galvanized steels are at ambient temperature, add sulphuric acid as bonding agent at concentration of 0.5% to 1%.
    - .1 In this case, no restriction applies to temperature of solution.
  - .4 Chromate solution sold for this purpose may replace solution described above, provided it is of equivalent effectiveness.
    - .1 Provide product description as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
- .10 Chairs, bolsters, bar supports, spacers: to CSA-A23.1/A23.2.
- .11 Mechanical splices: subject to approval of Departmental Representative.
- .12 Plain round bars: to CSA-G40.20/G40.21.

## 2.2 FABRICATION

- .1 Fabricate reinforcing steel in accordance with Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada, SP-66, and CSA-A23.1/A23.2.
- .2 Obtain Departmental Representative's written approval for locations of reinforcement splices other than those shown on placing drawings.
- .3 Upon approval of Departmental Representative, weld reinforcement in accordance with CSA W186.
- .4 Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and lists.
  - .1 Ship epoxy coated bars in accordance with ASTM A775A/A775M.

## 2.3 SOURCE QUALITY CONTROL

- .1 Upon request, provide Departmental Representative with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis, minimum 4 weeks prior to beginning reinforcing work.
- .2 Upon request inform Departmental Representative of proposed source of material to be supplied.

## **PART 3 - EXECUTION**

### 3.1 PREPARATION

- .1 Galvanizing to include chromate treatment.
  - .1 Duration of treatment to be 1 hour per 25 mm of bar diameter.
- .2 Conduct bending tests to verify galvanized bar fragility in accordance with ASTM A143/A143M.

**3.2 FIELD BENDING**

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

**3.3 PLACING REINFORCEMENT**

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

**3.4 FIELD TOUCH-UP**

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

**3.5 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 35 43 Environmental Procedures.
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 35 43 Environmental Procedures.
- .3 Waste Management: separate waste materials for recycling and reuse in accordance with 01 35 43 Environmental Procedures.

**END OF SECTION 03 20 00**

**PART 1**

**GENERAL**

1.1 RELATED REQUIREMENTS

- .1 Section 03 10 00 – Concrete Forming and Accessories
- .2 Section 03 20 00 – Concrete Reinforcing

1.2 REFERENCE STANDARDS

- .1 ASTM International
  - .1 ASTM C260/C260M-10a(2016), Standard Specification for Air-Entraining Admixtures for Concrete.
  - .2 ASTM C309-11, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
  - .3 ASTM C494/C494M-16, Standard Specification for Chemical Admixtures for Concrete.
  - .4 ASTM C1017/C1017M-13e1, Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
  - .5 ASTM D412-06ae2, Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension.
  - .6 ASTM D624-00(2012), Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomer.
  - .7 ASTM D1751-04(2013)e1, Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
  - .8 ASTM D1752-04a(2013), Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-37.2-M88, Emulsified Asphalt, Mineral Colloid-Type, Unfilled, for Dampproofing and Waterproofing and for Roof Coatings.
  - .2 CAN/CGSB-51.34-M89, Vapour Barrier, Polyethylene Sheet for Use in Building Construction.
- .3 CSA International
  - .1 CSA A23.1/A23.2-14, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
  - .2 CSA A283-06(R2016), Qualification Code for Concrete Testing Laboratories.
  - .3 CSA A3000-13, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).

1.3 ABBREVIATIONS AND ACRONYMS

- .1 Portland Cement: hydraulic cement, blended hydraulic cement (XXb - b denotes blended) and Portland-limestone cement.
  - .1 Type GU, GUb and GUL - General use cement.
  - .2 Type MS and MSb - Moderate sulphate-resistant cement.
  - .3 Type MH, MHb and MHL - Moderate heat of hydration cement.
  - .4 Type HE, HEb and HEL - High early-strength cement.
  - .5 Type LH, LHb and LHL - Low heat of hydration cement.

- .6 Type HS and HSb - High sulphate-resistant cement.
- Fly ash:
  - .7 Type F - with CaO content less than 15%.
  - .8 Type CI - with CaO content ranging from 15 to 20%.
  - .9 Type CH - with CaO greater than 20%.
- .2 GGBFS - Ground, granulated blast-furnace slag.
- 1.4 ADMINISTRATIVE REQUIREMENTS
  - .1 Pre-installation Meetings: convene pre-installation meeting one week prior to beginning concrete works.
    - .1 Ensure Site supervisor, concrete producer, testing laboratories, speciality contractor - finishing, forming, Departmental Representative, and other key personnel attend.
      - .1 Verify project requirements.
- 1.5 ACTION AND INFORMATIONAL SUBMITTALS
  - .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
  - .2 Provide concrete mix designs for review by Departmental Representative.
  - .3 Provide testing reports for review by Departmental Representative and do not proceed without written approval when deviations from mix design or parameters are found.
  - .4 Provide adhesive anchoring system data for review by Departmental Representative. Data to include product description, testing and product evaluation certifications, and factored design resistances in both uncracked and cracked concrete.
  - .5 Submit composite layout drawings showing embedded items, sleeves, and openings required by all trades for review by Departmental Representative. Do not install any sleeves or openings which are not shown on structural drawings without approval of Departmental Representative.
  - .6 Concrete pours: provide accurate records of poured concrete items indicating date and location of pour, quality, air temperature and test samples taken as described in PART 3 - FIELD QUALITY CONTROL.
  - .7 Concrete hauling time: provide for review by Departmental Representative deviations exceeding maximum allowable time of 120 minutes for concrete to be delivered to site of Work and discharged after batching.
  - .8 Provide copy of WHMIS MSDS in accordance with Section 01 35 33 - Health and Safety Requirements.
- 1.6 QUALITY ASSURANCE
  - .1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.
  - .2 Provide Departmental Representative, minimum 4 weeks prior to starting concrete work, with valid and recognized certificate from plant delivering concrete.
    - .1 Provide test data and certification by qualified independent inspection and testing laboratory that materials and mix designs used in concrete mixture will meet specified requirements.
  - .3 Minimum 4 weeks prior to starting concrete work, provide proposed quality control procedures for review by Departmental Representative on following items:

- .1 Falsework erection.
- .2 Hot weather concrete.
- .3 Cold weather concrete.
- .4 Curing.
- .5 Finishes.
- .6 Formwork removal.
- .7 Joints.
- .4 Quality Control Plan: provide written report to Departmental Representative verifying compliance that concrete in place meets performance requirements of concrete as established in PART 2 - PRODUCTS.

**1.7 DELIVERY, STORAGE AND HANDLING**

- .1 Delivery and Acceptance Requirements:
  - .1 Concrete hauling time: deliver to site of Work and discharged within 120 minutes maximum after batching.
    - .1 Do not modify maximum time limit without receipt of prior written agreement from Departmental Representative and concrete producer as described in CSA A23.1/A23.2.
    - .2 Deviations to be submitted for review by Departmental Representative.
  - .2 Concrete delivery: ensure continuous concrete delivery from plant meets CSA A23.1/A23.2.
- .2 Packaging Waste Management: remove for reuse and return of pallets, padding, packaging materials in accordance with Section 01 74 19 - Waste Management and Disposal.

**PART 2      PRODUCTS**

**2.1 DESIGN CRITERIA**

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

**2.2 PERFORMANCE CRITERIA**

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

**2.3 MATERIALS**

- .1 Portland Cement: to CSA A3001, Type GU.
  - .1 Reduction in cement from Base Mix to Actual Supplementary Cementing Materials (SCMs) Mix, as percentage.
- .2 Blended hydraulic cement: Type GU<sub>b</sub> to CSA A3001.
- .3 Portland-limestone cement: Type GUL to CSA A23.1.
- .4 Supplementary cementing materials: with minimum 20% fly ash replacement, by mass of total cementitious materials to CSA A3001.
- .5 Water: to CSA A23.1.



- .6 Aggregates: to CSA A23.1/A23.2.
  - .7 Admixtures:
    - .1 Air entraining admixture: to ASTM C260.
    - .2 Chemical admixture: to ASTM C1017 and ASTM C494. Departmental Representative to approve accelerating or set retarding admixtures during cold and hot weather placing.
  - .8 Shrinkage compensating grout: premixed compound consisting of non-metallic aggregate, Portland cement, water reducing and plasticizing agents to CSA A23.1/A23.2.
    - .1 Compressive strength: 50 MPa at 28 days.
  - .9 Non-premixed dry pack grout: composition of non-metallic aggregate Portland cement with sufficient water for mixture to retain its shape when made into ball by hand and capable of developing compressive strength of 50 MPa at 28 days.
  - .10 Curing compound: to CSA A23.1/A23.2 and ASTM C309, Type 1-chlorinated rubber.
  - .11 Type 1 Waterstops: ribbed extruded PVC of sizes indicated with shop welded corner and intersecting pieces with legs not less than 600 mm long:
    - .1 Tensile strength: to ASTM D412, method A, Die "C", minimum 48 MPa.
    - .2 Elongation: to ASTM D412, method A, Die "C", minimum 275%.
    - .3 Tear resistance: to ASTM D624, method A, Die "B", minimum 30 kN/m.
  - .12 Type 2 Waterstops:
    - .1 Bentonite waterstop.
  - .13 Premoulded joint fillers:
    - .1 Bituminous impregnated fibre board: to ASTM D1751.
    - .2 Sponge rubber: to ASTM D1752, Type I, flexible grade.
  - .14 Weep hole tubes: plastic.
  - .15 Polyethylene film: 0.25 mm thickness to CAN/CGSB-51.34.
- 2.4 MIXES
- .1 Alternative 1 - Performance Method for specifying concrete: to meet Departmental Representative performance criteria to CSA A23.1/A23.2.
    - .1 Ensure concrete supplier meets performance criteria as established below and provide verification of compliance as in Quality Control Plan.
    - .2 Provide concrete mix to meet following plastic state requirements:
      - .1 Uniformity: uniform density, air content, and slump.
      - .2 Workability: free of segregation, surface blemishes, loss of mortar, and colour variations.
      - .3 Finishability: to CSA A23.1/A23.2.
    - .3 Provide concrete mix to meet following hard state requirements:
      - .1 Mix: Type 1
        - .1 Durability and class of exposure: N.
        - .2 Compressive strength at 28 day age: 25 MPa minimum.
        - .3 Intended application: Typical unless noted otherwise.
        - .4 Aggregate size: 20mm maximum

- .2 Mix: Type 2
  - .1 Durability and class of exposure: F-2.
  - .2 Compressive strength at 28 day age: 30 MPa minimum.
  - .3 Intended application:
    - .1 Exterior walls, columns, suspended slabs, beams exposed to freezing and thawing (above water table elevation 2.0m geodetic noted on drawings).
    - .2 Duct banks above water table elevation 2.0m geodetic noted on drawings.
  - .4 Aggregate size: 20mm maximum
- .3 Mix: Type 3
  - .1 Durability and class of exposure: N.
  - .2 Compressive strength at 28 day age: 30 MPa minimum.
  - .3 Intended application: Suspended slabs, beams, walls, and columns.
  - .4 Aggregate size: 20mm maximum
- .4 Mix: Type 4
  - .1 Durability and class of exposure: C-1.
  - .2 Compressive strength at 28 day age: 35 MPa minimum.
  - .3 Intended application:
    - .1 Duct banks below water table elevation 2.0m geodetic noted on drawings.
    - .2 Reinforced slabs on grade exposed to chlorides and freezing and thawing.
    - .3 Footings, foundation walls, and columns below water table elevation 2.0m geodetic noted on drawings.
  - .4 Aggregate size: 20mm maximum
- .4 Provide quality management plan to ensure verification of concrete quality to specified performance.
- .5 Concrete supplier's certification: both batch plant and materials meet CSA A23.1 requirements.

### **PART 3**      **EXECUTION**

#### 3.1      PREPARATION

- .1 Obtain Departmental Representative's written approval before placing concrete.
  - .1 Provide 24 hours minimum notice prior to placing of concrete.
- .2 Place concrete reinforcing in accordance with Section 03 20 00 - Concrete Reinforcing.
- .3 During concreting operations:
  - .1 Development of cold joints not allowed.
  - .2 Ensure concrete delivery and handling facilitates placing with minimum of re-handling, and without damage to existing structure or Work.
- .4 Pumping of concrete is permitted only after approval of equipment and mix.

- .5 Ensure reinforcement and inserts are not disturbed during concrete placement.
- .6 Prior to placing of concrete obtain Departmental Representative's approval of proposed method for protection of concrete during placing and curing in adverse weather.
- .7 Protect previous Work from staining.
- .8 Clean and remove stains prior to application for concrete finishes.
- .9 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.
- .10 Do not place load upon new concrete until authorized by Departmental Representative.

### 3.2 INSTALLATION/APPLICATION

- .1 Do cast-in-place concrete work to CSA A23.1/A23.2.
- .2 Sleeves and inserts:
  - .1 Do not permit penetrations, sleeves, ducts, pipes or other openings to pass through joists, beams, column capitals or columns, except where indicated or approved by Departmental Representative.
  - .2 Where approved by Departmental Representative, set sleeves, ties, pipe hangers and other inserts and openings as indicated or specified elsewhere.
  - .3 Sleeves and openings greater than 100 x 100 mm not indicated, must be reviewed by Departmental Representative.
  - .4 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain written approval of modifications from Departmental Representative before placing of concrete.
  - .5 Confirm locations and sizes of sleeves and openings shown on drawings.
- .3 Anchor bolts:
  - .1 Set anchor bolts to templates in co-ordination with appropriate trade prior to placing concrete.
- .4 Drainage holes and weep holes:
  - .1 Form weep holes and drainage holes in accordance with Section 03 10 00 - Concrete Forming and Accessories. If wood forms are used, remove them after concrete has set.
  - .2 Install weep hole tubes and drains as indicated.
- .5 Grout under base plates and equipment using procedures in accordance with manufacturer's recommendations which result in 100 % contact over grouted area.
- .6 Finishing and curing:
  - .1 Finish concrete to CSA A23.1/A23.2.
  - .2 Use procedures as reviewed by Departmental Representative or those noted in CSA A23.1/A23.2 to remove excess bleed water. Ensure surface is not damaged.
  - .3 Use curing compounds compatible with applied finish on concrete surfaces.
  - .4 Finish concrete floor to CSA A23.1/A23.2. Class A.
  - .5 Concrete floor to have finish hardness equal to or greater than Mohs hardness to CSA A23.1/A23.2.
  - .6 Provide hand screeded and steel trowel finish unless otherwise indicated.

.7 Rub exposed sharp edges of concrete with carborundum to produce 3 mm minimum radius edges unless otherwise indicated.

.7 Waterstops:

- .1 Install waterstops to provide continuous water seal.
- .2 Do not distort or pierce waterstop in way as to hamper performance.
- .3 Do not displace reinforcement when installing waterstops.
- .4 Use equipment to manufacturer's requirements to field splice waterstops.
- .5 Tie waterstops rigidly in place.
- .6 Use only straight heat sealed butt joints in field.
- .7 Use factory welded corners and intersections unless otherwise approved by Departmental Representative.

.8 Joint fillers:

- .1 Furnish filler for each joint in single piece for depth and width required for joint, unless otherwise authorized by Departmental Representative.
- .2 When more than one piece is required for joint, fasten abutting ends and hold securely to shape by stapling or other positive fastening.
- .3 Locate and form expansion, isolation, construction joints as indicated.
- .4 Install joint filler.
- .5 Use 12 mm thick joint filler to separate slabs-on-grade from vertical surfaces and extend joint filler from bottom of slab to within 12 mm of finished slab surface unless indicated otherwise.

.9 Dampproof membrane:

- .1 Install dampproof membrane under concrete slabs-on-grade inside building.
- .2 Lap dampproof membrane minimum 150 mm at joints and seal.
- .3 Seal punctures in dampproof membrane before placing concrete.
- .4 Use patching material at least 150 mm larger than puncture and seal.

3.3 SURFACE TOLERANCE

- .1 Concrete tolerance to CSA A23.1. Straightedge Method to tolerance of 8mm in 3000mm.

3.4 FIELD QUALITY CONTROL

- .1 Site tests: conduct tests as follows in accordance with Section 01 45 00 - Quality Control and submit report as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
  - .1 Concrete pours.
  - .2 Slump.
  - .3 Air content.
  - .4 Compressive strength at 7 and 28 days.
  - .5 Air and concrete temperature.
- .2 Inspection and testing of concrete and concrete materials will be carried out by testing laboratory approved by Departmental Representative for review to CSA A23.1/A23.2.
  - .1 Ensure testing laboratory is certified to CSA A283.
- .3 Ensure test results are distributed for review by Departmental Representative.

- .4 Contractor will retain the testing laboratory and pay for costs of tests.
- .5 Contractor will take additional test cylinders during cold weather concreting. Cure cylinders on job site under same conditions as concrete which they represent.
- .6 Non-Destructive Methods for Testing Concrete: to CSA A23.1/A23.2.
- .7 Inspection or testing by Consultant will not augment or replace Contractor quality control nor relieve Contractor of his contractual responsibility.

3.5 **CLEANING**

- .1 Clean in accordance with Section 01 35 43 Environmental Procedures.
- .2 Waste Management: separate waste materials for recycling and reuse in accordance with Section 01 35 43 Environmental Procedures.
  - .1 Divert unused concrete materials from landfill to local facility after receipt of written approval from Departmental Representative.
  - .2 Provide appropriate area on job site where concrete trucks and be safely washed.
  - .3 Divert unused admixtures and additive materials (pigments, fibres) from landfill to official hazardous material collections site as approved by Departmental Representative.
  - .4 Do not dispose of unused admixtures and additive materials into sewer systems, into lakes, streams, onto ground or in other location where it will pose health or environmental hazard.
  - .5 Prevent admixtures and additive materials from entering drinking water supplies or streams.
  - .6 Using appropriate safety precautions, collect liquid or solidify liquid with inert, non-combustible material and remove for disposal.
  - .7 Dispose of waste in accordance with applicable local, Provincial/Territorial and National regulations.

**END OF SECTION 03 30 00**

## **PART 1– GENERAL**

### 1.1 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
  - .1 ASTM C88, Test Method for Soundness of Aggregates by Use of Sodium Sulphate or Magnesium Sulphate.
  - .2 ASTM C136, Method for Sieve Analysis of Fine and Coarse Aggregate.
  - .3 ASTM C117, Test Method for Material Finer than 0.075 mm Sieve in Mineral Aggregates by Washing.
  - .4 ASTM D1557, Specification for Test Methods for Aggregate Mixtures using 10 lb (4.54 kg) Rammer and 18 inch (457 mm) Drop.
  - .5 ASTM D698, Standard Test Methods for Moisture Density Relations of Soils and Soil Aggregate Mixtures using 2.49 kg Rammer and 304.8 mm Drop.
  - .6 ASTM D 2487 (2000), Classification of Soils for Engineering Purposes (Unified Soil Classification System).
  - .7 ASTM D 5434 (1997), Standard Guide for Field Logging of Subsurface Explorations of Soil and Rock.
- .2 Canadian Standards Association (CSA International)
  - .1 CSA-A23.1/A23.2-09, Concrete Materials and Methods of Concrete Construction.
- .3 Canadian council of Ministers of the Environment (CCME)
- .4 Canadian Environmental Quality Guidelines (CEQG)
- .5 CCME Canada-Wide Standard for Petroleum Hydrocarbons in Soil (CWS PHC)
- .6 Health Canada Guidelines for Canadian Drinking Water Quality (CDWQ)
- .7 Environment Canada Guidance Document on Federal Interim Groundwater Quality Guidelines for Federal Contaminated Sites (FIGQG)
- .8 Federal Environmental Quality Guidelines (FEQG)
- .9 BC Contaminated Sites Regulation (BCCSR)
- .10 BC Hazardous Waste Regulation (BCHWR)
- .11 BC Approved Water Quality Guidelines (BCAWQG)
- .12 BC Heritage Conservation Act

### 1.2 REGULATIONS

- .1 Protect slopes and banks and perform all work in accordance with Federal, Provincial and Municipal regulations whichever is more stringent.
- .2 Not later than one week before backfilling or filling, provide test results from the approved testing firm certifying the suitability of the chosen material. Ensure material is clean and free of seeds, to prevent introduction of invasive species.
- .3 Do not begin backfilling or filling operations until material has been approved for use by the Departmental Representative.
- .4 Not later than 48 hours before backfilling or filling with approved material, notify the Departmental Representative.
- .5 Before commencing work, conduct, with the Departmental Representative, condition survey of existing structures, trees and other plants, lawns, fencing, service poles, wires, rail tracks and paving, survey bench marks and monuments which may be affected by work.

1.3 BURIED SERVICES

- .1 Before commencing work verify the location of all buried services on and adjacent to the site.
- .2 Arrange with appropriate authority for relocation of buried services that interfere with execution of work. Pay costs of relocating services.

1.4 PROTECTION

- .1 Protect excavations from freezing.
- .2 Keep excavations clean, free of standing water, and loose soil.
- .3 Where soil is subject to significant volume change due to change in moisture content, cover and protect to the Departmental Representative's approval.
- .4 Protect natural and man-made features required to remain undisturbed. Unless otherwise indicated or located in an area to be occupied by new construction, protect existing trees from damage unless approved by the Departmental Representative.
- .5 Protect buried services that are required to remain undisturbed.
- .6 Midden and burial sites as shown on the drawings shall not be disturbed without prior written approval from the Departmental Representative.

**PART 2–PRODUCTS**

2.1 MATERIALS

- .1 Furnish all necessary materials, at a minimum furnish:
  - .1 8 mil minimum plastic sheeting for base of any stockpiles;
  - .2 8 mil plastic sheeting for covering of contaminated soil in any stockpiles.
- .2 Gravel to be composed of inert, durable material, reasonably uniform in quality and free from soft or disintegrated particles. In absence of satisfactory performance records over a five year period for particular source of material, soundness to be tested according to ASTM test procedure C-88 or latest revised issue. Maximum weight average losses for coarse and fine aggregates to be 30% when magnesium sulphate is used after five cycles.
- .3 All crushed gravel when tested according to ASTM C-136 and ASTM C-117, or latest revised issue, to have a generally uniform gradation and conform to following sieve must have one or more fractured faces. Determination of the Ministry of Transportation and Highways' Specification I-11, Fracture Count for Coarse Aggregate, Method "A", which determines fractured faces by count. The Plasticity Index for crushed gravel to not exceed 6.0.
- .4 Native material is workable soil free of organic or foreign matter; obtained within limits of Contract may be deemed native material if it is approved by the Departmental Representative. Native material may be reused only if tested and confirmed to be "Uncontaminated Soil" as approved by the Departmental Representative. Native material is not acceptable if it is contaminated or impracticable to control its water content or compact to specified density.

**PART 3–EXECUTION**

3.1 SITE PREPARATION

- .1 Remove obstructions, ice and snow, from surfaces to be excavated within limits indicated.
- .2 Cut pavement or sidewalk neatly along limits of proposed excavation in order that surface may break evenly and cleanly.

### 3.2 EXCAVATION

- .1 All excavated soil under this contract shall be treated as potentially contaminated soil. Excavate, handle and store excavated soil as per this Section and other related sections, as well as the relevant References listed in Section 1.1.
- .2 Topsoil stripping
  - .1 Do not handle topsoil while in wet or frozen condition or in any manner in which soil structure is adversely affected.
  - .2 Strip topsoil over areas to be covered by new construction, over areas where grade changes are required, and so that excavated material may be stockpiled without covering topsoil.
- .3 Excavate as required to carry out work, in all materials met. Do not disturb soil or rock below bearing surfaces. Notify the Departmental Representative when excavations are complete.
- .4 Excavate for concrete sidewalks and paving to subgrade levels. In addition, remove all topsoil, organic matter, debris and other loose and harmful matter encountered at subgrade level.

### 3.3 BACKFILLING

- .1 Asphalt areas disturbed by the work to be repaired with hot-mix asphalt concrete compacted to a minimum of 95% of 75 blow Marshal density in accordance with ASTM D1559 to a minimum finished thickness of 80mm. Contractor to submit asphalt concrete mix design to Departmental Representative for approval minimum of one week prior to asphalt paving.
- .2 Inspection: do not commence backfilling until fill material and spaces to be filled have been inspected and approved by the Departmental Representative.
- .3 Remove snow, ice, construction debris, organic soil and standing water from spaces to be filled.
- .4 Lateral support: maintain even levels of backfill around structures as work progresses, to equalize earth pressures.
- .5 Compaction: place backfill and compact to following Modified Proctor densities in compliance with ASTM D1557. (All densities in compliance with ASTM D1557).
  - .1 Roads, driveways, shoulders, re-shaped ditches and sidewalks to minimum 95%.
  - .2 Use caution in pipe zone to ensure no damage to pipe.
- .6 Under seeded and sodded areas: use site excavated material to bottom of topsoil except in trenches and within 600 mm of foundations.
- .7 Blown rock material, not capable of fine grading, is not acceptable, imported material must be placed on this type of material.
- .8 Against foundations (except as applicable to trenches and under slabs and paving): excavated material or imported material with no stones larger than 200 mm diameter within 600 mm of structures.

### 3.4 CONTAMINATED MATERIAL

- .1 Potentially Contaminated Soil
  - .1 It is unknown if the soils at William Head Institution are known to contain contaminants such as hydrocarbons and metals. Contractor is to take appropriate measures per this Section for excavation work.
  - .2 All excavated soil under this contract shall be treated as potentially contaminated soil. Excavate, handle and store excavated soil as per this Section and all other related sections.



- .2 Contaminated Material Removal
  - .1 Excavation
    - .1 As per direction from PWGSC.
  - .2 Dewatering
    - .1 Surface water shall be diverted to prevent entry into the excavation. Dewatering shall be limited to that necessary to assure adequate access, a safe excavation, prevent the spread of contamination, and to ensure that compaction requirements can be met.
- .3 Contaminated Soil Handling
  - .1 Soil Segregation
    - .1 Excavate known or suspect material and place in stockpile at storage area designated by Departmental Representative. In no case will the material be transported off site before laboratory analysis has been received and excavated materials have been characterized for disposal.
    - .2 As per direction from PWGSC.
  - .2 Soil Testing
    - .1 Testing of excavated soil will be performed by the Departmental Representative. Soil will be assessed for indications of contamination and will be classified as confirmed contaminated soil, special waste soil, or uncontaminated soil.
    - .2 The Departmental Representative will dispose of the excavated soil material after testing is completed, according to applicable rules and regulations.

### 3.5 ARCHAEOLOGICAL RESOURCES

- .1 Potentially Archaeological Resource Containing Soil
  - .1 It is unknown if soils in the area also contain midden and potentially archeological artifacts. Contractor is to take appropriate measures per this Section for excavation work.
- .2 Archaeological Resource Chance Find Procedure
  - .1 Excavation
    - .1 Protect any archaeological or heritage objects discovered and immediately report the discovery to the Departmental Representative. Protection of archaeological or heritage objects may require rescheduling of work activities or relocation of resources.
    - .2 If an archaeological site is encountered, stop work and notify the Departmental Representative immediately.
    - .3 Ensure that employees and contractors involved in project construction are aware of and comply with, requirements regarding discovery of any archaeological/heritage resources.

### 3.6 GRADING

- .1 Grade so that water will drain away from buildings, walls and paved areas, to catch basins and other disposal areas approved by the Departmental Representative.

### 3.7 SHORTAGE AND SURPLUS

- .1 Supply all necessary fill to meet backfilling and grading requirements and with minimum and maximum rough grade variance.
- .2 Dispose of surplus aggregate material off site.

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**PROJECT # R.098006.001**  
**PWGSC**  
**WILLIAM HEAD INSTITUTION (WHI)**  
**WHI – SEWER SYSTEM UPGRADE AND REHABILITATION**  
6000 William Head Road, Metchosin, BC

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**END OF SECTION 31 00 99**

## **PART 1– GENERAL**

### **1.1 RELATED REQUIREMENTS**

- .1 Section 01 33 00 Submittal Procedures.
- .2 Section 01 35 13.43 Special Procedures for Contaminated Sites.
- .3 Section 01 35 33 Health and Safety Requirements.
- .4 Section 01 35 43 Environmental Procedures.
- .5 Section 01 45 00 Quality Control.
- .6 Section 02 41 99 Demolition for Minor Works.
- .7 Section 32 11 23 Aggregate Base Courses

### **1.2 REFERENCES**

- .1 Master Municipal Contract Documents (MMCD), Platinum Edition Volume II - 2009, British Columbia.
- .2 American Society for Testing and Materials International (ASTM)
  - .1 ASTM C117-04, Standard Test Method for Material Finer than 0.075 mm (No.200) Sieve in Mineral Aggregates by Washing.
  - .2 ASTM C136-05, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
  - .3 ASTM D422-632002, Standard Test Method for Particle-Size Analysis of Soils.
  - .4 ASTM D698-00ae1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup>) (600 kN- m/m<sup>3</sup>).
  - .5 ASTM D1557-02e1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft<sup>3</sup>) (2,700 kN- m/m<sup>3</sup>).
  - .6 ASTM D4318-05, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
- .3 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-8.1-88, Sieves, Testing, Woven Wire, Inch Series.
  - .2 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.
- .4 Canadian Standards Association (CSA International)
  - .1 CAN/CSA-A3000-03, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
    - .1 CSA-A3001-03, Cementitious Materials for Use in Concrete.
  - .2 CSA-A23.1/A23.2-04, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
- .5 U.S. Environmental Protection Agency (EPA)/Office of Water
  - .1 EPA 832R92005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

### **1.3 DEFINITIONS**

- .1 Excavation classes: two classes of excavation will be recognized; common excavation and rock excavation.

- .1 Rock: solid material in excess of 1.00m<sup>3</sup>, and which cannot be removed by means of heavy duty mechanical excavating equipment available on site. Frozen material not classified as rock
- .2 Common excavation: excavation of materials of whatever nature, which are not included under definitions of rock excavation.
- .2 Unclassified excavation: excavation of deposits of whatever character encountered in Work.
- .3 Topsoil:
  - .1 Material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping and seeding.
  - .2 Material free from subsoil, clay lumps, brush, objectionable weeds, and other litter, and free from cobbles, stumps, roots, and other objectionable material larger than 25 millimeters in any dimension. Source documentation is to be provided.
- .4 Waste material: excavated material unsuitable for use in Work or surplus to requirements.
- .5 Borrow material: material obtained from locations outside area to be graded, and required for construction of fill areas or for other portions of Work.
- .6 Recycled fill material: material, considered inert, obtained from alternate sources and engineered to meet requirements of fill areas.
- .7 Unsuitable materials:
  - .1 Weak, chemically unstable, and compressible materials.
  - .2 Frost susceptible materials:
    - .1 Fine grained soils with plasticity index less than 10 when tested to ASTM D4318, and gradation within limits specified when tested to ASTM D422 and ASTM C136: Sieve sizes to CAN/CGSB-8.1 CAN/CGSB-8.2.
    - .2 Table:

Sieve Designation	% Passing
2.00 mm	100
0.10 mm	45 - 100
0.02 mm	10 – 80
0.005 mm	0 - 45
    - .3 Coarse grained soils containing more than 20 % by mass passing 0.075 mm sieve.
- .8 Unshrinkable fill: very weak mixture of cement, concrete aggregates and water that resists settlement when placed in utility trenches, and capable of being readily excavated.

**1.4 MEASUREMENT AND PAYMENT**

- .1 With the exception of pay items listed hereunder, payment for all work performed in this Section will be included in the Contractor's Lump Sum Contract prices.
- .2 Additional payment for trench excavation by hand will only be made in addition to the work items involving trench work where excavation by machinery is not practicable and only under prior approval by Departmental Representative. Payment will be based on before and after excavation cross-section areas at sufficient equal intervals over the length of over-excavation.
- .3 Payment for over-excavation including backfilling will only be made for over-excavation authorized by Departmental Representative. Payment will be based on before and after excavation cross-section areas at sufficient equal intervals over the length of over-excavation.

- .4 Payment for removal and disposal of disused pipes and headwalls encountered during trench excavation to specific disposal site will be in addition to trench work with no deduction of payment from such trench work. No payment will be made under this item for removal and disposal carried out as part of the operation for removal and disposal for excavated materials from trench work.
- .5 All costs incurred as a result of unauthorized excavation beyond neat lines or limits of excavation shown on Contract Drawings including remedial backfill will be at Contractor's cost.

#### 1.5 EXCAVATION AND DISPOSAL

- .1 Contractor to submit to Departmental Representative for review and approval, location of proposed disposal facility prior to disposal of any material.
- .2 Payment for disposal (including loading and hauling costs) of characterized material will be paid as a negotiated change order to the contract. Contractor must provide PWGSC with all disposal records including weigh bills, disposal receipts and chain of custody documentation.

#### 1.6 SUBMITTALS

- .1 Make submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Preconstruction Submittals:
  - .1 Contractor to submit records of underground utility pre-locates of existing utilities in accordance with Section 01 33 00 Submittal Procedures.
  - .2 Submit construction equipment list for major equipment to be used in this section prior to start of Work.
    - .1 All tracked equipment to have rubber track pads when working on concrete or paved surfaces on site.
    - .2 Any damaged sections of pavement/concrete to be repaired by the contractor at the Contractor's expense.
  - .3 Submit certificates for proposed granular materials to confirm compliance with the Canadian Council of Ministers of the Environment (CCME) Residential/Parkland (RL/PL) Land Usage Soil Quality Guidelines.
- .3 Quality Control: in accordance with Section 01 45 00 - Quality Control:
  - .1 Submit name of professional engineer retained by the Contractor for design and review of temporary works related to underpinning and bracing of existing structure and excavations for review and approval by Departmental Representative.
  - .2 Submit name of testing laboratory retained by Contractor for materials testing for review and approval by Departmental Representative.
  - .3 Submit condition survey of existing conditions as described in EXISTING CONDITIONS article of this Section.
  - .4 Submit for review by Departmental Representative proposed dewatering heave prevention methods as described in PART 3 of this Section.
  - .5 Submit to Departmental Representative written notice at least 7 days prior to excavation work, to ensure cross sections are taken.
  - .6 Submit to Departmental Representative written notice when bottom of excavation is reached.
  - .7 Submit to Departmental Representative testing inspection results report as described in PART 3 of this Section.

- .4 Samples:
  - .1 Inform Departmental Representative at least 4 weeks prior to beginning Work, of proposed source of fill materials and provide documentation that proposed fill meets CCME guidelines.

#### 1.7 QUALITY ASSURANCE

- .1 Qualification Statement: submit proof of insurance coverage for professional liability for professionals retained by Contractor.
- .2 Submit design and supporting data for excavations at least 2 weeks prior to beginning Work. Design and supporting data submitted to bear stamp and signature of qualified professional engineer registered or licensed in Province of British Columbia, Canada.
- .3 Keep design and supporting data on site.
- .4 Do not use soil material until written report of soil test results are reviewed and approved by Departmental Representative.
- .5 Health and Safety Requirements:
  - .1 Do construction occupational health and safety in accordance with Section 01 35 33 - Health and Safety Requirements.

#### 1.8 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 35 43 Environmental Procedures.
- .2 Divert materials from landfill to local facility for reuse.

#### 1.9 EXISTING CONDITIONS

- .1 Buried services:
  - .1 Before commencing work verify location of buried services on and adjacent to work area.
  - .2 Conduct Ground Penetrating Radar (GPR) in all areas of excavation to identify location and approximate depth of services.
  - .3 Conduct a "Hydro-Vac" excavation of utilities identified on Contract documents and:
    - .1 Conduct a survey and record vertical and horizontal location of service in UTM-10 NAD 86 coordinate and geodetic elevation format.
    - .2 Record the diameter of piping, width and depth of concrete ducting and size of structures.
  - .4 Arrange with appropriate authority for relocation of buried services that interfere with execution of work.
  - .5 Remove obsolete buried services within 2 m of foundations: cap cut-offs.
  - .6 Size, depth and location of existing utilities and structures as indicated are for guidance only. Completeness and accuracy are not guaranteed.
  - .7 Prior to beginning excavation Work, notify applicable Departmental Representative to establish location and state of use of buried utilities and structures. Clearly mark such locations to prevent disturbance during Work.
  - .8 Maintain and protect from damage, water, sewer, gas, electric, telephone and other utilities and structures encountered.
  - .9 Where utility lines or structures exist in area of excavation, obtain direction of Departmental Representative before removing or re-routing.

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

**PART 2- PRODUCTS**

**2.1 MATERIALS**

- .1 Granular Base and Granular Sub-Base material: properties in accordance with the following requirements:
  - .1 Crushed or screened stone, gravel or sand.
  - .2 Gradations to be within limits specified when tested to ASTM C136 and ASTM C117. Sieve sizes to CAN/CGSB-8.1 CAN/CGSB-8.2.
  - .3 Table:

Sieve Designation	% Passing		
	Granular Sub-Base (75mm crushed gravel)	Granular Base (19mm crushed gravel)	Sand
75 mm	100	-	-
50 mm	-	-	-
37.5 mm	60-100	-	-
25 mm	-	-	-
19 mm	35-80	100	-
12.5 mm	-	75-100	100
9.5 mm	26-60	60-90	-
4.75 mm	20-40	40-70	45-100
2.36 mm	15-30-	27-55	30-90
2.00 mm	-	-	-
1.18 mm	10-20	16-42	-
0.600 mm	5-15	8-30	10-50
0.425 mm	-	-	-
0.300 mm	3-10	5-20	3-20
0.180 mm	-	-	-
0.150 mm	-	-	-
0.075 mm	0-5	2-8	0-8

- .2 Unshrinkable fill: proportioned and mixed to provide:
  - .1 Maximum compressive strength of 0.4 MPa at 28 days.
  - .2 Maximum cement content of 25 kg/m; to CSA-A3001, Type GU.
  - .3 Minimum strength of 0.07MPa at 24 h.

- .4 Concrete aggregates: to CSA-A23.1/A23.2.
- .5 Cement: Type GU.
- .6 Slump: 160 to 200 mm.

### **PART 3- EXECUTION**

#### **3.1 TEMPORARY EROSION AND SEDIMENTATION CONTROL**

- .1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to sediment and erosion control drawings, specific to site, in accordance with Section 01 35 43. The Contractor is to submit a comprehensive erosion and sedimentation control plan in accordance with 01 33 00 Submittal Procedures.
- .2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
- .3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

#### **3.2 SITE PREPARATION**

- .1 Remove obstructions, ice and snow, from surfaces to be excavated within limits indicated.
- .2 Cut pavement or sidewalk neatly along limits of proposed excavation in order that surface may break evenly and cleanly.

#### **3.3 PREPARATION/PROTECTION**

- .1 Protect existing features in accordance with applicable local regulations.
- .2 Keep excavations clean, free of standing water, and loose soil.
- .3 Where soil is subject to significant volume change due to change in moisture content, cover and protect to Departmental Representative.
- .4 Protect natural and man-made features required to remain undisturbed. Unless otherwise indicated or located in an area to be occupied by new construction, protect existing trees from damage.
  - .1 Protect buried services that are required to remain undisturbed.

#### **3.4 STRIPPING OF TOPSOIL**

- .1 Begin topsoil stripping of areas as indicated after area has been cleared of brush, weeds, grasses and removed from site.
- .2 Strip topsoil to depths as indicated.
  - .1 Do not mix topsoil with subsoil.
- .3 Stockpile in locations as directed by Departmental Representative.
  - .1 Stockpile height not to exceed 2 m and should be protected from erosion.
- .4 Dispose of unused topsoil as directed by Departmental Representative.



### 3.5 STOCKPILING

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

### 3.6 COFFERDAMS, SHORING, BRACING AND UNDERPINNING

- .1 Contractor is responsible for the protection and temporary support of all project excavations, with special attention to work adjacent to crane rails and existing structures.
- .2 Contractor to retain and pay for services of professional engineer registered in the Province of British Columbia for design and review of temporary works related to underpinning and bracing of existing structure and excavations.
- .3 Maintain sides and slopes of excavations in safe condition by appropriate methods and in accordance with Section 01 35 33 - Health and Safety Requirements and WorkSafe BC.
  - .1 Where conditions are unstable, Contractor to retain and pay costs for geotechnical engineer to review condition and provide recommendations
- .4 Construct temporary Works to depths, heights and locations as indicated by Contractor's geotechnical engineer.
- .5 During backfill operation:
  - .1 Unless otherwise indicated or directed by Departmental Representative, remove sheeting and shoring from excavations.
  - .2 Do not remove bracing until backfilling has reached respective levels of such bracing.
  - .3 Pull sheeting in increments that will ensure compacted backfill is maintained at elevation at least 500 mm above toe of sheeting.
- .6 When sheeting is required to remain in place, cut off tops at elevations as indicated.
- .7 Upon completion of substructure construction:
  - .1 Remove cofferdams, shoring and bracing.

### 3.7 DEWATERING AND HEAVE PREVENTION

- .1 Keep excavations free of water while Work is in progress.
- .2 Provide for Departmental Representative review details of proposed dewatering or heave prevention methods, including dikes, well points, and sheet pile cut-offs.
- .3 Avoid excavation below groundwater table if quick condition or heave is likely to occur.
  - .1 Prevent piping or bottom heave of excavations by groundwater lowering, sheet pile cut-offs, or other means.
- .4 Protect open excavations against flooding and damage due to surface run-off.
- .5 Dispose of water in accordance with Section 01 35 43 - Environmental Procedures, to approved runoff areas or containment facilities and in manner not detrimental to public and private property, or portion of Work completed or under construction.

- .1 Provide and maintain temporary drainage ditches and other diversions outside of excavation limits.
- .6 Provide flocculation tanks, settling basins, or other treatment facilities to remove suspended solids or other materials before discharging to storm sewers, watercourses or drainage areas.

### 3.8 EXCAVATION

- .1 Advise Departmental Representative at least 7 days in advance of excavation operations. Excavate to lines, grades, elevations and dimensions as indicated.
- .2 Remove concrete, masonry, paving, walks, demolished foundations and rubble and other obstructions encountered during excavation offsite.
- .3 Excavation must not interfere with bearing capacity of adjacent foundations and slabs. Contractor to notify Departmental Representative immediately where undermining of slabs of foundations occurs. Contractor responsible for devising and executing a remediation plan for filling all voids associated with undermining of slabs and foundations.
- .4 Do not disturb soil within branch spread of trees or shrubs that are to remain.
  - .1 If excavating through roots, excavate by hand and cut roots with sharp axe or saw, as directed by the project Arborist.
  - .2 Provide 24 hours notice to Departmental Representative of need for Arborist on site.
- .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. No more than 5 m of trench may be exposed at end of day's operation and must be securely covered. Road plates are to be used to cover exposed excavations in areas of vehicular travel.
- .6 Keep excavated and stockpiled materials 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 in location with PWGSC property approved by Departmental Representative.
- .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 including those that extend below required elevations to extent and depth as directed by Departmental Representative.
- .14 Correct unauthorized over-excavation as follows:
  - .1 Fill with granular base material to not less than 95% Modified Proctor Density.
- .15 Hand trim, make firm and remove loose material and debris from excavations.
  - .1 Where material at bottom of excavation is disturbed, compact foundation soil to density at least equal to undisturbed soil.

- .2 Clean out rock seams and fill with concrete mortar or grout to approval of Departmental Representative.

### 3.9 BEDDING AND SURROUND OF UNDERGROUND SERVICES

- .1 Place and compact granular material for bedding and surround of underground services as indicated. Bedding to match gradation under Section 2.1.3 above.
- .2 Place bedding and surround material in unfrozen condition.

### 3.10 BACKFILLING

- .1 Do not proceed with backfilling operations until completion of following:
  - .1 Departmental Representative has inspected and approved installations.
  - .2 Departmental Representative has inspected and approved of construction below finish grade.
  - .3 Inspection, testing, approval, and recording location of underground utilities.
  - .4 Removal of concrete formwork.
  - .5 Removal of shoring and bracing; backfilling of voids with satisfactory soil material.
- .2 Areas to be backfilled to be free from debris, snow, ice, water and frozen ground.
- .3 Do not use backfill material which is frozen or contains ice, snow or debris.
- .4 Place backfill material in uniform layers not exceeding 300 mm compacted thickness up to grades indicated. Compact each layer before placing succeeding layer.
- .5 Backfilling around installations:
  - .1 Do not backfill around or over cast-in-place concrete within 24 hours after placing of concrete.
  - .2 Place layers simultaneously on both sides of installed Work to equalize loading. Difference not to exceed 0.150 m.
  - .3 Where temporary unbalanced earth pressures are liable to develop on walls or other structures:
    - .1 Permit concrete to cure for minimum 14 days or until it has sufficient strength to withstand earth and compaction pressure and approval obtained from Departmental Representative.
- .6 Place unshrinkable fill in areas as indicated.
- .7 Consolidate and level unshrinkable fill with internal vibrators.
- .8 Install drainage system in backfill as indicated.

### 3.11 RESTORATION

- .1 Upon completion of Work, remove waste materials and debris in accordance to Section 01 35 43 Environmental Procedures, trim slopes, and correct defects as directed by Departmental Representative.
- .2 Replace topsoil as indicated.
- .3 Reinstall lawns to elevation which existed before excavation.

- .4 Reinstatement pavements and sidewalks disturbed by excavation to thickness, structure and elevation which existed before excavation.
- .5 Clean and reinstatement areas affected by Work as directed by Departmental Representative.
- .6 Use temporary plating to support traffic loads over unshrinkable fill for initial 24 hours.
- .7 Protect newly graded areas from traffic and erosion and maintain free of trash or debris.

**END OF SECTION 31 23 33.01**

## **PART 1– GENERAL**

### 1.1 RELATED SECTIONS

- .1 Section 32 12 16.01 – Asphalt Paving

### 1.2 REFERENCES

- .1 ASTM International
  - .1 ASTM C117-04, Standard Test Methods for Material Finer Than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.
  - .2 ASTM C131-06, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
  - .3 ASTM C136-06, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
  - .4 ASTM D698-07e1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft-lbf/ft<sup>3</sup>) (600kN- m/m<sup>3</sup>).
  - .5 ASTM D1557-09, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000ft-lbf/ft<sup>3</sup>) (2,700kN-m/m<sup>3</sup>).
  - .6 ASTM D1883-07e2, Standard Test Method for CBR (California Bearing Ratio) of Laboratory Compacted Soils.
  - .7 ASTM D4318-10, Standard Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils.
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-8.1-88, Sieves, Testing, Woven Wire, Inch Series.
  - .2 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.
- .3 U.S. Environmental Protection Agency (EPA) / Office of Water
  - .1 EPA 832/R-92-005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.
- .4 Master Municipal Contract Documents (MMCD), Platinum Edition Volume II - 2009, British Columbia – Section 31 05 17 – Aggregates and Granular Materials.
  - .1 Sub-section 2.0 – Products
  - .2 Sub-section 3.0 – Execution

### 1.3 ACTION AND INFORMATION SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 Submit certificates for proposed granular materials to confirm compliance with the Canadian Council of Ministers of the Environment (CCME).

### 1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer/supplier guidelines and requirements.

**PART 2 - PRODUCTS**

2.1 MATERIALS

- .1 Granular Base and Granular Sub-Base material: properties in accordance with the following requirements:
  - .1 Crushed or screened stone, gravel or sand.
  - .2 Gradations to be within limits specified when tested to ASTM C136 and ASTM C117. Sieve sizes to CAN/CGSB-8.1 CAN/CGSB-8.2.
  - .3 Table:

Sieve Designation	% Passing	
	Granular Sub-Base (75mm crushed gravel)	Granular Base (19mm crushed gravel)
75 mm	100	-
50 mm	-	-
37.5 mm	60-100	-
25 mm	-	-
19 mm	35-80	100
12.5 mm	-	75-100
9.5 mm	26-60	60-90
4.75 mm	20-40	40-70
2.36 mm	15-30-	27-55
2.00 mm	-	-
1.18 mm	10-20	16-42
0.600 mm	5-15	8-30
0.425 mm	-	-
0.300 mm	3-10	5-20
0.180 mm	-	-
0.150 mm	-	-
0.075 mm	0-5	2-8

**PART 3- EXECUTION**

3.1 PREPARATION

- .1 Temporary Erosion and Sedimentation Control:
  - .1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction, sediment and erosion control plan, specific to site, that complies with EPA 832/R-92-005 or requirements of authorities having jurisdiction, whichever is more stringent.
  - .2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
  - .3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.2 PLACEMENT AND INSTALLATION

- .1 Place granular base after sub-base and subgrade surface is inspected and approved in writing by Departmental Representative.
- .2 Placing:
  - .1 Construct granular base to depth and grade in areas indicated.
  - .2 Ensure no frozen material is placed.
  - .3 Place material only on clean unfrozen surface, free from snow and ice.
  - .4 Begin spreading base material on crown line or on high side of one-way slope.
  - .5 Place material using methods which do not lead to segregation or degradation of aggregate.
  - .6 Place material to full width in uniform layers not exceeding 150 mm compacted thickness.
    - .1 Departmental Representative may authorize thicker lifts (layers) if specified compaction can be achieved.
  - .7 Shape each layer to smooth contour and compact to specified density before succeeding layer is placed.
  - .8 Remove and replace that portion of layer in which material becomes segregated during spreading.
- .3 Compaction Equipment:
  - .1 Ensure compaction equipment is capable of obtaining required material densities.
- .4 Compacting: in accordance with Section 01 45 00 – Quality Control:
  - .1 Compact to density not less than 95% Modified Proctor Density to ASTM D1557.
  - .2 Shape and roll alternately to obtain smooth, even and uniformly compacted base.
  - .3 Apply water as necessary during compacting to obtain specified density.
  - .4 In areas not accessible to rolling equipment, compact to specified density with mechanical tampers approved in writing by Departmental Representative.
  - .5 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.
  - .6 Submit name of testing laboratory retained by Contractor for materials testing for review and approval by Departmental Representative.
- .5 Proof rolling:
  - .1 For proof rolling use standard roller of 45400 kg gross mass with four pneumatic tires each carrying 11350 kg and inflated to 620 kPa. Four tires arranged abreast with centre to centre spacing of 730 mm.
  - .2 Obtain written approval from Departmental Representative to use non-standard proof rolling equipment.
  - .3 Make sufficient passes with proof roller to subject every point on surface to three separate passes of loaded tire.
  - .4 Where proof rolling reveals areas of defective subgrade:
    - .1 Remove base, sub-base and subgrade material to depth and extent as directed by Departmental Representative.
    - .2 Backfill excavated subgrade with common material and compact.
    - .3 Replace sub-base material and compact.
    - .4 Replace base material and compact in accordance with this Section.

- .5 Where proof rolling reveals defective base or sub-base, remove defective materials to depth and extent as directed by Departmental Representative and replace with new materials in accordance with this section at no extra cost.

### 3.3 SITE TOLERANCES

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

### 3.4 PROTECTION

- .1 Maintain finished base in condition conforming to this Section until succeeding material is applied or until acceptance by Departmental Representative.

### 3.5 CLEANING

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

**END OF SECTION 32 11 23**



## **PART 1 - GENERAL**

### 1.1 RELATED SECTIONS

- .1 Section 32 11 23 – Aggregate Base Courses

### 1.2 REFERENCES

- .1 Asphalt Institute (AI)
  - .1 AI MS-2-1994, Mix Design Methods for Asphalt Concrete and Other Hot-Mixes.
- .2 ASTM International
  - .1 ASTM C88-13, Standard Test Method for Soundness of Aggregates by Use of Sodium Sulphate or Magnesium Sulphate.
  - .2 ASTM D1557-12e1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lb/ft<sup>3</sup> (2,700 kN-m/m<sup>3</sup>))
- .3 The Master Painters Institute (MPI)
  - .1 Architectural Painting Specification Manual.
    - .1 MPI #32, Traffic Marking Paint, Alkyd.
- .4 Master Municipal Contract Documents (MMCD), Platinum Edition Volume II - 2009, British Columbia, Specification 32 12 16 – Hot Mix Asphalt Concrete Paving.
  - .1 Section 2.0 – Products
  - .2 Section 3.0 – Execution

### 1.3 SUBMITTALS

- .1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Submit asphalt concrete mix design to Departmental Representative at least 2 weeks prior to commencing work.

### 1.4 SAMPLES

- .1 Submit samples in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Submit to Department Representative, samples of material for sieve analysis at least 2 weeks before beginning Work.

### 1.5 QUALITY ASSURANCE

- .1 Testing to be completed by accredited testing laboratory.

### 1.6 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 35 43 – Environmental Procedures.
- .2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard, packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
- .4 Place materials defined as hazardous or toxic in designated containers.
- .5 Divert unused aggregate materials from landfill to facility for reuse as approved by Department Representative.

- .6 Fold up metal banding, flatten and place in designated area for recycling.
- .7 Do not dispose of unused paint thinner material into sewer system, into streams, lakes, onto ground or in other location where it will pose health environmental hazard.
- .8 Divert unused asphalt from landfill to facility capable of recycling materials.

#### 1.7 DELIVERY, STORAGE AND HANDLING

- .1 Storage and Handling Requirements:
  - .1 Store materials in accordance with manufacturer's recommendations.
  - .2 Store and protect aggregate from damage.
  - .3 Replace defective or damaged materials with new.

### **PART 2 - PRODUCTS**

#### 2.1 MATERIALS

- .1 Prime coat: N/A
- .2 Tack coat: CAN/CGCB – 16.2, Grade SS-1
- .3 Asphalt cement: CGSB – 16.3-M 90, Grade 80-100
- .4 Asphalt concrete: MMCD Upper Course #2
- .5 Traffic paint: yellow and white to CAN/CGSB-1.74.
- .6 Paint thinner: to CAN/CGSB-1.5.

### **PART 3 - EXECUTION**

#### 3.1 FOUNDATIONS

- .1 Foundations for roadways and parking lots comprise:
  - .1 250mm compacted thickness of granular subbase.
  - .2 100mm compacted thickness of granular base.
- .2 Compaction: compact each lift of granular material to 100% maximum density to ASTM D698. Maximum lift thickness: 150 mm.

#### 3.2 PAVEMENT THICKNESS

- .1 Pavements for roadways and parking lots as per MMCD Specification 32 12 16 – Hot-Mix Asphalt Concrete Paving (Section 2.1.2).
  - .1 Base course: 40mm, MMCD Upper Course #2
  - .2 Wear course: 40mm, MMCD Upper Course #2

#### 3.3 PAVEMENT CONSTRUCTION

- .1 Construction of asphalt concrete: to MMCD Specification 32 12 16 – Hot-Mix Asphalt Concrete Paving (Section 3.0).
  - .1 Sections 2 – Products
  - .2 Section 3 – Execution
- .2 Surface preparation: to MMCD Specification 32 12 16 – Hot-Mix Asphalt Concrete Paving (Section 3.0).
  - .1 Sections 2 – Products

.2 Section 3 – Execution

3.4 TRAFFIC MARKINGS

- .1 Refer to Section 32 17 23 – Pavement Markings

3.5 FINISHED TOLERANCES

- .1 Ensure finished asphalt surface within 6 mm of design elevation but not uniformly high or low.  
.2 Ensure finished asphalt surface does not have irregularities exceeding 6 mm when checked with a 3 m straight edge placed in any direction.  
.3 Water ponding not permitted.  
.4 Against concrete gutter, finished asphalt surface to be higher than the gutter by not more than 6mm.

3.6 DEFECTIVE WORK

- .1 Correct irregularities which develop before completion of rolling by loosening upper mix and removing or adding material as required.  
.2 If irregularities or defects remain after final compaction, remove upper course promptly and lay new material to form a true and even surface and compact immediately to specified density.

3.7 CLEANING

- .1 Remove lids or covers from all castings and clean any prime, tack coat or hot-mix asphaltic concrete from frames, lids and covers of all castings.  
.2 Progress Cleaning:  
.1 Leave Work area clean at end of each day.  
.3 Final Cleaning:  
.1 Upon project completion, remove surplus materials, rubbish, tools and equipment.

3.8 PROTECTION

- .1 Keep vehicular traffic off newly paved areas until paving surface temperature has cooled below 38 degrees C.  
.1 Do not permit stationary loads on pavement until 24 hours after placement.

**END OF SECTION 32 12 16.01**

## **PART 1 – GENERAL**

### 1.1 RELATED REQUIREMENTS

- .1 Section 01 33 00 Submittal Procedures
- .2 Section 01 45 00 Quality Control
- .3 Section 31 23 33.01 Excavating, Trenching, and Backfilling.

### 1.2 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
  - .1 ASTM A48/A48M-00, Standard Specification for Gray Iron Castings.
  - .2 ASTM C117-04, Standard Test Method for Materials Finer than 75- $\mu\text{m}$  (No. 200) Sieve in Mineral Aggregates by Washing.
  - .3 ASTM C136-05, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
  - .4 ASTM C139-05, Standard Specification for Concrete Masonry Units for Construction of Catch Basins and Manholes.
  - .5 ASTM C478M-06, Standard Specification for Precast Reinforced Concrete Manhole Sections Metric.
  - .6 ASTM D1557-12e1, Modified Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft<sup>3</sup>(2,700 kN- m/m<sup>3</sup>)).
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-8.1-88, Sieves, Testing, Woven Wire, Inch Series.
  - .2 CAN/CGSB-8.2-M88], Sieves, Testing, Woven Wire, Metric.
- .3 Canadian Standards Association (CSA International)
  - .1 CAN/CSA-A23.1-04/A23.2-04, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
  - .2 CAN/CSA-A3000-03(R2005), Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
    - .1 CSA-A3001-03, Cementitious Materials for Use in Concrete.
    - .2 CSA-A3002-03, Masonry and Mortar Cement.
  - .3 CAN/CSA-A165 Series-04, CSA Standards on Concrete Masonry Units (Consists of A165.1, A165.2 and A165.3).
  - .4 CAN/CSA-G30.18-M92(R2002), Billet Steel Bars for Concrete Reinforcement.
  - .5 CAN/CSA-G164-M92(R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.
- .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).

### 1.3 SUBMITTALS

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

- .3 Quality assurance submittals: submit following in accordance with Section 01 45 00 - Quality Control.
  - .1 Submit manufacturer's test data and certification at least 2 weeks prior to beginning Work. Include manufacturer's drawings, information and shop drawings where pertinent.
  - .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 Pre-Installation Meetings: convene pre-installation meeting one week prior to beginning work of this Section, with contractor's representative and Departmental Representative to:
  - .1 Verify project requirements.
  - .2 Review installation and substrate conditions.
  - .3 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 site specifications.
  - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Waste Management and Disposal:
  - .1 Separate waste materials for reuse and recycling in accordance with Section 01 35 43 – Environmental Procedures.

### **PART 2 – PRODUCTS**

#### 1.6 MATERIALS

- .1 Cast-in-place concrete:
  - .1 In accordance with Section 03 30 00 - Cast-in-Place Concrete.
  - .2 Cement: to CAN/CSA-A3001, Type GU.
  - .3 Concrete mix design to produce minimum 27.6 MPa minimum compressive strength at 28 days and containing 25mm maximum size coarse aggregate, with water/cement ratio to CAN/CSA-A23.1.
    - .1 Air entrainment to CAN/CSA-A23.1, class C-3 exposure.
  - .4 Supplementary cementing materials: with minimum 20% Type F fly ash replacement, by mass of total cementitious materials to CAN/CSA A3001.
  - .5 Concrete reinforcement: in accordance with Section 03 20 00 - Concrete Reinforcing.
- .2 Precast manhole units: to ASTM C478M, circular or oval.
  - .1 Top sections eccentric cone or flat slab top type with opening offset for vertical ladder installation.
  - .2 Monolithic bases to be approved by Departmental Representative.
- .3 Precast catch basin sections: to ASTM C139 and ASTM C478M.
- .4 Joints: made watertight using rubber rings, bituminous compound, epoxy resin cement.

- .5 Mortar:
  - .1 Masonry Cement: to CAN/CSA-A3002.
- .6 Ladder rungs: to CAN/CSA-G30.18, No.25M billet steel deformed bars, hot dipped galvanized to CAN/CSA-G164.
  - .1 Rungs to be safety pattern (drop step type).
- .7 Adjusting rings: to ASTM C478M.
- .8 Concrete Brick: to CAN3-A165 Series.
- .9 Drop manhole pipe: same as sewer pipe.
- .10 Galvanized iron sheet: approximately 2 mm thick.
- .11 Steel gratings, I-beams and fasteners: as indicated.
- .12 Frames, gratings, covers to dimensions as indicated and following requirements:
  - .1 Metal gratings and covers to bear evenly on frames.
    - .1 Frame with grating or cover to constitute one unit.
    - .2 Assemble and mark unit components before shipment.
  - .2 Gray iron castings: to ASTM A48/A48M, strength class 30B.
  - .3 Castings: coated with two applications of asphalt.
  - .4 Manhole frames and covers: cover cast with perforations and complete with two 25 mm square lifting holes.
  - .5 Catch basin frames and covers: ASTM A48 and to withstand H2O loading.
  - .6 Size: 762mm clear diameter.
- .13 Granular bedding and backfill: in accordance with Section 31 23 33.01 Excavating Trenching and Backfilling.
- .14 Unshrinkable fill: in accordance with Section 31 23 33.01 Excavating, Trenching and Backfilling.

### **PART 3 – EXECUTION**

#### **1.7 MANUFACTURER'S INSTRUCTIONS**

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

#### **1.8 EXCAVATION AND BACKFILL**

- .1 Excavate and backfill in accordance with Section 31 23 33.01 - Excavating Trenching and Backfilling and as indicated.
- .2 Obtain approval of Departmental Representative before installing manholes or catch basins.

#### **1.9 CONCRETE WORK**

- .1 Do concrete work in accordance with Section 03 30 00 - Cast-in-Place Concrete.
- .2 Place concrete reinforcement in accordance with Section 03 20 00 - Concrete Reinforcing.
- .3 Position metal inserts in accordance with dimensions and details as indicated.

#### **1.10 INSTALLATION**

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

- .2 Complete units as pipe laying progresses.
  - .1 Maximum of three units behind point of pipe laying will be allowed.
- .3 Dewater excavation to approval of Departmental Representative and remove soft and foreign material before placing concrete base.
- .4 Cast bottom slabs directly on undisturbed ground.
- .5 Set precast concrete base on 150 mm minimum of granular bedding compacted to 95% Modified Proctor Density to ASTM D1557.
- .6 Precast units:
  - .1 Set bottom section of precast unit in bed of cement mortar and bond to concrete slab or base.
  - .2 Make each successive joint watertight with rubber ring gaskets, bituminous compound, cement mortar, epoxy resin cement, or combination of these materials.
  - .3 Clean surplus mortar and joint compounds from interior surface of unit as work progresses.
  - .4 Plug lifting holes with concrete plugs set in cement mortar or mastic compound.
- .7 For sewers:
  - .1 Place stub outlets and bulkheads at elevations and in positions indicated.
  - .2 Bench to provide smooth U-shaped channel.
    - .1 Side height of channel to be 0.75 times full diameter of sewer.
    - .2 Slope adjacent floor at 1 in 20.
    - .3 Curve channels smoothly.
    - .4 Slope invert to establish sewer grade.
- .8 Compact granular backfill to 95% Modified Proctor Density to ASTM D1557.
- .9 Place unshrinkable backfill in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.
- .10 Installing units in existing systems:
  - .1 Where new unit is installed in existing run of pipe, ensure full support of existing pipe during installation, and carefully remove that portion of existing pipe to dimensions required and install new unit as specified.
  - .2 Make joints watertight between new unit and existing pipe.
  - .3 Where deemed expedient to maintain service around existing pipes and when systems constructed under this project are ready for operation, complete installation with appropriate break-outs, removals, redirection of flows, blocking unused pipes or other necessary work.
- .11 Set frame and cover to required elevation on no more than three courses of brick.
  - .1 Make brick joints and join brick to frame with cement mortar.
  - .2 Parge and make smooth and watertight.
- .12 Place frame and cover on top section to elevation as indicated.
  - .1 If adjustment required use concrete ring.
- .13 Clean units of debris and foreign materials.
  - .1 Remove fins and sharp projections.
  - .2 Prevent debris from entering system.

1.11 ADJUSTING TOPS OF EXISTING UNITS

- .1 Remove existing gratings, frames and store for re-use at locations designated by Departmental Representative.
- .2 Sectional units:
  - .1 Raise or lower straight walled sectional units by adding or removing precast sections as required.
  - .2 Raise or lower tapered units by removing cone section, adding, removing, or substituting riser sections to obtain required elevation, then replace cone section.
    - .1 When amount of raise is less than 600 mm use standard manhole brick, modoloc or grade rings.
- .3 Monolithic units:
  - .1 Raise monolithic units by roughening existing top to ensure proper bond and extend to required elevation with mortared brick course for 150 mm or less alteration.
  - .2 Lower monolithic units with straight wall by removing concrete to elevation indicated for rebuilding.
  - .3 When monolithic units with tapered upper section are lowered more than 150 mm, remove concrete for entire depth of taper plus as much straight wall as necessary, then rebuild upper section to required elevation with cast-in-place concrete.
  - .4 Install additional manhole ladder rungs in adjusted portion of units as required.
  - .5 Re-use existing gratings, frames.
  - .6 Re-set gratings and frames to required elevation on not more than 3 courses of brick.
    - .1 Make brick joints and join brick to frame with cement mortar, parge and trowel smooth.
    - .2 Re-set gratings and frames to required elevation on full bed of cement mortar, parge and trowel smooth.

1.12 SEALING OVER EXISTING UNITS

- .1 Cut galvanized iron sheet to extend 50 mm beyond opening of existing manhole or catch basin grating.
  - .1 Center iron sheet over existing grating and spot or stitch weld to grating.
- .2 Fill with cast-in-place concrete.

1.13 FIELD QUALITY CONTROL

- .1 In accordance with Section 01 45 00 – Quality Control.

1.14 CLEANING

- .1 Proceed in accordance with Section 01 35 43 – Environmental Procedures.
- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

**END OF SECTION 33 05 13**



## **PART 1– GENERAL**

### 1.1 RELATED REQUIREMENTS

- .1 Section 01 33 00 Submittal Procedures
- .2 Section 01 33 00 Cast-in-Place Concrete.
- .3 Section 32 11 23 Aggregate Base Courses.
- .4 Section 31 23 33.01 Excavating, Trenching and Backfilling.

### 1.2 REFERENCES

- .1 ASTM International
  - .1 ASTM C117-04, Standard Test Method for Material Finer Than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.
  - .2 ASTM C136-06, Standard Method for Sieve Analysis of Fine and Coarse Aggregates.
  - .3 ASTM C443M-10, Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets (Metric).
  - .4 ASTM D698-12e2, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup>(600 kN- m/m<sup>3</sup>)).
  - .5 ASTM D1557-12e1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lb/ft<sup>3</sup> (2,700 kN-m/m<sup>3</sup>)).
  - .6 ASTM D1056-07, Standard Specification for Flexible Cellular Materials- Sponge or Expanded Rubber.
  - .7 ASTM D2412 Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
  - .8 ASTM D3035 Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter
  - .9 ASTM D3212-07 (2013), Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
  - .10 ASTM D3350 Standard Specification for Polyethylene Plastics Pipe and Fittings Materials
  - .11 ASTM 3261 Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing
  - .12 ASTM F1055 Standard Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene and Crosslinked Polyethylene (PEX) Pipe and Tubing
  - .13 ASTM F477, Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
  - .14 ASTM D1869-95(2010), Standard Specification for Rubber Rings for Asbestos-Cement Pipe.
  - .15 ASTM D2680-01(2009), Standard Specification for Acrylonitrile- Butadiene-Styrene (ABS) and Poly (Vinyl Chloride) (PVC) Composite Sewer Piping.
  - .16 ASTM D3034-08, Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
  - .17 ASTM F405-05, Standard Specification for Corrugated Polyethylene (PE) Tubing and Fittings.
  - .18 ASTM F794-03(2009), Standard Specification for Poly(Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter.

- .2 Canadian General Standards Board (CGSB)
    - .1 CAN/CGSB-8.1-M89, Sieves, Testing, Woven Wire, Inch Series.
    - .2 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.
    - .3 CAN/CGSB-34.9-94, Asbestos-Cement Sewer Pipe.
  - .3 CSA International
    - .1 CAN/CSA-A3000-08, Cementitious Materials Compendium.
    - .2 CSA A257 Series-M92 (R2009), Standards for Concrete Pipe.
    - .3 CAN/CSA-B1800-15, Thermoplastic Non-pressure Pipe Compendium - B1800 Series.
    - .4 CSA G401-07, Corrugated Steel Pipe Products.
    - .5 CSA B137.1 Polyethylene (PE) pipe, tubing, and fittings for cold-water pressure services
  - .4 U.S. Environmental Protection Agency (EPA) / Office of Water
    - .1 EPA 832/R-92-005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.
- 1.3 SCHEDULING
- .1 Schedule Work to minimize interruptions to existing services and to maintain existing flow during construction.
  - .2 Submit schedule of expected interruptions for approval and adhere to approved schedule.
- 1.4 ACTION AND INFORMATIONAL SUBMITTALS
- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
  - .2 Product Data:
    - .1 Submit manufacturer's recent test data and certification that materials to be incorporated in to the works are representative and meet the requirements for this section. Include manufacture's drawings where pertinent.
  - .3 Submit shop drawings for Slip-in Inline Elastomeric Check Valves. Submittals to include:
    - .1 Information on the performance and operation of the valve, materials of construction, dimensions and weights, elastomer characteristics, headloss, flow data and pressure ratings.
    - .2 Documentation from manufacturer confirming independent hydraulic testing to determine headloss, jet velocity and vertical opening height characteristics on a minimum of three (3) sizes of valves ranging from 150mm through 600mm. The testing must have been conducted for free discharge (pressurized and open channel flow discharging to atmosphere) and submerged conditions.
  - .4 Certification to be marked on pipe.
  - .5 Test and Evaluation Reports: submit manufacturer's test data and certification at least 2 weeks prior to beginning Work.
- 1.5 DELIVERY, STORAGE AND HANDLING
- .1 Deliver, store and handle materials in accordance with site specifications and manufacturer's written instructions.
  - .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
  - .3 Storage and Handling Requirements:

- .1 Store materials in accordance with manufacturer's recommendations.
- .2 Store and protect pipes from damage.
- .3 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan Waste Reduction Workplan related to Work of this Section.
- .5 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, packaging materials as specified in Section 01 35 43 – Environmental Procedures.

## **PART 2- PRODUCTS**

### **2.1 PVC PIPE, MAINLINE SMOOTH WALL**

- .1 Polyvinyl chloride pipe up to 1200mm in diameter, DR35 unless otherwise noted. Pipe to have minimum pipe stiffness (F/Y) of 320 kPa at 5.0% deflection, ASTM D2412. Pipe to be manufactured to specifications for pipe size ranges as follows:
  - .1 100 mm dia. – 375 mm dia. To ASTM D3034
  - .2 450 mm dia. – 1200 mm dia. To ASTM F679
- .2 Pipes to be certified to CSA B182.2 for pipe size diameter 100 mm to 1200 mm.
- .3 Joints: To conform to ASTM D3212; Pipe to include integral bell and spigot ends with stiffened wall sections and formed groove for a rubber gasket; elastomeric gaskets to ASTM F477.
  - .1 Pipe joints to withstand minimum hydrostatic pressure of 345kPa without leakage.
  - .2 Pipe joints in pipes with pipe stiffness less than 320kPa to withstand 550kPa.
- .4 Normal pipe length joint to joint to be 4.0 m.
- .5 Maximum installed short term deflection not to exceed 5.0% of the base inside diameter.

### **2.2 HIGH DENSITY POLYETHYLENE PIPE**

- .1 Pipe:
  - .1 To ASTM D3035 pressure class specified in Contract documents.
  - .2 Pipes to be certified to Canadian Standards Association CSA B137.1.
  - .3 To be compatible with specified mechanical joint fittings and valves without special adapters.
- .2 Joints: Butt fusion in accordance with manufacturer's recommendations.
- .3 Fittings:
  - .1 Fabricated HDPE mitred fittings to ASTM D3035 suitable for pressure rating specified in Contract Documents.
  - .2 Moulded HDPE fittings to ASTM D3261 suitable for pressure rating specified and fusion to main pipe, dimensions as specified in Contract Documents.
- .4 Flanged joints to ASTM 3350 flat faced stub end and loose hot-dipped galvanized ductile iron (ASTM A536) backup ring drilling to ANSI B16.1, ANSI B16.5, or AWWA C207, class suitable for pressure rating specified in Contract Documents.

### **2.3 SLIP-IN INLINE ELASTOMERIC CHECK VALVES**

- .1 Check Valves are to be all rubber and the flow operated check type with slip-in cuff connection to the following:

- .1 Valve shall be ply reinforced throughout the body, saddle and bill, which is cured and vulcanized into a one-piece unibody construction. A separate valve body or pipe used as the housing is not acceptable.
  - .2 The valve shall be manufactured with no metal, mechanical hinges or fasteners, which would be used to secure any component of the valve to a valve housing.
  - .3 Port area of the saddle shall contour into a circumferential sealing area (the "bill") that is concentric with the pipe which shall allow passage of flow in one direction while preventing reverse flow.
  - .4 Entire valve shall fit within the pipe inside diameter. The saddle area of the valve must be flat, not conical, and integral with the rubber body above centerline in order to not produce any areas or voids that can collect or trap debris. The valve must be easily installed in pipes with poor end condition without the need to modify or utilize the headwall or structure to seal and anchor the valve. Once installed, the valve shall not protrude beyond the face of the structure or end of the pipe.
  - .5 Valve shall incorporate multiple concave grooves molded integrally into the flat saddle wall thickness extending longitudinally a minimum of 80% of the length of the saddle to reduce opening resistance and reduce headloss.
  - .6 Company name, plant location, valve size patent number, and serial number shall be bonded to the check valve.
- .2 Slip-in style Valves to be furnished stainless steel expansion clamps. The clamps, which will secure the valve in place, shall be installed in the upstream or downstream cuff of the valve, depending on installation orientation, and shall expand outwards by means of a turnbuckle. Each band shall be pre-drilled allowing for the valve to be pinned and secured into position in accordance with the manufacturer's installation instructions.

#### 2.4 PIPE BEDDING AND SURROUND MATERIAL

- .1 As indicated on drawings and in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling
- .2 Concrete mixes and materials for bedding, cradles, encasement, supports: in accordance with Section 03 30 00 - Cast-in-Place Concrete.

#### 2.5 BACKFILL MATERIAL

- .1 As indicated on drawings and in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.
- .2 Unshrinkable fill: in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

#### 2.6 JOINT MORTAR

- .1 Portland cement: to CAN/CSA-A3000, normal type 10.
- .2 Mortar: one part Portland cement to two parts clean sharp sand mixed with minimum amount of water to obtain optimum consistency for use intended. Do not use additives.

### **PART 3- EXECUTION**

#### 3.1 PREPARATION

- .1 Clean pipes and fittings of debris and water before installation, and remove defective materials from site to approval of Departmental Representative.

### 3.2 TRENCHING

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

### 3.3 CONCRETE BEDDING AND ENCASEMENT

- .1 Do concrete Work in accordance with Section 03 30 00 - Cast-in-Place Concrete. Place concrete to details as indicated.
- .2 Position pipe on concrete blocks to facilitate placing of concrete.
  - .1 When necessary, rigidly anchor or weight pipe to prevent flotation when concrete is placed.
- .3 Backfill over concrete after 24 hours from placing.

### 3.4 GRANULAR BEDDING

- .1 Place bedding in unfrozen condition.
- .2 Place granular bedding material in uniform layers not exceeding 300 mm compacted thickness to depth as indicated.
- .3 Shape bed true to grade and to provide continuous, uniform bearing surface for pipe.
  - .1 Do not use blocks when bedding pipes.
- .4 Shape transverse depressions as required to suit joints.
- .5 Compact each layer full width of bed to at least 95 % Modified Proctor Density to ASTM D155.
- .6 Fill excavation below bottom of specified bedding adjacent to manholes or catch basins with lean mix concrete compacted bedding material.

### 3.5 INSTALLATION

- .1 Lay and join pipe in accordance with manufacturer's recommendations and to approval of Departmental Representative. PVC pipe and open profile HDPE pipe to CSA B182.11.
- .2 Handle pipe using methods approved by Departmental Representative.
  - .1 Do not use chains or cables passed through rigid pipe bore so that weight of pipe bears upon pipe ends.
- .3 Lay pipes on prepared bed, true to line and grade with pipe inverts smooth and free of sags or high points.
  - .1 Ensure barrel of each pipe is in contact with shaped bed throughout its full length.
- .4 Begin laying at outlet and proceed in upstream direction with socket ends of pipe facing upgrade.
- .5 Joint deflection permitted within limits recommended by pipe manufacturer.
- .6 Water to flow through pipes during construction only as permitted by Departmental Representative.
- .7 Whenever Work is suspended, install removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.
- .8 Install plastic pipe and fittings in accordance with CAN/CSA-B1800.

- .9 Joints:
  - .1 Concrete, clay and asbestos cement pipe:
    - .1 Install gaskets as recommended by manufacturer.
    - .2 Support pipes with hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.
    - .3 Align pipes before joining.
    - .4 Maintain pipe joints free from mud, silt, gravel and other foreign material.
    - .5 Avoid displacing gasket or contaminating with dirt or other foreign material. Remove disturbed or dirty gaskets; clean, lubricate and replace before joining is attempted.
    - .6 Complete each joint before laying next length of pipe.
    - .7 Minimize joint deflection after joint has been made to avoid joint damage.
    - .8 Apply sufficient pressure in making joints to ensure that joint is complete as outlined in manufacturer's recommendations.
    - .9 Mortared joints:
      - .1 Pipe exterior: for bell and spigot pipe, use mortar to seal outside of joints. Press and bed mortar into place.
      - .2 Allow mortar to set minimum of 1 hour before backfilling.
- .10 When any stoppage of Work occurs, restrain pipes as directed by Departmental Representative, to prevent "creep" during down time.
- .11 Plug lifting holes with Departmental Representative approved prefabricated plugs, set in shrinkage compensating grout.
- .12 Cut pipes as required for special inserts, fittings or closure pieces, as recommended by pipe manufacturer, without damaging pipe or its coating and to leave smooth end at right angles to axis of pipe.
- .13 Make watertight connections to manholes and catch basins.
  - .1 Use shrinkage compensating grout when suitable gaskets are not available.
- .14 Use prefabricated saddles or approved field connections for connecting pipes to existing sewer pipes.
  - .1 Joint to be structurally sound and watertight.
- .15 Temporarily plug open upstream ends of pipes with removable watertight concrete, steel or plastic bulkheads.

### 3.6 PIPE SURROUND

- .1 Upon completion of pipe laying, and after Departmental Representative has inspected pipe joints, surround and cover pipes as indicated.
  - .1 Leave joints and fittings exposed until field testing is completed.
- .2 Hand place surround material in uniform layers not exceeding 300 mm compacted thickness as indicated.
  - .1 Do not dump material within 3 m of pipe.
- .3 Place layers uniformly and simultaneously on each side of pipe.
- .4 Compact each layer full width of bed to at least 95 % Modified Proctor Density to ASTM D155.
- .5 Compact each layer full width of bed to at least 95 % Modified Proctor Density to ASTM D155.

- .6 When field test results are acceptable to Departmental Representative, place surround material at pipe joints.

### 3.7 BACKFILL

- .1 Place backfill material in unfrozen condition.
- .2 Place backfill material, above pipe surround, in uniform layers not exceeding 300 mm compacted thickness up to grades as indicated.
- .3 Compact each layer full width of bed to at least 95 % Modified Proctor Density to ASTM D155).
- .4 Place unshrinkable backfill in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

### 3.8 FIELD TESTS AND INSPECTIONS

- .1 Provide means of access to permit Departmental Representative to do inspections.
- .2 Repair or replace pipe, pipe joint or bedding found defective.
- .3 Remove foreign material from sewers and related appurtenances by flushing with water.
- .4 Conduct water pressure in the presence of Departmental representative on drain sump connections between drain sump and discharge. Minimum static test pressure of 861 kPa for 1 hr duration in accordance with manufactures recommended test procedure for piping.
- .5 Television and photographic inspections:
  - .1 Carry out inspection of installed sewers by closed circuit television camera, photographic camera or by other related means. Contractor will pay for costs of tests.
  - .2 Submit reports to Departmental Representative within 10 working days of completion of the field work on a continuous basis as the inspection area or pipeline types are finalized.
  - .3 Submit inspection report, digital video on DVD-R and corresponding digital report on CD-R to Departmental Representative for review.

### 3.9 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 35 43 – Environmental Procedures.
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 35 43 – Environmental Procedures.

**END OF SECTION 33 41 00**

## **PART 1– GENERAL**

### 1.1 RELATED REQUIREMENTS

- .1 Section 01 33 00 Submittal Procedures
- .2 Section 01 33 00 Cast-in-Place Concrete.
- .3 Section 32 11 23 Aggregate Base Courses.
- .4 Section 31 23 33.01 Excavating, Trenching and Backfilling.

### 1.2 REFERENCES

- .1 ASTM International
  - .1 ASTM F1216-07a: Standard Practice for Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of a Resin-Impregnated Tube
  - .2 ASTM F2019-11: Standard Practice for Rehabilitation of Existing Pipelines and Conduits by the Pulled in Place Installation of Glass Reinforced Plastic (GRP) Cured-in-Place Thermosetting Resin Pipe (CIPP)
  - .3 ASTM D790-10: Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
  - .4 ASTM D5813-04 (2008): Standard Specification for Cured-In-Place Thermosetting Resin Sewer Piping Systems
  - .5 ASTM D2990-09: Standard Test Methods for Tensile, Compressive and Flexural Creep and Creep Rupture of Plastics

## **PART 2– PRODUCTS**

### 2.1 LINER MATERIALS AND TYPE

- .1 The CIPP liner shall be a UV Cured CIPP liner consisting of glass reinforced plastic (GRP) meeting the requirements of ASTM F2019-11. Felt based CIPP liners (i.e. cured using steam, hot water or ambient cure) shall not be permitted.
- .2 The UV Cured CIPP liner materials shall have a substantial history of successful use in municipal sewer application in the province of British Columbia.
- .3 The UV Cured CIPP liner shall have short-term testing in accordance with ASTM D790 and long-term testing data available in accordance with ASTM D2290 to establish long-term characteristics in the design. The testing shall have been completed by a qualified third-party testing agency.
- .4 Should the Contractor have reason to use materials that differ from the original proposed materials, proposed alternate materials shall meet the above standards and require the approval of the Departmental Representative prior to use. Review of alternative approaches shall be at the cost of the Contractor. No guarantee of acceptance is implied.

### 2.2 MINIMUM PHYSICAL PROPERTIES

The UV Cured CIPP liner shall meet the following minimum requirements:

- .1 Flexural Modulus of at least 8,000 MPa Short-Term (ASTM D790) with 50-year retention of at least 50% (ASTM D2990);
- .2 Flexural Strength of at least 150 MPa Short-Term (ASTM D790) with 50-year retention of at least 50% (ASTM D2990);
- .3 Minimum thickness of 3.0mm or design thickness, whichever is greater.



## 2.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's recent test data and certification that materials to be incorporated in the works are representative and meet the requirements for this section. Include manufacturer's drawings where pertinent.
- .3 The Contractor shall submit the following shop drawings with respect to the CIPP liner:
  - .1 CIPP Liner Design in accordance with ASTM F1216-07a and the design parameters specified in this Contract, sealed and stamped by a Professional Engineer (P.Eng) licensed to practice in the province of British Columbia;
  - .2 Third-party test data to substantiate the short-term (ASTM D790) and long-term flexural modulus (ASTM D2990) used in the CIPP Liner Design for the same diameter and type of liner being proposed in this Contract;
  - .3 Material specifications and technical envelope of the CIPP liner, including the proposed liner tube (composition and type), and proposed resin (manufacture, type and identification number);
  - .4 Description of the UV-CIPP installation procedure to be utilized, including wet-out plan and curing plan. Provide a sample of the wet-out process sheet to be used;
  - .5 Contingency plan in the event of improper placement of the UV Cured CIPP liner, the CIPP's failure to achieve the required structural integrity, and damage to the host pipe;
  - .6 A baseline IR (Infrared Spectroscopy) scan of the resin to be used on this Contract.

## **PART 3- EXECUTION**

### 3.1 LINER INSTALLATION

- .1 The Contractor shall submit the liner installation procedure four weeks before the commencement of construction to the Departmental Representative for review and approval. Delays due to inadequate or incomplete submittals shall be the Contractor's responsibility.
- .2 The Contractor shall not commence any lining or associated preparatory work (i.e. cleaning) until the Departmental Representative has reviewed and approved their liner installation methodology.
- .3 The liner and resin shall be protected during installation into the existing sewer. No significant amount of resin shall be lost by contact with manhole walls or the sewer pipe during installation. The liner shall neither be contaminated nor diluted by exposure to dirt, debris, or water during the pull.
- .4 The Contractor shall ensure that all required equipment is in proper working condition prior to commencement of installation of the liner.

### 3.2 MEASURING INSIDE DIAMETER OF EXISTING SEWER

- .1 The Contractor shall measure and confirm the internal diameter and length of the existing sewer to be lined to appropriately size the UV Cured CIPP liner. The Contractor shall not rely on contract drawings, contract documents, as-built drawings and existing CCTV videos to obtain the length and diameter of the existing sewer.
- .2 The Contractor shall measure the inside diameter of the existing sanitary sewer at the upstream and downstream manhole location at the very least. Should measurements be made prior to the sewer being cleaned, the Contractor shall use a rod or any other device that can penetrate the internal sewer buildup to obtain an accurate measurement of the inside diameter. Measurement by tape is not permitted. In addition, the Contractor shall provide flow control to obtain proper measurements if deemed necessary.

- .3 Measurements shall account for any debris buildup, offset joints, change in ovality, partial collapse, broken pipe or any other factors that may result in incorrect liner sizing. In addition, measurements shall account for the fact the pipe inside the manhole may be representative of the bell diameter and not the actual pipe ID.
- .4 Measurements shall be provided to the Departmental Representative as a submittal.

### 3.3 CLEANING, FLUSHING, AND PREPARATION

- .1 The Contractor shall ensure that cleaning and preparation of the existing sanitary sewer to be lined is completed in a manner that prevents irreversible damage (i.e. collapse). In addition, the Contractor shall take all precautionary measures to avoid an open-cut repair prior to lining. The Contractor shall note that an open-cut repair is very challenging and difficult given the limited access into this site, and that the existing sanitary sewer is installed on wooden beams and piles known to be in poor structural condition. The Contractor shall notify the Departmental Representative via submittal of sections of the existing sewer which he believes may fail and their methodology to avoid causing irreversible damage to the existing sewer.
- .2 All soft and loose debris, such as sludge, dirt, sand, rocks, soil, grease and other material that may have settled shall be cleaned from the sewer using suitable methods, such as water jetting. The Contractor shall ensure the resulting debris and sludge from the cleaning operations is handled appropriately such that no material will enter the surrounding environment.
- .3 All protrusions and hard deposits shall be removed by means of robotic cutting/grinding such that the internal diameter of the sewer is not reduced by more than 15mm by any material remaining after the cutting/grinding providing that such material is hard and firmly attached to the sewer wall. Regardless of the 15mm tolerance, no sharp protrusions and/or deposits shall be left in place that will cause indentations to the liner. The Contractor shall ensure that the robotic cutting/grinding operation does not cut into the sewer itself.
- .4 All sludge, debris, deposits and foreign objects removed from the existing sanitary sewer during cleaning operations shall be removed from the pipe and disposed of at an approved municipal sanitary landfill in accordance with Section 01 35 43 Environmental Procedures. Disposing of such debris in the downstream/upstream sections of sanitary sewer is strictly prohibited. Dewatering may be performed on-site and the supernatant discharged to the temporary by-pass pumping station. The Contractor shall inform the Departmental Representative prior to discharging the supernatant and not discharge until the Departmental Representative has provided approval to proceed. Flow rate will be restricted such that the total flow rate (including incoming sewage flow rates) does not exceed 75% of the capacity of the by-pass station, nor 65L/s, whichever is less, and the sewage level in the pumping station does not exceed the obvert of the lower of two downstream inverts. The Departmental Representative will make the final determination of the adequacy of the dewatering process and the Contractor shall conform to his decision at no additional cost. Solids shall be disposed of off-site.
- .5 Prior to undertaking any cleaning, preparation or flushing works, the Contractor shall provide via submittal the cleaning and preparation methods to be utilized to the Departmental Representative for review and approval. The submittal shall include:
  - .1 Cleaning procedure;
  - .2 Equipment to be utilized;
  - .3 Procedure for removal of debris from upstream manhole;
  - .4 Dewatering of sludge, if any;
  - .5 Name, address and telephone number of the dumping site.
- .6 The Contractor shall provide for and pay for any chemical testing or other analysis required to dump sewage debris and for removal, transportation, tipping and all other costs associated with disposal of the debris. Copies of such test shall be provided to the Departmental Representative for record purposes.

- .7 The CCTV inspection report included with the Tender Documents shall be reviewed by the Contractor and all identifiable and/or visible defects in the existing sewer including the following but not limited to shall be repaired. The Contractor shall include in his/her tender price the cost to repair these defects and these shall be considered incidental to the cleaning, flushing & preparation item.
- .8 Standard cleaning, flushing and preparation of the existing sewer shall be paid for under the applicable lump sum item in the Contract Documents. Should any deposits, protrusions, roots or foreign materials be resistant to standard cleaning methods, or not identified above or not identifiable and/or visible in the CCTV inspection report provided, these defects shall be removed by robotic cutting or grinding. This work shall be paid for on a time basis through the applicable unit price item in the Contract. The Contractor is reminded that the cleaning is to be done from the upstream maintenance hole which is expected to make removal of debris more difficult. The Contractor shall allow for this effort in the bid.

### 3.4 VOID FILLING

- .1 Additional voids neither identified above nor visible in the CCTV inspection included with the Tender Documents may be present in the bedding around the existing sewer at locations where there are missing pieces of existing sewer. Should a void be deemed by the Departmental Representative to create a significant structural weakness in the liner due to bridging of the liner, the void shall be filled to provide support for the liner around the existing sewer prior to lining.
- .2 The Contractor shall identify immediately following the V1 CCTV investigation and notify the Departmental Representative of such voids. Should the Departmental Representative require voids to be filled, the Contractor shall submit their methodology for filling the voids, including all material and equipment used during this procedure. The cost to fill voids shall be paid for through the applicable provisional unit price items in the Contract.
- .3 This provision applies to existing voids in the pipeline. It does not apply to voids created by the Contractor's work, unless at the discretion of the Departmental Representative, the creation of such voids was unavoidable as a result of the work being undertaken.
- .4 Costs associated with the filling of additional voids shall be paid for under the applicable provisional item in the Contract. This includes any additional work done for the filling of voids identified in the V1 CCTV inspection.

### 3.5 WET-OUT

- .1 The UV Cured CIPP liner shall be impregnated with resin at the liner manufacturer's wet out facility in accordance with ASTM F2019-11. The quantity of resin used in the liners and its impregnation into the liner tube shall meet the requirements of the applicable ASTM guidelines.
- .2 The Contractor shall submit a quality control report for the wet-out facility that demonstrates proper materials and amounts are used in the resin-impregnation process. The quality control report shall include resin lot numbers, volumes of resin, catalyst, and enhancers, date of wet-out, storage and transportation controls and quality assurance procedures. All records and documentation shall be provided to the Departmental Representative via shop drawing submittal.
- .3 The Departmental Representative reserves the right to inspect the UV-Cured CIPP liner at the manufacturer's plant and wet-out facility for compliance to the Contract Documents. The Contractor shall arrange for such visits to the wet-out facility at no additional cost to the Contract.
- .4 The impregnated UV-Cured CIPP liner shall be stored and transported to site using UV light-proof container. The Contractor shall exercise care in shipping, handling and storage to avoid damaging the liner. Should the liner be damaged, the liner shall be replaced by the Contractor at no additional cost to the Contract.

3.6 CURING

- .1 A monitoring system shall be used to track the liner’s exposure to UV light during the curing process to ensure adequate curing of the resin. The monitoring system shall be capable of generating an automated report showing the maximum temperature achieved during the curing process and the time in which the curing temperature was sustained for each sensor along the sensor array. Curing logs shall be provided to the Departmental Representative with temperatures recorded at 10-minute intervals (maximum).
- .2 The Contractor shall demonstrate to the Departmental Representative that the monitoring system is properly functioning prior to installation of the UV Cured CIPP Liner. In particular, the Contractor shall demonstrate that each UV sensor within the sensor array is correctly displaying the UV light output. Should consecutive sensors not function properly, the Contractor shall remove and replace the sensor array with a new sensor array to the satisfaction of the Departmental Representative.
- .3 The Contractor shall provide a startup checklist via submittal for review by the Departmental Representative.

3.7 UV CURED CIPP LINER DESIGN

- .1 The liner thickness shall be designed by the Contractor in accordance with ASTM F1216-07a, Appendix X1 for the fully deteriorated gravity pipe condition and the requirements listed in Table 1. The design method in later editions of ASTM F1216 shall not be permitted. The liner design shall bear the seal of a Professional Engineer licensed to practice in the Province of British Columbia.
- .2 The Contractor shall confirm the field conditions, including the depth to invert, and ovality of the existing sewer. Should field conditions vary from those indicated in Table 1, the Contractor shall adjust the liner design accordingly and the adjusted liner design shall be submitted to the Departmental Representative. The Contractor shall proceed with the liner installation once the liner design has been returned by the Departmental Representative.

**Table 1: CIPP Design Parameters**

<b>Parameter</b>	<b>Requirement</b>
Design Method	ASTM F1216-07a, Appendix X1 for Fully Deteriorated Gravity Pipe. Design by later versions of the ASTM F1216 is not permitted.
Design Life	50 years
Safety Factors	2.0 for all equations
External Hydrostatic Pressure	Based on ground water table at ground surface
External Earth Load	Based on 1.5-2.0m cover over top of pipe
Live Load	H2O Loading
Ovality	3% or the actual ovality of the sewer section
Soil Weight	1920 kg/m <sup>3</sup>
Soil Modulus	5 MPa
Enhancement Factor	7.0

CIPP Liner Flexural Modulus	The long-term flexural modulus shall be used in the design. The long-term flexural modulus shall be the short-term flexural modulus multiplied by the Creep Retention Factor (CRF). The Contractor shall submit third party test data substantiating both the short-term flexural modulus and CRF used in the liner design in accordance with ASTM D790 and ASTM D2990, respectively. The short-term flexural modulus and CRF shall conform to the requirements of this Contract.
CIPP Liner Flexural Strength	The long-term flexural strength shall be used in the design. The long-term flexural strength shall be the short-term flexural strength multiplied by the Creep Retention Factor (CRF). The Contractor shall submit third party test data substantiating both the short-term flexural strength and creep retention factor used in the liner design in accordance with ASTM D790 and ASTM D2990, respectively. The short-term flexural strength and CRF shall conform to the requirements of this Contract.

### 3.8 UV CURED CIPP LINER DESIGN RECONCILIATION

- .1 The thickness for the final approved CIPP liner design shall be the minimum structural thickness of the liner subject to design reconciliation based on the actual properties of the liner derived from testing of the liner samples. For instance, if the actual measured properties are measured to be different than those assumed in the liner design, the required thickness shall be determined by design reconciliation. The required thickness may increase or decrease depending on the actual measured properties (i.e. flexural strength and flexural modulus) of the installed liner. However, under no circumstance, shall the measured properties be less than those minimum values for flexural strength and flexural modulus specified in this Contract.

### 3.9 LINER THICKNESS

- .1 The effective liner thickness measurement shall be in accordance with ASTM D5813-04 (2008), that is, the liner thickness shall be measured at eight equally spaced points around the circumference of the liner with the effective liner thickness being the average of these measurements. No thickness can be less than 87.5% of the required thickness for measuring liner thickness and for calculating the effective thickness from the measurements. The measured liner thickness shall only consist of the structural liner components only and shall not include the thickness of any non-structural components (i.e. coatings).

The wall thickness tolerance is:

Minus: 0%

Plus: 25%

### 3.10 LINER FIT, FINISH, AND PROPERTIES

The installed UV cured CIPP liner shall conform to the following:

- .1 Continuity of Liner – The liner shall be continuous over the entire length of the installation from manhole to manhole. There shall be no breaks, separations, or joints.
- .2 Liner fit to existing sewer liner - the outside surface of the liner shall be in contact with the inside surface of the cleaned existing sewer subject to a 1.0 mm contact tolerance. Should a gap exist between the outside surface of the liner and the inside surface of the sewer exceeding this tolerance, the liner shall be deemed deficient; however, exceptions shall be made should there be

existing sewer irregularities, such as off set joints, protrusions, bumps or other similar situations in the existing sewer that remain after the sewer has been cleaned and prepared. Ovalization of the sewer or curves made by joint deflection shall not be considered irregularities. A liner fit exception at the existing sewer irregularity shall not present an obstruction to sewage flow.

- .3 Liner shape – the liner shape shall be defined by the liner fit to the existing sewer, that is, the liner shape shall conform to the shape of the cleaned existing sewer. When the existing sewer is not defined (i.e. the existing sewer is missing pieces), the liner may bridge the missing wall section or indent into the missing wall section. Where the liner bridges, the shape of the liner shall match the adjacent sewer and the inside diameter of the liner shall meet the contact tolerance requirements as specified in the Contract Documents. Where the liner indents, the depth of the indent shall not reduce the liner wall thickness below the wall thickness tolerance as specified in the Contract Documents.
- .4 Liner wall – the liner wall shall be free of any interior bulges, ribs, ripples, folds or other irregularities except where these irregularities comply with the contact tolerance, wall thickness tolerance, fit and shape as specified in the Contract Documents. The liner wall shall be free of any voids (dry spots), cavities, or bubbles.
- .5 Liner termination – the ends of the liner shall be neat and smooth. The liner shall extend slightly beyond the manhole opening as required to allow for a seal to be installed around the liner at the pipe-manhole interface. The end seal at the pipe-manhole interface shall be Amex Liner End for Sewage or approved equivalent.

### 3.11 ODOUR CONTROL

- .1 The Contractor shall submit an odour-control plan prior to the beginning any lining work on the existing sewer to the Departmental Representative for review. The Contractor shall respond, investigate and act immediately on any odour complaint that may occur, including odours that may result from escape of styrene from the liner into or out of the sewer being lined. The Contractor shall provide adequate sewer ventilation and odour mitigation during the CIPP lining process, including but not limited to adequately sized exhaust fan(s) to alleviate any odour issues. Exhaust fans shall be located at the manhole immediately downstream of the sewer section being lined and any other manholes that will permit air to be exhausted from the sewer being lined.

### 3.12 LINER DEFICIENCIES

- .1 Any deficiencies identified in the liner by the Departmental Representative shall be rectified by the Contractor. Prior to rectification of the liner deficiency, the Contractor shall submit their corrective methodology to the Departmental Representative for review. Should the Departmental Representative deem that the corrective action is not acceptable, the Contractor shall remove and replace the liner at no additional cost to the Contract. Such deficiencies include, but are not limited to the following:
  - .1 The liner does not meet the minimum thickness, flexural strength or flexural modulus or any combination of the above as specified in the Contract;
  - .2 The short-term flexural strength, short-term flexural modulus or thickness or both do not meet the values used in the liner design. During such circumstances, the liner shall be deemed deficient until the liner design has been reconciled and it has been demonstrated that the installed liner meets the design requirements listed in Table 1: CIPP Design Parameters;
  - .3 Excessive bulges, ribs, ripples, fold that do not comply with the contact tolerance as specified in the Contract. These deficiencies are indicative of structural deficiency of the liner and may be indicative of internal separation between the liner and the host pipe;
  - .4 Any deficiency that is deemed to cause an obstruction to sewage flow.

3.13 MEASUREMENT OF PAYMENT

- .1 Measurement of UV Cured CIPP liner shall be by horizontal length of liner supplied and installed in the sewer from where it exits the entrance maintenance hole to where it enters the exit maintenance hole, as measured by the Departmental Representative. Specifically, the measurement is not from centre of maintenance hole to centre of maintenance hole.

3.14 BASIS OF PAYMENT

- .1 The Work outlined in this Section shall be paid for under the applicable unit price item in the Contract Documents and shall be full compensation for all Labour, Equipment and Material to do the Work.
- .2 Payment for the installation for the UV Cured CIPP lining shall be made as follows:
  - .1 85% of the unit price shall be paid upon installation (including curing) of the UV Cured CIPP liner
  - .2 15% of the unit price shall be paid upon confirmation of the UV Cured CIPP liner strength and thickness, including delivery and acceptance of all required submissions, including but not limited to, flexural strength, flexural modulus and thickness lab test results, wet out logs, curing logs, and V3 CCTV videos.

**PART 4 - V1, V2, AND V3 CCTV INSPECTIONS**

4.1 V1 - PRELIMINARY CCTV INSPECTION

- .1 The Contractor shall undertake a preliminary CCTV inspection, referred to as the V1 CCTV Inspection, to determine and record the initial condition of the sewer. The Contractor shall provide whatever means necessary to sufficiently record the initial condition of the existing sewer, including but not limited to, preliminary cleaning of the existing sewer, dewatering and/or bypassing of the sewer flows at no additional cost to the Contract.
- .2 The V1 CCTV Inspection shall be compared to the CCTV Inspection provided with the tender document to determine whether a significant change exists. A significant change is defined as a condition that will prevent lining of the section, require a repair before lining, or may require a change in the liner design parameters resulting in an increased thickness. Should a significant change condition be encountered, the Contractor shall immediately notify of the Departmental Representative of such a condition.
- .3 Sewer defect coding is not required for the V1 CCTV Inspection.

4.2 V2 – POST CLEANING AND PREPARATION CCTV INSPECTION

- .1 The Contractor shall undertake a CCTV Inspection, referred to as the V2 CCTV Inspection, after completion of the cleaning and preparation of the existing sewer section to be lined, including all reaming, cutting and void filling. During the V2 CCTV inspection, the existing sewer shall have no standing water or flow that will result in poor quality of the CCTV video and make it difficult to assess the post cleaning and preparation of the existing sewer. All sewer flows shall be bypassed during the V2 CCTV Inspection at the expense of the Contractor.
- .2 The V2 CCTV Inspection shall be provided to the Departmental Representative at least 5 working days prior to lining for the Departmental Representative's review of cleaning and preparation. The Contractor shall not commence lining until the Departmental Representative has reviewed and accepted the cleaning and preparation of the existing sewer.
- .3 Should a deficiency be noted by the Departmental Representative in the V2 CCTV video that requires rectification, the Contractor shall rectify the deficiency and retake the V2 CCTV at no additional cost to the Contract. The retaken V2 CCTV Inspection shall be submitted to the Departmental Representative for review and acceptance.

- .4 Sewer defect coding is not required for the V2 CCTV Inspection.

#### 4.3 V3 – POST UV CURED LINER CCTV INSPECTION

- .1 The Contractor shall undertake a CCTV Inspection, referred to as the V3 CCTV Inspection, after completion of the sewer rehabilitation. The V3 CCTV Inspection shall be provided to the Departmental Representative as part of the approval process for the lined sewer.
- .2 Should a deficiency in the lined sewer section be identified requiring rectification, the V3 CCTV Inspection shall be retaken after the corrective action has taken place at no additional cost to the Contract. The retaken V3 CCTV Inspection shall be submitted to the Departmental Representative for review and approval.
- .3 Sewer defect coding is required for the V3 CCTV Inspection.

#### 4.4 CCTV EQUIPMENT AND VEHICLES

The CCTV camera equipment used for the V1, V2, and V3 inspections shall adhere to the following requirements described herein.

- .1 The CCTV camera equipment shall be self-propelled type with colour pan, tilt zoom view and full 360-degree radial capability with a range of at least 160 m from the insertion location. The camera shall be capable of producing a continuous picture resolution of not less than 400 lines at the live recording. The camera shall consist on a self-contained, adjustable, directed light source compatible with the lens angle and dispersed to create even distribution of the light around the pipe perimeter without the loss of contrast, flare out of picture or shadowing. The camera shall be equipped with sufficient lighting and shall record an accurate representation of the pipe without any picture distortions.
- .2 The camera equipment shall be located in the center of the pipe such that the camera captures the full circumference of the pipe to properly confirm the features of the existing sewer during the V1 and V2 CCTV inspections and to properly confirm the features of the UV Cured CIPP liner following installation during the V3 CCTV Inspection.
- .3 The CCTV vehicles shall have sufficient space to accommodate both the Departmental Representative and a representative of the County, as well as the CCTV operator, for live viewing of the sanitary sewer.
- .4 The CCTV vehicle may not pass the limits for vehicles shown on the drawings; i.e., it must remain at the at end of the sewer.

#### 4.5 CCTV VIDEO DISPLAY AND QUALITY

- .1 Each individual CCTV inspection shall be continuous over the sewer section. The Contractor shall ensure that the speed of the inspection is not greater than 5m per minute. The Contractor may be required to stop to inspect specific features of the existing sewer as required by the Departmental Representative.
- .2 The initial screen of the CCTV inspection shall contain the municipality name, contract number, project name, location, start manhole ID (as referenced in the drawings), end manhole ID (as referenced in the drawings), date, time, distance, weather, flow direction, camera direction, size and material of sewer, and contractor name. The initial screen shall be displayed for a minimum of 30 seconds. The video must include a tilt and view of the start maintenance hole and the termination maintenance hole. The metered location of the camera within the sewer shall be displayed continuously throughout the inspection and shall be zeroed at the start maintenance hole.
- .3 The Contractor shall retake any videos which the Departmental Representative deems to not have captured sufficient detail as a result of, but not limited to, insufficient lighting, picture distortions, focus issues, speed at which video is taken or any other issues that undermine the video quality.



The Contractor shall remove any steam or fog in the pipe that obscures the view. Ventilation or other provisions shall be provided by the Contractor to eliminate any steam or fog as required.

#### 4.6 CCTV DIGITAL FILES AND REPORTS

- .1 The recorded CCTV videos, in an MPEG-2 file format (or approved equal) suitable for proper playback without jumping or discontinuities, shall be submitted to the Departmental Representative on digital video disc (DVD) or other approved media. The file name in the DVD shall clearly and concisely identify the sewer section and location of the CCTV inspection. DVDs containing filenames that do not properly identify the video inspection will be rejected by the Departmental Representative.
- .2 The CCTV video files shall play properly on up-to-date versions of the following video playing software applications: Microsoft Windows Media Player, Apple QuickTime Player and VLC Player. Video files that do not play properly and completely on each of these software applications will be rejected by the Departmental Representative.
- .3 Should CCTV video files not playback properly and/or not conform to the requirements above, the Contractor shall correct the CCTV videos to the satisfaction of the Departmental Representative, including re-doing the CCTV inspection if necessary at no additional cost to the Contract.
- .4 The Contractor shall submit an inspection report (in PDF format) with each V1, V2, and V3 video inspection on the same DVD. The inspection report shall document the contract number, project name, location, date of inspection, pipe material, pipe diameter, start and end manhole ID (as referenced on the drawing), summary comments, disk, tape and file numbers. The report shall detail features noted in the video inspection of the existing sewer or UV Cured CIPP liner and their locations with respect to the clock position of the pipe and the distance from the starting manhole.

#### 4.7 CCTV OPERATOR REQUIREMENTS AND DEFECT CODING

- .1 CCTV investigations and defect coding shall be completed by certified operators with valid NASSCO PACP Certification. The Contractor shall provide all documentation that operators have had training with an approved entity approved by NASSCO to the Departmental Representative. The Departmental Representative reserves the right to request a new operator or specify a form of training for the current operator should the Departmental Representative consider the current operator to be inadequate at no additional cost to the Contract.
- .2 Defect coding shall be in accordance with the Water Research Council (WRC) Manual of Sewer Condition and Classification Third Edition.

#### 4.8 MEASUREMENT OF PAYMENT

- .1 Measurement of CCTV inspections shall be by horizontal length of pipe captured as measured by the Departmental Representative.

#### 4.9 BASIS OF PAYMENT

- .1 Payment shall be made under the applicable unit price item in the Contract Documents for CCTV inspection and shall include all labour, material and equipment to do the Work.
- .2 Payment shall be made following submission and acceptance of each CCTV video and report to the satisfaction of the Departmental Representative.

### **PART 5 - BYPASS PUMPING AND FLOW CONTROL**

The Contractor shall design, supply and install a temporary sewer bypass pumping system required for the diversion of sewer flows prior to any work being undertaken on the existing sanitary sewer, including, but not limited to, CCTV inspections, cleaning and preparation of the existing sewer, and UV Cured CIPP lining. The temporary sewer bypass system shall be designed to convey all sewage flows such that no flow

is conveyed into the sewer section being rehabilitated. The temporary sewer bypass system shall remain in place until the final installed UV Cured CIPP liner has been accepted by the Departmental Representative, including all supporting documents, such as the thickness measurements, flexural strength test results, flexural modulus test results, design reconciliation, wet out and curing logs, and V3 CCTV video.

The Contractor shall be responsible for any damage, repairs and cleanup to property or the environment caused by pump system failures, lack of pump capacity, forcemain breaks or overflows. The Contractor shall demonstrate that the insurance policies required under this Contract include coverage for damages caused by bypass pumping system and system failures.

## 5.1 FLOW MANAGEMENT PLAN

- .1 The design, installation and operation of the temporary bypass pumping system shall be the Contractor's responsibility subject to the requirements of this specification. The Contractor shall familiarize him/herself with the sanitary sewer system to determine flow diversion points, discharge manholes, bypass piping sizes and lengths, pumps, generators, standby equipment and all other details required to complete the work as specified herein.
- .2 The Contractor shall retain the services of a Consultant specializing in the design and operation of temporary bypass pumping systems. The Contractor shall provide the Consultant's qualifications, including three (3) reference projects of a similar size and complexity comparable to this project. The consultant shall be to the satisfaction of the Departmental Representative and shall be replaced by the Contractor if the Departmental Representative considers the consultant to be inadequate or inexperienced, at no additional cost to the Contract.
- .3 The Contractor shall prepare with his/her Consultant a Flow Management Plan outlining the bypassing of existing sewer flows to permit the rehabilitation work. The Contractor shall ensure that the bypass pumping system and discharge piping is adequate to carry peak flows (including I&I) of up to 20L/s at all times during the bypass operation. The Flow Management Plan shall be signed and stamped by a P.Eng licensed to practice in the Province of British Columbia. The Flow Management Plan shall detail the following, as a minimum:
  - .1 Description of the flow management setup
  - .2 Bypass routing drawing based on sewer by-pass location
  - .3 Capacity assessment
  - .4 Pump curves
  - .5 Duration of the flow management operation
  - .6 Equipment monitoring
  - .7 Equipment maintenance
  - .8 Freezing protection system
  - .9 Public protection system
  - .10 Noise mitigation
  - .11 Remote monitoring system
  - .12 Emergency procedures for:
    - .1 Low fuel
    - .2 Pump fail
    - .3 Generator fail
    - .4 High liquid level
    - .5 Higher than anticipated flow rates
  - .13 Spill response procedures, indicating the following information at a minimum:

- .1 Action to be undertaken to mitigate the adverse effects of the spill on the environment, including plan for containing the spill and addressing the source of the spill;
- .2 Action to be undertaken to investigate the cause of the spill;
- .3 Procedures to report the spill
- .14 Emergency 24-hour contact information and escalation procedures
- .4 The Contractor shall ensure that the Flow Management Plan does not involve any excavation.

## 5.2 PUMPS AND PUMP REDUNDANCY

- .1 Provide electric or diesel-powered pumps that shall be fully automatic, self-priming and critically silenced-low noise. The pumps shall be equipped with all necessary stop and start controls, hospital grade silencer and sound-attenuating enclosure. Additional sound attenuation measures may be required at the discretion of the Departmental Representative.
- .2 All pumps used must be constructed to allow dry running for periods of time up to five hours to accommodate the cyclical nature of effluent flows. Maintain one stand-by pump of each size on or near site which are utilized for bypassing local connections and may not have sufficient redundancy.
- .3 One additional back-up pump of equal capacity as other pumps shall be provided and isolated from the primary pumping system by a valve and ready to start when required. The backup pump shall have the ability to be put in service within 5 minutes by operating valves and without requiring any installation alterations, including bypass piping.

## 5.3 TEMPORARY SEWER BYPASS PIPING

- .1 The sewer bypass piping shall conform to the following specifications:
  - .1 Bypass piping shall be HDPE (High Density Polyethylene) conforming to the requirements of ASTM F714-13 and shall be made from a PE4710 high density polyethylene resin;
  - .2 HDPE pipe shall be joined with butt, heat fusion joints as outlined in ASTM D2620-13 and conform to the Generic Butt Fusion Joining Procedure for Field Joining of Polyethylene Pipe, Technical Report TR-33/2005, published by the Plastic Pipe Institute (PPI). All joints shall be made in strict compliance with the manufacturer's recommendations. A factory qualified joining technician as designated by pipe manufacturer shall perform all heat fusion joints;
  - .3 HDPE butt fusion fittings shall have a pressure rating equal to the pipe unless otherwise specified on the plans;
  - .4 The Contractor shall design piping to account for any vacuum considerations as required;
  - .5 The number, diameter and pressure rating of the bypass pipes shall be designed to convey peak flows; however, bypass piping shall be sized to avoid flow velocities higher than 2 m/s unless approved by the Departmental Representative;
  - .6 Bypass piping shall be anchored to prohibit movement and shall be insulated should freezing weather be anticipated;
  - .7 The bypass pump shall discharge to existing manhole SMH18A. However, if the Contractor chooses, they can discharge to the downstream manhole of the section being lined. The Contractor must submit the discharge location in the Flow Management Plan and must demonstrate the feasibility and method of discharging to the existing downstream manhole SMH18A to the satisfaction of the Departmental Representative.
- .2 PRESSURE TEST – BYPASS PUMPING
  - .1 The Contractor shall perform leakage and pressure tests of the bypass pumping discharge piping using potable water prior to actual operation in accordance with ASTM F2164-13. The test pressure shall be 1.5 times the expected maximum pressure the bypass will

- experience based on the Flow Management Plan, but no less than 80 psig. The test pressure shall be held for a period of 2 hours in which no leakage is permitted on the bypass pipe.
- .2 The Departmental Representative shall witness and approve the leakage test.
- .3 SEWER PLUGGING
- .1 Plugging or blocking of sewage flows shall incorporate a primary and secondary plugging device. Sewer plugs shall be based and sized according to the inner diameter of the existing sewer, flow characteristics of the existing sewer, and flow diversion point, as verified on site by the Contractor.
  - .2 Plugging and secondary plugging shall be removed in a manner that permits the sewage flow to slowly return to normal without surge, to prevent surcharging or causing other major disturbances downstream. The Contractor shall draw down the level of the incoming flows as much as reasonably possible using the by-pass pumping system just prior to removing the plugs.
  - .3 Sewer plugs shall be anchored to prevent washout of the plugs down the sewer.
- .4 BASIS OF PAYMENT
- .1 This item shall be paid for under the applicable lump sum price in the Contract. Payment for this item shall be made as follows:
    - .1 10% payment upon acceptance of the Flow Management Plan;
    - .2 25% payment upon commissioning of the Temporary Bypass Pumping System;
    - .3 50% payment prorated over the duration of the project in which the Temporary Bypass Pumping System is in service;
    - .4 15% payment upon removal of the Temporary Bypass Pumping System.

#### **PART 6 - TESTING OF CIPP LINER**

- .1 The Contractor shall provide testing of the UV Cured CIPP liner material as per the following:
  - .1 Flexural Modulus and Flexural Strength test in accordance with ASTM D790
  - .2 Thickness measurement test in accordance with ASTM D5813
- .2 The Contractor shall include in his price all extraction of all UV Cured CIPP samples for testing, including excavation and disposal of material, cutting of sample coupon from existing sewer, delivery of sample to approved testing facility (Paragon Systems or approved equal) and testing, reporting and delivery of reports to the Departmental Representative.
- .3 The testing agency shall be retained by the Contractor as a subcontractor under the terms of the Contract, but the testing agency shall maintain an open line of communication with the Departmental Representative and shall share collected data and submit relevant test reports to the Departmental Representative accordingly.
- .4 One liner sample shall be extracted from the sanitary sewer being relined. Given the diameter of the sewer, a plate type sample or sample cut from the end of the sewer is acceptable. The sample length shall be confirmed with the approved testing facility prior to extraction. In addition, the length and size of the sample shall be sufficient to obtain at least 5 test specimens for ASTM D790 testing.
- .5 The samples shall be marked with the contractor name, contract number, upstream manhole ID, downstream manhole ID, size of sewer, location, and date removed. Each sample must be identified, dated and signed by the Departmental Representative prior to leaving the project site.
- .6 Samples shall be delivered to the testing facility immediately following extraction such that sample test results are provided to the Departmental Representative within 10 days following installation of the UV Cured CIPP liner. Should samples not be submitted within a timely manner, the

Departmental Representative reserves the right to suspend work until the test results are submitted. Test reports shall contain pictures of the sample that was tested clearly showing all the information marked on the sample according to this specification.

- .7 Should a liner sample be deemed deficient by the Departmental Representative or Contractor given that the sample is inadequate for testing or not representative of the liner within the sewer, the Contractor shall obtain a new sample of the liner suitable for testing at no additional cost to the Contract.
- .8 MEASUREMENT OF PAYMENT
  - .1 Measurement of payment will be based on each sample location collected and tested.
- .9 BASIS OF PAYMENT
  - .1 Payment for UV Cured CIPP material testing shall be made under the applicable unit price item in the Contract Documents.
  - .2 Payment will be made upon submission of the UV Cured CIPP material test reports (flexural modulus, flexural strength, thickness) to the satisfaction of the Departmental Representative.

**END OF SECTION 33 78 00**

# **APPENDIX A**



### PRELIMINARY HAZARD ASSESSMENT FORM

Project Number:	R.098006.001		
Location:	William Head Institution		
Date:	March 2020		
Name of Departmental Representative:	Calvin Lu		
Name of Client:	Correctional Services Canada		
Name of Client Project Co-ordinator	Ryan Singer	PH: ( )-	-

Site Specific Orientation Provided at Project Location    **Yes**     **No**

Notice of Project Required    **Yes**     **No**

**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 PWGSC 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. PWGSC 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
	PWGSC, OGD's, or tenants		General Public or other contractors		
Examples: Chemical, Biological, Natural, Physical, and Ergonomic					Note: When thinking about this pre-construction hazard assessment, remember a <b>hazard</b> is anything that may cause harm, such as chemicals, electricity, working from heights, etc; the <b>risk</b> 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.
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.	<b>Yes</b>	<b>No</b>	<b>Yes</b>	<b>No</b>	

Typical Construction Hazards					
Concealed/Buried Services (electrical, gas, water, sewer etc)	X		X		
Slip Hazards or Unsound Footing	X		X		
Working at Heights		X		X	
Working Over or Around Water	X		X		
Heavy overhead lifting operations, mobile cranes etc.		X		X	
Marine and/or Vehicular Traffic (site vehicles, public vehicles, etc.	X		X		



Fire and Explosion Hazards		X		X	
High Noise Levels	X		X		
Excavations	X		X		
Blasting		X		X	
Construction Equipment	X		X		
Pedestrian Traffic (site personnel, tenants, visitors, public)	X		X		
Multiple Employer Worksite	X		X		

<b>Electrical Hazards</b>					<b>Comments</b>
Contact With Overhead Wires		X		X	
Live Electrical Systems or Equipment	X		X		
<b>Other:</b>					
<b>Physical Hazards</b>					
Equipment Slippage Due To Slopes/Ground Conditions		X		X	
Earthquake	X		X		
Tsunami	X		X		
Avalanche		X		X	
Forest Fires		X		X	
Fire and Explosion Hazards		X		X	
Working in Isolation		X		X	
Working Alone		X		X	
Violence in the Workplace		X		X	
High Noise Levels	X		X		
Inclement weather	X		X		
High Pressure Systems		X		X	
<b>Other:</b>					
<b>Hazardous Work Environments</b>					
Confined Spaces / Restricted Spaces	X		X		
Suspended / Mobile Work Platforms					
<b>Other:</b>					
<b>Biological Hazards</b>					
Mould Proliferations		X		X	
Accumulation of Bird or Bat Guano		X		X	
Bacteria / Legionella in Cooling Towers / Process Water		X		X	
Rodent / Insect Infestation		X		X	
Poisonous Plants		X		X	
Sharp or Potentially Infectious Objects in Wastes	X		X		
Wildlife					
<b>Chemical Hazards</b>					
Asbestos Materials on Site	X		X		If "yes" a pre-project asbestos survey report is required. Provide Contractor with DP – 057 ELF Form 16 "Contractor Notification and Acknowledgement"





Designated Substance Present		X		X	If "yes" a pre-project designated substance survey report is required.
Chemicals Used in work	X		X		
Lead in paint		X		X	If "yes" a pre-project lead survey report is required.
Mercury in Thermostats or Switches		X		X	If "yes" a pre-project mercury survey report is required.
Application of Chemicals or Pesticides		X		X	
PCB Liquids in Electrical Equipment		X		X	
Radioactive Materials in Equipment		X		X	
<b>Other:</b>					
<b>Contaminated Sites Hazards</b>					
Hazardous Waste	X		X		
Hydrocarbons		X		X	
Metals		X		X	
Other:					

<b>Security Hazards</b>					<b>Comments</b>
Risk of Assault	X		X		Prison site.
<b>Other:</b>					
<b>Other Hazards</b>					

<b>Other Compliance and Permit Requirements<sup>1</sup></b>	<b>YES</b>	<b>NO</b>	<b>Notes / Comments<sup>2</sup></b>
Is a Building Permit required?		X	
Is a Electrical permit required?		X	
Is a Plumbing Permit required?		X	
Is a Sewage Permit required?		X	
Is a Dumping Permit required?		X	
Is a Hot Work Permit required?		X	
Is a Permit to Work required?	X		Mandatory for ALL AFD managed work sites.
Is a Confined Space Entry Permit required?	X		Mandatory
Is a Confined Space Entry Log required?	X		Mandatory for all Confined Spaces
Discharge Approval for treated water required?	X		

**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.**

<b>Service Provider Name</b>			
<b>Signatory for Service Provider</b>		<b>Date Signed</b>	
<b>RETURN EXECUTED DOCUMENT TO PWGSC DEPARTMENTAL REPRESENTATIVE PRIOR TO ANY WORK COMMENCING</b>			