



Construction Services

Project Specifications

DCU – Sinclair Canyon Electrical Upgrade and Site Rehabilitation Project, Kootenay National Park

For
Parks Canada Agency
Kootenay National Park,
British Columbia.
Project Number: R.067256.802
Western Project # R.079636.001

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**DCU-SINCLAIR CANYON ELECTRICAL UPGRADE AND
SITE REHABILITATION**

KOOTENAY NATIONAL PARK, BC

**PROJECT # R.067256.802
WESTERN PROJECT # R.079636.001**

PROJECT SEALS PAGE



ELECTRICAL



STRUCTURAL



CIVIL

Part 1 General

1.1 SECTION INCLUDES:

- .1 Work covered by Contract Documents;
- .2 Contract Method;
- .3 Work by others;
- .4 Future work;
- .5 Work sequence;
- .6 Contractor use of premises;
- .7 Owner occupancy.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 35 00 – Health & Safety Requirements

1.3 WORK COVERED BY CONTRACT DOCUMENTS

.1 Work of this Contract comprises multidisciplinary rehabilitation of the Sinclair Canyon Site adjacent to the town of Radium, British Columbia. The project includes, but is not limited to:

- Electrical site rehabilitation including but not limited to:
 - a. Supply and install new roadway Luminaires, Galvanized Steel Poles, and Foundations.
 - b. Supply and install new parking luminaires, Galvanized Steel poles, and foundations.
 - c. Supply and install new pathway luminaires, bollards, and foundations.
 - d. Supply and install of supporting conduit, wiring, and electrical infrastructure for site distribution.
 - e. Removal and disposal of existing lighting infrastructure to approved facility.
 - f. Supply and installation of conduit systems for communications and CCTV
 - i. Supply and installation of communications conduits, pull boxes, and pull string/mule tape for future fibre optic cabling.
 - g. Supply of Electrical Power distribution equipment including enclosures, panel boards, breakers, contactors, foundations and associated wiring and integral equipment.
 - h. Supply of Pedestrian Crossing equipment, signage, foundations, poles and associated wiring.

- i. Supply and installation of Lighting control module, associated wiring, and programming to the satisfaction of the department representative.
- Civil Site rehabilitation including but not limited to:
 - a. Concrete and asphalt sidewalk demolition.
 - b. Wood railing demolition.
 - c. Pavement and curb removal.
 - d. Grading
 - e. Asphalt Paving
 - f. Installation of Curb and Gutter
 - g. Installation of Jersey barrier and guide rails.
 - h. Installation of catch basin(s)
 - i. Installation of miscellaneous Signage.
 - j. Completion of miscellaneous landscaping and remediation work to return site conditions to existing or better.
 - k. Remediation of existing rundle stone wall including procurement of stone and approved mortar to match that existing.
- Retaining Structures including piles, casings, and associated work including but not limited to:
 - a. Review of existing geotechnical information
 - b. Installation of tangent pile wall
 - c. Structural pedestrian walkway and retaining wall
 - d. Grading, reinforcing, and fill
 - e. Concrete form work, control joints, saw cutting
 - f. Backfill
- Phased construction, to accommodate limited interruption to the services of the building and the existing park.
- Supply and installation of complete systems, fully functional, tested, and commissioned in accordance with specification.
- Supply of turnover documentation including shop drawings, warranty documents, operation and maintenance binders in accordance with specification.

- Provide training for all systems to the department's representative and supporting facility operators.

1.4 CONTRACT METHOD

- .1 Construct Work under single, stipulated price contract.

1.5 WORK BY OTHERS

- .1 Not applicable.

1.6 WORK SEQUENCE

- .1 Construct Work in stages to accommodate Owner's continued use of site and premises during construction.
- .2 Co-ordinate Progress Schedule and co-ordinate with Owner Occupancy during construction.
- .3 Maintain fire access/control.
- .4 Required construction phases: Phased construction is required to accommodate limited interruption permitted to the main road servicing the site and car parking facilities.
- .5 Co-ordinate with articles 'Contractor Use of Premises', 'Progress Schedule', and with Drawings.
- .6 Construct Work in stages to provide for continuous public usage. Do not close off public usage of facilities until use of one stage of Work will provide alternate usage.

1.7 SITE MEETINGS

- .1 Construction meetings with Departmental Representative to be held on site bi-weekly.
- .2 All contractors shall also attend bi-weekly site meetings.
- .3 Contractors shall attend commissioning meetings.

1.8 CONTRACTOR USE OF PREMISES

- .1 Contractor shall limit use of premises for work, for storage, and for access, use of premises, to allow:
 - .1 Owner occupancy.
 - .2 Public usage.
- .2 Co-ordinate use of premises such as work areas, storage, delivery of materials and equipment, parking, washroom facilities provision and use, elevator, power and water use shall be coordinated with and under direction of Departmental Representative. See Section 01 14 00 for contractor entry/exit of primary staging area, entry log, and contractor parking locations.
- .3 Contractor shall supply all necessary signage, hoarding and fencing.

- .4 Contractor is responsible for all dust control measures. Contractor shall maintain the work areas under negative pressure to minimize potential for dust spread in the building.
- .5 Contractor shall coordinate all work during normal hours of operation, Monday to Friday 7:00 am - 7:00 pm. Increase to the hours of operation would need approval from the Department Representative. Coordinate all deliveries to minimize the disruption to the normal operation of the facility - coordinate with the Departmental Representative.
- .6 All work to be performed after hours shall be coordinated with the Departmental Representative.
- .7 Any work performed by the contractor outside of normal working hours requires notification of on-site security commissionaires.
- .8 A temporary storage area for removed equipment is to be located in a designated storage area as coordinate with Departmental Representative. Contractor shall supply all hoarding and fencing. See Section 01 35 00.
- .9 Contractor shall abide by all on-site security provisions and regulations.

1.9 OWNER OCCUPANCY

- .1 Owner will occupy premises during entire construction period for execution of normal operations.
- .2 Co-operate with Owner in scheduling operations to minimize conflict and to facilitate Owner usage.

1.10 CONTRACTOR FURNISHED ITEMS

- .1 Contractor Responsibilities:
 - .1 Designate submittals and delivery date for each product in progress schedule.
 - .2 Review shop drawings, product data, samples, and other submittals. Submit to Departmental Representative notification of any observed discrepancies or problems anticipated due to non-conformance with Contract Documents.
 - .3 Receive and unload products at site.
 - .4 Handle products at site, including uncrating and storage.
 - .5 Protect products from damage and from exposure to elements.
 - .6 Assemble, install, connect, adjust, and finish products.
 - .7 Provide installation inspections required by local authorities.
 - .8 Repair or replace and make good items damaged by contractor on site during construction.
 - .9 The word “make good” used in the contract documents means “to restore new or existing work after being damaged, cut, patched or rejected by the Departmental Representative” and also means “using materials identical to the original materials with visible surfaces matching the appearance of the original surfaces in all details and with no apparent junctions between new and original surfaces. Where original materials are no longer available, the Contractor may submit a proposal of materials for review by the Departmental Representative.”

1.11 MOCK-UP

- .1 Not applicable.

1.12 ALTERATIONS, ADDITIONS OR REPAIRS TO EXISTING BUILDING

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

1.13 EXISTING SERVICES

- .1 Notify Department Representative and utility companies of intended interruption of services and obtain required permission.
- .2 Where Work involves breaking into or connecting to existing services, give Department Representative 48 hours, notice for necessary interruption of electrical service throughout course of work. Minimize duration of interruptions. Carry out work at times as directed by governing authorities with minimum disturbance to client, pedestrian, and vehicular traffic operations.
- .3 Provide alternative routes for pedestrian and vehicular traffic.
- .4 Establish location and extent of service lines in area of work before starting Work. Notify Department Representative of findings.
- .5 Provide adequate bridging over trenches which cross sidewalks or roads to permit normal traffic.
- .6 Where unknown services are encountered, immediately advise Department Representative and confirm findings in writing.
- .7 Protect, relocate or maintain existing active services. When inactive services are encountered, cap off in manner approved by authorities having jurisdiction.
- .8 Record locations of maintained, re-routed and abandoned service lines.
- .9 Construct barriers in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.

1.14 CONSTRUCTION PERIOD

Allowable time for construction shall be negotiated with the department representative. Provide tentative construction schedule with Bid.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES:

- .1 Connecting to existing services.
- .2 Special scheduling requirement.

1.2 RELATED SECTIONS

- .1 Section 01 56 00 – Temporary Barriers and Enclosures.

1.3 ACCESS AND EGRESS

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

1.4 USE OF SITE AND FACILITIES

- .1 Execute work with least possible interference or disturbance to normal use of premises. Make arrangements with Departmental Representative to facilitate work as stated.
- .2 Maintain existing services to building(s) and provide for personnel and vehicle access.
- .3 Departmental Representative will assign sanitary facilities for use by Contractor's personnel. Keep facilities clean.
- .4 Closures: protect work temporarily until permanent enclosures are completed.

1.5 ALTERATIONS, ADDITIONS OR REPAIRS TO EXISTING BUILDING

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

1.6 EXISTING SERVICES

- .1 Notify, Departmental Representative and utility companies of intended interruption of services and obtain required permission.
- .2 Where Work involves breaking into or connecting to existing services, give Departmental Representative 48 hours of notice for necessary interruption of mechanical or electrical service throughout course of work. Keep duration of interruptions to a minimum. Carry out interruptions after normal working hours of occupants, as coordinated with the Department Representative.
- .3 Provide for personnel and pedestrian and vehicular traffic.
- .4 Construct barriers in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.

1.7 SPECIAL REQUIREMENTS

- .1 Paint public or staff occupied areas Monday to Friday during normal work hours as coordinated with Department Representative. Increase to the hours of operation would need approval from Department Representative.
- .2 Carry out noise generating Work (such as drilling and coring or similar noise generating work) Monday to Friday during work hours as per approval from Department Representative. Increase to the hours of operation would need approval from Department Representative.
- .3 Ensure Contractor's personnel employed on site become familiar with and obey regulations including safety, fire, traffic and security regulations.
- .4 Keep within limits of work and avenues of ingress and egress.
- .5 Ingress and egress of Contractor vehicles at site is limited to 6.
- .6 Deliver materials outside off peak traffic hours during normal work hours as approved by Departmental Representative.

1.8 BUILDING SMOKING ENVIRONMENT

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

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 11 00.

1.2 ADMINISTRATIVE

- .1 Schedule and administer project meetings throughout the progress of the work at the call of Departmental Representative.
- .2 Prepare and distribute agenda at least three (3) days prior to meetings.
- .3 Distribute written notice of each meeting seven (7) days in advance of meeting date to Departmental Representative and Consultant.
- .4 Provide physical space and make arrangements for meetings.
- .5 Preside at meetings.
- .6 Record the meeting minutes. Include significant proceedings and decisions. Identify actions by parties.
- .7 Reproduce and distribute copies of minutes within five (5) days after meetings and transmit to meeting participants and, affected parties not in attendance, Departmental Representative and Consultant.
- .8 Representative of Contractor, Subcontractor and suppliers attending meetings will be qualified and authorized to act on behalf of party each represents.

1.3 PRE-CONSTRUCTION MEETING

- .1 Within 15 days after award of Contract, request a meeting of parties in contract to discuss and resolve administrative procedures and responsibilities.
- .2 Attendance will include, but is not limited to, the Departmental Representative and Consultant, will be in attendance.
- .3 Departmental Representative to establish time and location of pre-construction meeting, contractor to notify parties concerned minimum four (4) days before meeting.
- .4 The Contractor will chair the meeting, record minutes, and issue minutes.
- .5 Agenda to include:
 - .1 Introduction of official representative of participants in the Work.
 - .2 Start date on site.
 - .3 Communication protocol for submission of shop drawings, samples, colour chips. Submit submittals in accordance Section 01 33 00 – Submittal Procedures.
 - .4 Requirements for temporary facilities, site sign, offices, storage sheds, utilities, fences in accordance with Section 01 52 00 - Construction Facilities.
 - .5 Site safety in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.

- .6 Communication Protocol for proposed changes, change orders, procedures, approvals required.
- .7 Owner's work.
- .8 Record drawings in accordance with Section 01 78 00 – Closeout Submittals.
- .9 Maintenance manuals in accordance with Section 01 78 00 - Closeout Submittals.
- .10 Take-over procedures, acceptance, warranties in accordance with Section 01 78 00 - Closeout Submittals.
- .11 Monthly progress claims, administrative procedures, photographs, hold backs.
- .12 Appointment of inspection and testing agencies or firms.

1.4 PROGRESS MEETINGS

- .1 During course of Work and two weeks prior to project completion, schedule progress meetings bi-weekly.
- .2 Attendance will include, but is not limited to, the Departmental Representative and Consultant, will be in attendance.
- .3 Contractor, responsible to record meeting minutes and circulate to attending parties and affected parties not in attendance within five (5) working days, after the meeting.
- .4 Record next meeting dates in the meeting minutes or notify parties a minimum seven (7) days in advance for the ad-hoc meetings.
- .5 Agenda to include the following:
 - .1 Review, approval of minutes of previous meeting.
 - .2 Review Health & Safety including any incidents, near misses, and WorkSafe BC visits;
 - .3 Review of Work progress since previous meeting.
 - .4 Construction schedule review;
 - .5 Review of off-site fabrication delivery schedules.
 - .6 Corrective measures and procedures to regain projected schedule.
 - .7 Request For Information (RFI) log review;
 - .8 Engineering Disciplines Reviews:
 - .1 Electrical
 - .2 Structural
 - .3 Civil
 - .4 Geotechnical
 - .5 Landscape Architect
 - .9 Change order log review;
 - .10 Review submittal schedules.
 - .11 Review updated as-builts;
 - .12 Review and resolve site issues;

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PROJECT MEETINGS

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.13 New business.

END OF SECTION

Part 1 General

1.1 ADMINISTRATIVE

- .1 Submit to Department Representative and Consultant weekly construction progress reports complete with photographs and descriptions indicating the progress achieved and percentile complete for each activity. Outline upcoming activities and provide 3 week look ahead.
- .2 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.
- .3 Do not proceed with Work affected by submittal until review is complete.
- .4 Present shop drawings, product data, samples and mock-ups in SI Metric units.
- .5 Where items or information is not produced in SI Metric units converted values are acceptable.
- .6 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 considered rejected.
- .7 Notify Departmental Representative, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.
- .8 Verify field measurements and affected adjacent Work is coordinated.
- .9 Contractor's responsibility for errors and omissions in submission is not relieved by Departmental Representative's review of submittals.
- .10 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Departmental Representative review.
- .11 Keep one reviewed copy of each submission on site.
- .12 Do not proceed with work until relevant submissions are reviewed by Departmental Representative.

1.2 SHOP DRAWINGS AND PRODUCT DATA

- .1 The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by Contractor to illustrate details of a portion of Work.
- .2 When specified in the Contract document, submit drawings stamped and signed by professional engineer registered or licensed in British Columbia of Canada.
- .3 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion

of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been co-ordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.

- .4 Allow ten (10) days for Departmental Representative's review of each submission, unless noted otherwise.
- .5 Adjustments made on shop drawings by Departmental Representative are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Departmental Representative prior to proceeding with Work.
- .6 Make changes in shop drawings as Departmental Representative may require, consistent with Contract Documents. When resubmitting, notify Departmental Representative in writing of revisions other than those requested.
- .7 Accompany submissions with transmittal letter, in [duplicate], containing:
 - .1 Date.
 - .2 Project title and number.
 - .3 Contractor's name and address.
 - .4 Identification and quantity of each shop drawing, product data and sample.
 - .5 Other pertinent data.
- .8 Submissions include:
 - .1 Date and revision dates.
 - .2 Project title and number.
 - .3 Name and address of:
 - .1 Subcontractor.
 - .2 Supplier.
 - .3 Manufacturer.
 - .4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.
 - .5 Details of appropriate portions of Work as applicable:
 - .1 Fabrication.
 - .2 Layout, showing dimensions, including identified field dimensions, and clearances.
 - .3 Setting or erection details.
 - .4 Capacities.
 - .5 Performance characteristics.
 - .6 Standards.
 - .7 Operating weight.
 - .8 Wiring diagrams.
 - .9 Single line and schematic diagrams.

- .10 Relationship to adjacent work.
- .9 After Departmental Representative's review, distribute copies.
- .10 Submit electronic copy of product data sheets or brochures for requirements requested in specification Sections and as Departmental Representative may reasonably request.
- .11 Submit electronic copies of test reports for requirements requested in specification Sections and as requested by Departmental Representative.
 - .1 Report signed by authorized official of testing laboratory that material, product or system identical to material, product or system to be provided has been tested in accord with specified requirements.
 - .2 Testing must have been within 3 years of date of contract award for project.
- .12 Submit electronic copies of certificates for requirements requested in specification Sections and as requested by Departmental Representative.
 - .1 Statements printed on manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements.
 - .2 Certificates must be dated after award of project contract complete with project name.
- .13 Submit electronic copies of manufacturer's instructions for requirements requested in specification Sections and as requested by Departmental Representative.
 - .1 Pre-printed material describing installation of product, system or material, including special notices and Material Safety Data Sheets concerning impedances, hazards and safety precautions.
- .14 Submit copies of Manufacturer's Field Reports for requirements requested in specification Sections and as requested by Departmental Representative.
- .15 Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.
- .16 Submit electronic copies of Operation and Maintenance Data for requirements requested in specification Sections and as requested by Departmental Representative.
- .17 Delete information not applicable to project.
- .18 Supplement standard information to provide details applicable to project.
- .19 If upon review by Departmental Representative, no errors or omissions are discovered or if only minor corrections are made, electronic copies will be returned and fabrication and installation of Work may proceed. If shop drawings are rejected, noted copy will be returned and resubmission of corrected shop drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.
- .20 The review of shop drawings by Departmental Representative is for sole purpose of ascertaining conformance with general concept.
 - .1 This review shall not mean that Departmental Representative approves detail design inherent in shop drawings, responsibility for which shall remain with

Contractor submitting same, and such review shall not relieve Contractor of responsibility for errors or omissions in shop drawings or of responsibility for meeting requirements of construction and Contract Documents.

- .2 Without restricting generality of foregoing, Contractor is responsible for dimensions to be confirmed and correlated at job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for co-ordination of Work of sub-trades.
- .21 Shop drawings format larger than 11' x 17' (275mm x 430mm) must be submitted with hard copies together with electronic format. Submit sufficient copies such that Departmental Representative will be provided with five (5) copies plus contractor's distribution and maintenance manual.
- .22 Electronic submissions will only be reviewed and returned electronically. No hard copies will be returned to contractor.
- .23 All electronic submissions to be uploaded to Document Control System FTP site hosted by consultant.

1.3 SAMPLES

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

1.4 MOCK-UPS

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

1.5 PHOTOGRAPHIC DOCUMENTATION

- .1 Submit electronic colour digital photography in jpg format, standard resolution monthly with progress statement, as directed by Departmental Representative.
- .2 Project identification: name and number of project and date of exposure indicated.
- .3 Viewpoints and their location as reasonably determined by Departmental Representative.

- .4 Provide photographic documentation of adjacent existing conditions prior to commencement of construction for determining and accidental damage as a result of contractor's work.
- .5 Frequency of photographic documentation: monthly as directed by Departmental Representative.
 - .1 Upon completion of: demolition, excavation, framing and services before concealment, of Work, and as directed by Departmental Representative.

1.6 CERTIFICATES AND TRANSCRIPTS

- .1 Submit electronic copies of test results and inspection reports required as noted in each section of specifications.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Government of Canada.
 - .1 Canada Labour Code - Part II
 - .2 Canada Occupational Health and Safety Regulations.
- .2 National Building Code of Canada (NBC 2015):
 - .1 Part 8, Safety Measures at Construction and Demolition Sites.
- .3 Canadian Standards Association (CSA as amended):
 - .1 CSA S269.1-16 Falsework for Construction Purposes
 - .2 CSA S350-M1980 (R2003) Code of Practice for Safety in Demolition of Structures
- .4 Fire Protection Engineering Services, HRSDC:
 - .1 FCC No. 301, Standard for Construction Operations.
 - .2 FCC No. 302, Standard for Welding and Cutting.
- .5 American National Standards Institute (ANSI):
 - .1 ANSI A10.3, Operations – Safety Requirements for Powder-Actuated Fastening Systems.
- .6 Province of British Columbia:
 - .1 Workers Compensation Act Part 3-Occupational Health and Safety.
 - .2 Occupational Health and Safety Regulation
- .7 Current B.C. Electrical Code

1.2 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures
- .2 Section 01 51 00 - Temporary Utilities
- .3 Section 01 56 00 - Temporary Barriers and Enclosures

1.3 WORKERS' COMPENSATION BOARD COVERAGE

- .1 Comply fully with the Workers' Compensation Act, regulations and orders made pursuant thereto, and any amendments up to the completion of the work.
- .2 Maintain Workers' Compensation Board coverage during the term of the Contract, until and including the date that the Certificate of Final Completion is issued.

1.4 COMPLIANCE WITH REGULATIONS

- .1 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.

1.5 SUBMITTALS

- .1 Submit to Departmental Representative submittals listed for review, in accordance with Section 01 33 00.
- .2 Work affected by submittal shall not proceed until review is complete.
- .3 Submit the following:
 - .1 Health and Safety Plan.
 - .2 Copies of reports or directions issued by Federal and Provincial health and safety inspectors.
 - .3 Copies of incident and accident reports.
 - .4 Complete set of Material Safety Data Sheets (MSDS), and all other documentation required by Workplace Hazardous Material Information System (WHMIS) requirements. Safety Data Sheets (SDS) per Globally Harmonized System (GHS) of Classification and Labelling of Chemicals shall be adopted from Q2 of 2017 based on construction schedule.
 - .5 Emergency Procedures.
- .4 The Departmental Representative will review the Contractor's site-specific project Health and Safety Plan and emergency procedures, and provide comments to the Contractor within two (2) 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 Health and Safety Plan, and any revised version, to the Departmental Representative is for information and reference purposes only. It shall not:
 - .1 Be construed to imply approval by the Departmental Representative;
 - .2 Be interpreted as a warranty of being complete, accurate and legislatively compliant;
 - .3 Relieve the Contractor of his legal obligations for the provision of health and safety on the project.

1.6 RESPONSIBILITY

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

1.7 HEALTH AND SAFETY COORDINATOR

- .1 The Health and Safety Coordinator must:
 - .1 Be responsible for completing all health and safety training, and ensuring that personnel that do not successfully complete the required training are not permitted to enter the site to perform work.
 - .2 Be responsible for implementing, daily enforcing, and monitoring the site-specific Health and Safety Plan.
 - .3 Be on site during execution of work.

1.8 GENERAL CONDITIONS

- .1 Provide safety barricades and lights around work site as required to provide a safe working environment for workers and protection for pedestrian and vehicular traffic.
- .2 Ensure that non-authorized persons are not allowed to circulate in designated construction areas of the work site.
 - .1 Provide appropriate means by use of barricades, fences, warning signs, traffic control personnel, and temporary lighting as required.
 - .2 Secure site at night time as deemed necessary to protect site against entry.

1.9 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 the above authorities, the most stringent provision will apply. Should a dispute arise in determining the most stringent requirement, the Departmental Representative will advise on the course of action to be followed.

1.10 WORK PERMITS

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

1.11 FILING OF NOTICE

- .1 The General Contractor is to complete and submit a Notice of Project as required by Provincial authorities.
- .2 Provide copies of all notices to the Departmental Representative.

1.12 HEALTH AND SAFETY PLAN

- .1 Conduct a site-specific hazard assessment based on review of Contract documents, required work, and project site. Identify any known and potential health risks and safety hazards.
- .2 Prepare and comply with a site-specific project Health and Safety Plan based on hazard assessment, including, but not limited to, the following:
 - .1 Primary requirements:
 - .1 Contractor's safety policy.
 - .2 Identification of applicable compliance obligations.
 - .3 Definition of responsibilities for project safety/organization chart for project.
 - .4 General safety rules for project.
 - .5 Job-specific safe work, procedures.
 - .6 Inspection policy and procedures.
 - .7 Incident reporting and investigation policy and procedures.
 - .8 Occupational Health and Safety Committee/Representative procedures.
 - .9 Occupational Health and Safety meetings.
 - .10 Occupational Health and Safety communications and record keeping procedures.
 - .2 Summary of health risks and safety hazards resulting from analysis of hazard assessment, with respect to site tasks and operations which must be performed as part of the work.
 - .3 List hazardous materials to be brought on site as required by work.
 - .4 Indicate Engineering and administrative control measures to be implemented at the site for managing identified risks and hazards.
 - .5 Identify personal protective equipment (PPE) to be used by workers.
 - .6 Identify personnel and alternates responsible for site safety and health.
 - .7 Identify personnel training requirements and training plan, including site orientation for new workers.
- .3 Develop the plan in collaboration with all subcontractors. Ensure that work/activities of subcontractors are included in the hazard assessment and are reflected in the plan.
- .4 Revise and update Health and Safety Plan as required, and re-submit to the Departmental Representative.
- .5 Departmental Representative's review: the review of Health and Safety Plan by Public Works and Government Services Canada (PWGSC) shall not relieve the Contractor of responsibility for errors or omissions in final Health and Safety Plan or of responsibility for meeting all requirements of construction and Contract documents.

1.13 EMERGENCY PROCEDURES

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

- .1 Designated personnel from own company.
- .2 Regulatory agencies applicable to work and as per legislated regulations.
- .3 Local emergency resources.
- .4 Departmental Representative and site staff.
- .2 Include the following provisions in the emergency procedures:
 - .1 Notify workers and the first-aid attendant, of the nature and location of the emergency.
 - .2 Evacuate all workers safely.
 - .3 Check and confirm the safe evacuation of all workers.
 - .4 Notify the fire department or other emergency responders.
 - .5 Notify adjacent workplaces or residences which may be affected if the risk extends beyond the workplace.
 - .6 Notify Departmental Representative and site staff.
- .3 Provide written rescue/evacuation procedures as required for, but not limited to:
 - .1 Work at high angles.
 - .2 Work in confined spaces or where there is 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 Revise and update emergency procedures as required, and re-submit to the Departmental Representative.

1.14 HAZARDOUS PRODUCTS

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

SDS (Safety Data Sheets) Per Globally Harmonized System (GHS) of Classification and Labelling of Chemicals shall be adopted from Q2 of 2017 based on construction schedule.
- .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.

Submit applicable SDS per GHS after Q2 of 2017 based on construction schedule.
 - .2 In conjunction with Departmental Representative, schedule to carry out work during "off hours."

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

1.15 ASBESTOS HAZARD

- .1 In case of discovery of any suspected asbestos containing material during demolition, inform Departmental Representative and, carry out work or demolition activities involving asbestos in accordance with applicable Provincial regulations.

1.16 REMOVAL OF LEAD-CONTAINING PAINTS

- .1 All paints containing TCLP lead concentrations above 5 ppm are classified as hazardous.
- .2 Carry out demolition activities involving lead-containing paints in accordance with applicable Provincial regulations.

1.17 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.
- .2 Before undertaking any work, coordinate required energizing and de-energizing of new and existing circuits with Departmental Representative.
- .3 Maintain electrical safety procedures and take necessary precautions to ensure safety of all personnel working under this Contract, as well as safety of other personnel on site.

1.18 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.

1.19 OVERLOADING

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

1.20 CONFINED SPACES

- .1 Carry out work in confined spaces in compliance with Occupational Health and Safety Regulation, Part 9.

1.21 POWER-ACTUATED DEVICES

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

1.22 FIRE SAFETY AND HOT WORK

- .1 Obtain Departmental Representative's authorization before any welding, cutting or any other hot work operations can be carried out on site.
- .2 Hot work includes cutting/melting with use of torch, flame heating roofing kettles, or other open flame devices and grinding with equipment which produces sparks.

1.23 FIRE SAFETY REQUIREMENTS

- .1 Store oily/paint-soaked rags, waste products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed containers and remove from site on a daily basis.
- .2 Handle, store, use and dispose of flammable and combustible materials in accordance with the National Fire Code of Canada.

1.24 FIRE PROTECTION AND ALARM SYSTEM

- .1 Fire 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.

1.25 UNFORESEEN HAZARDS

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

1.26 POSTED DOCUMENTS

- .1 Post legible versions of the following documents on site:
 - .1 Health and Safety Plan.
 - .2 Sequence of work.
 - .3 Emergency procedures.
 - .4 Site drawing showing project layout, locations of the first-aid station, evacuation route and marshalling station, and the emergency transportation provisions.
 - .5 Notice of Project.
 - .6 Floor plans or site plans.
 - .7 Notice as to where a copy of the Workers' Compensation Act and Regulations are available on the work site for review by employees and workers.
 - .8 Workplace Hazardous Materials Information System (WHMIS) documents.

- .9 List of names of Joint Health and Safety Committee members, or Health and Safety Representative, as applicable.
 - .10 Material Safety Data Sheets (MSDS).
 - .11 Safety Data Sheets (SDS) per GHS from Q2 of 2017.
 - .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.
Adopt GHS from Q2 of 2017 and post Safety Data Sheets (SDS) as per construction schedule.
 - .3 Postings should be protected from the weather, and visible from the street or the exterior of the principal construction site shelter provided for workers and equipment, or as approved by the Departmental Representative.
- 1.28 MEETINGS**
- .1 Attend health and safety pre-construction meeting and all subsequent meetings called by the Departmental Representative.
- 1.29 CORRECTION OF NON-COMPLIANCE**
- .1 Immediately address health and safety non-compliance issues identified by the
 - .2 Provide Departmental Representative with written report of action taken to correct non-compliance with health and safety issues identified.
 - .3 The Departmental Representative may issue a "stop work order" if non-compliance of health and safety regulations is not corrected immediately or within posted time. The General Contractor/subcontractors will be responsible for any costs arising from such a "stop work order."

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES:

- .1 References and Codes.
- .2 Discovery of Asbestos (if any).

1.2 PRECEDENCE

- .1 Refer to General Conditions clauses.

1.3 REFERENCES AND CODES

- .1 Perform Work in accordance with National Building Code of Canada (NBC) including all amendments up to tender closing date and other codes of provincial or local application provided that in case of conflict or discrepancy, more stringent requirements apply.
- .2 New construction works shall meet or exceed requirements of:
 - .1 Contract documents.
 - .2 Specified standards, codes and referenced documents.
 - .3 Canadian Electrical Code- Latest Edition
 - .4 British Columbia Building Code 2012.
 - .5 National Building Code of Canada 2015.
 - .6 National Plumbing Code of Canada 2015.
 - .7 Labour Canada Code Part II.
 - .8 Occupational Safety and Health Standards.
 - .9 Treasury Board Guidelines.
 - .10 NFPA 30 - 2012 – Use, handling and storage of flammable and combustible liquids.
 - .11 NFPA 45 – 2011 – Standard on Fire Protection for Laboratories Using Chemicals.
 - .12 Parks Canada Traffic Manual
 - .13 Traffic Control Manual for Work on Roadways –by BC MoTH
 - .14 Transportation Association of Canada –TAC Guide
 - .15 Manual of Uniform Traffic Control Devices for Canada 2014- MUTCD
 - .16 Pedestrian Crossing Control Manual for British Columbia
 - .16 Legal AHJ Documents.

1.4 BUILDING SMOKING ENVIRONMENT

- .1 Comply with smoking restrictions.

END OF SECTION

Part 1 General

1.1 INSPECTION

- .1 Allow Departmental Representative access to Work. If part of Work is in preparation at locations other than Place of Work, allow access to such Work whenever it is in progress.
- .2 Give timely notice requesting inspection if Work is designated for special tests, inspections or approvals by Departmental Representative instructions, or law of Place of Work.
- .3 If Contractor covers or permits to be covered Work that has been designated for special tests, inspections or approvals before such is made, uncover such Work, have inspections or tests satisfactorily completed and make good such Work.
- .4 Departmental Representative will order part of Work to be examined if Work is suspected to be not in accordance with Contract Documents. If, upon examination such work is found not in accordance with Contract Documents, correct such Work and pay cost of examination and correction. If such Work is found in accordance with Contract Documents, Departmental Representative shall pay cost of examination and replacement.

1.2 INDEPENDENT INSPECTION AGENCIES

- .1 Independent Inspection/Testing Agencies will be engaged by Departmental Representative for purpose of inspecting and/or testing portions of Work. Cost of such services will be borne by Departmental Representative.
- .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 Departmental Representative. Departmental 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 Departmental Representative in advance of requirement for tests, in order that attendance arrangements can be made. All services and testing integral to the scope of work shall be provided by the contractor.

- .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 Departmental Representative
- .2 Representative as failing to confirm to Contract Documents. Replace or re-execute in accordance with Contract Document's.
- .3 Make good other Contractor's work damaged by such removals or replacements promptly.
- .4 If in opinion of Departmental Representative it is not expedient to correct defective Work or Work not performed in accordance with Contract Documents, Owner will deduct from Contract Price difference in value between Work performed and that called for by Contract Documents, amount of which will be determined by Departmental Representative.

1.6 REPORTS

- .1 Submit [4] copies of inspection and test reports to Departmental Representative.
- .2 Provide copies to subcontractor of work being inspected or tested of material being inspected or tested.

1.7 TESTS AND MIX DESIGNS

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

1.8 MOCK-UPS

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

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

1.9 MILL TESTS

- .1 Submit mill test certificates as requested.

1.10 EQUIPMENT AND SYSTEMS

- .1 Submit adjustment and balancing reports for electrical systems.
- .2 Refer to Section 26, 27 for definitive requirements.

END OF SECTION

Part 1 General

1.1 ACCESS AND DELIVERY

- .1 Only the designated entrance may be used for personnel access to the site.
- .2 Contractor is required to use only the designated entrance to access the work site, for deliveries to site, and as the exit for offsite disposal.
 - .1 Maintain for duration of contract.
 - .2 Make good damage resulting from Contractor's use.
- .3 Provide and maintain access roads, sidewalk crossing ramps and construction runways as may be required for access to the work. All roadways and walkways outside of the Contractor's work site must be kept clear of materials and equipment at all times.
- .4 Provide and maintain competent flag operators, traffic signals, barricades and flares, lights or lanterns as may be required to perform work and protect other users of the facility.

1.2 CONSTRUCTION PARKING

- .1 Construction staff is allowed to park in the designated stalls at the facility parking lot. Departmental Representative will have full discretion of the assignment of the number of stalls. Assigned stalls may not be sufficient to meet construction staff requirement.

1.3 STORAGE FACILITIES

- .1 Confine work and operations of employees to areas indicated on Contract Documents. Do not unreasonably encumber premises with products. Storage space to be limited to the area of construction.
- .2 Do not load or permit to load any part of Work with weight or force that will endanger Work or existing structure or elements.
- .3 Provide and pay for all off-site storage as required. Note that storage space is limited on site.

1.4 POWER

- .1 Subject to coordination with Departmental Representative, electrical power within the facility may be used at no extra cost. There is no guarantee of uninterrupted power supply. Contractor will use this power source at their own risk. Contractor will not be compensated for any incurred cost or time owing to any power failure. Contractor will be responsible for other power source as they consider being required for completing the project. Contractor will be responsible for all the cost of connecting and disconnecting from this power source after completion of project to the satisfaction of the Departmental Representative.
- .2 Contractor to supply his own compressed air for the duration of the contract (If required).

1.5 WATER SUPPLY

- .1 Water supply is available for use by Contractor.

1.6 SANITARY FACILITIES

- .1 Construction staff will be allowed to use the facility washrooms, but the facility must be maintained in safe and sanitary condition.

1.7 HEATING AND VENTILIATION

- .1 Do not begin work until arrangements have been made with the Departmental Representative for protection of on-floor heating, ventilating, and air conditioning.
- .2 If there is any dirt in the heating and ventilation system, at the completion of work, it will be the Contractor's responsibility to return system to its original state in accordance with the Departmental Representative's directions.
- .3 Prevent dust and odour migration to other occupied areas.
 - .1 Do not deactivate HVAC system to occupied floors. Purge air from construction floors only when directed by Departmental Representative, where dust and fumes will be generated.

1.8 SCAFFOLDING

- .1 Construct and maintain scaffolding in rigid, secure and safe manner.
- .2 Erect scaffolding independent of walls. Remove promptly when no longer required.

1.9 HOISTING

- .1 Provide, operate and maintain hoists required for moving of workers, materials and equipment. Make financial arrangements with sub-contractors for their use of hoists.
- .2 Hoists shall be operated by qualified operator.

1.10 HOARDING

- .1 Prior to all demolition and construction, install dust proof hoarding or protective barrier to separate construction zone and the rest of the operating facility; maintain in safe and clean condition throughout duration of project. Submit hoarding plan to Departmental Representative for approval.
- .2 Erect and maintain safety barricades around all openings and other danger areas as required by Building Code and WCB.
- .3 Make good all floor, ceiling and wall to their original condition after removal of hoarding at completion of project.

1.11 SITE OFFICE

- .1 Contractor to provide their own trailer as temporary site office. Coordinate with Departmental representative for exact location.

- .2 Contractor should clear and demolish site office at end of project according to contract requirement.

1.12 REMOVAL OF TEMPORARY FACILITIES

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

1.13 SIGNS AND NOTICES

- .1 Signs and notices for safety and instruction shall be in both official languages and graphic symbols conforming to CAN/CSA-Z321.
- .2 Maintain approved signs and notices in good condition for duration of Project, and dispose of offsite on completion of Project when directed by Departmental Representative.

1.14 CLEAN-UP

- .1 Remove construction debris, waste materials, packaging material from work site daily.
- .2 Clean dirt or mud tracked onto paved or surfaced roadways.
- .3 Store materials resulting from demolition activities that are salvageable.
- .4 Stack stored new or salvaged material not in construction facilities.
- .5 At completion of Project, remove and dispose of all debris, thoroughly clean and restore site to condition found at commencement of Work. Repair and make good to all damage caused by construction activities.

1.15 USE OF EXISTING UTILITIES

- .1 It is the intention of the Departmental Representative to supply temporary services where specified, however, in the event of any unforeseen occurrence, the Departmental Representative may discontinue such temporary service, without notice, and without acceptance of any liability, for damage or delay, caused by such withdrawal of temporary services.
- .2 Supply of temporary services by Department Representative is subject to the requirements of the facility and level of availability of existing services.
- .3 Contractor shall bear costs of all temporary services required for the project, subject to approval by Departmental Representative those available from existing services.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB 1.189-[00], Exterior Alkyd Primer for Wood.
 - .2 CGSB 1.59-[97], Alkyd Exterior Gloss Enamel.
- .2 Canadian Standards Association (CSA International)
 - .1 CSA-A23.1/A23.2-[04], Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 - .2 CSA-0121-[M1978(R2003)], Douglas Fir Plywood.
 - .3 CAN/CSA-Z321-[96(R2001)], Signs and Symbols for the Occupational Environment.
- .3 Public Works Government Services Canada (PWGSC) Standard Acquisition Clauses and Conditions (SACC)-ID: R0202D, Title: General Conditions 'C'.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.

1.3 INSTALLATION AND REMOVAL

- .1 Prepare site plan indicating proposed location and dimensions of area to be fenced and used by Contractor, number of trailers to be used, avenues of ingress/egress to fenced area and details of fence installation for all works, excavations, and sites to minimize unauthorized access to site.
- .2 Identify areas which have to be gravelled to prevent tracking of mud.
- .3 Indicate use of supplemental or other staging area.
- .4 Provide construction facilities in order to execute work expeditiously.
- .5 Remove from site all such work after use.
- .6 Identify laydown areas to be used for material storage.

1.4 SITE STORAGE/LOADING

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

1.5 CONSTRUCTION PARKING

- .1 Parking will be permitted on site provided it does not disrupt performance of Work.

- .2 Provide and maintain adequate access to project site.

1.6 SECURITY

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

1.7 OFFICES

- .1 Provide office heated to 22 degrees C, lighted 750 lx and ventilated, of sufficient size to accommodate site meetings and furnished with drawing laydown table.
- .2 Provide marked and fully stocked first-aid case in a readily available location.
- .3 Subcontractors to provide their own offices as necessary. Direct location of these offices.
- .4 Departmental Representative's Site office.
 - .1 Provide temporary office for Departmental Representative.
 - .2 Inside dimensions minimum 3.6 m long x 3 m wide x 2.4 m high, with floor 0.3 m above grade, complete with 4-50% opening windows and one lockable door.
 - .3 Insulate building and provide heating system to maintain 22 degrees C inside temperature at -20 degrees C outside temperature.
 - .4 Finish inside walls and ceiling with plywood, hardboard or wallboard and paint in selected colours. Finish floor with 19 mm thick plywood.
 - .5 Install electrical lighting system to provide min 750 lx using surface mounted.
 - .6 Equip office with 1 x 2 m table, 4 chairs, 6 m of shelving 300 mm wide, one drawer filing cabinet, and one coat rack and shelf.
 - .7 Maintain in clean condition.

1.8 EQUIPMENT, TOOL AND MATERIALS STORAGE

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

1.9 SANITARY FACILITIES

- .1 Provide sanitary facilities for work force in accordance with governing regulations and ordinances.
- .2 Post notices and take precautions as required by local health authorities. Keep area and premises in sanitary condition.

1.10 CONSTRUCTION SIGNAGE

- .1 Provide and erect project sign, within three weeks of signing Contract, in a location designated by Departmental Representative.

- .2 Construction sign (2 x 1)m, of wood frame and plywood construction painted with exhibit lettering produced by a professional sign painter.
- .3 Indicate on sign, name of Owner, Consultant, Contractor, and Subcontractor, of design style as detailed by Departmental Representative.
- .4 No other signs or advertisements, other than warning signs, are permitted on site.
- .5 Provide project identification site sign comprising framing, and one 1200 x 2400 mm signboard as detailed and as described below.
 - .1 Foundations: 15 MPa concrete to CSA-A23.1 minimum 200 mm x 900 mm deep.
 - .2 Framework and battens: SPF, pressure treated minimum 89 x 89 mm.
 - .3 Signboard: 19 mm Medium Density Overlaid Douglas Fir Plywood to CSA O121.
 - .4 Paint: alkyd enamel to CAN/CGSB-1.59 over exterior alkyd primer to CAN/CGSB 1.189.
 - .5 Fasteners: hot-dip galvanized steel nails and carriage bolts.
 - .6 Vinyl sign face: printed project identification, self-adhesive, vinyl film overlay, supplied by Departmental Representative.
- .6 Locate project identification sign as directed by Departmental Representative and construct as follows:
 - .1 Build concrete foundation, erect framework, and attach signboard to framing.
 - .2 Paint surfaces of signboard and framing with one coat primer and two coats enamel. Colour white on signboard face, black on other surfaces.
 - .3 Apply vinyl sign face overlay to painted signboard face in accordance with installation instruction supplied.
- .7 Direct requests for approval to erect Consultant/Contractor signboard to Departmental Representative For consideration general appearance of Consultant/Contractor signboard must conform to project identification site sign. Wording in both official languages.
- .8 Signs and notices for safety and instruction in both official languages Graphic symbols to CAN/CSA-Z321.
- .9 Maintain approved signs and notices in good condition for duration of project, and dispose of off-site on completion of project or earlier if directed by Departmental Representative.

1.11 PROTECTION AND MAINTENANCE OF TRAFFIC

- .1 The Contractor shall carry out traffic regulations in accordance with the current edition of the BC Traffic Control Manual for work on roadways.
- .2 Provide access and temporary relocated roads as necessary to maintain traffic. The contractor will need to obtain Restricted Activity Permits (RAPs) for traffic accommodation.

- .3 Maintain and protect traffic on affected roads during construction period except as otherwise specifically directed by Departmental Representative. During the months of July and August no lane closures are permitted unless approved by the Departmental Representative.
- .4 Provide measures for protection and diversion of traffic, including provision of watch-persons and flag-persons, erection of barricades, placing of lights around and in front of equipment and work, and erection and maintenance of adequate warning, danger, and direction signs. The Department Representative shall monitor the traffic control measures from time to time to achieve satisfactory traffic flow, safety of travelling public and coordination with adjacent contracts.
- .5 Protect travelling public from damage to person and property. The Contractor shall provide competent flag person, properly equipped and certified.
- .6 Contractor's traffic on roads selected for hauling material to and from site to interfere as little as possible with public traffic.
- .7 Verify adequacy of existing roads and allowable load limit on these roads. Contractor: responsible for repair of damage to roads caused by construction operations.
- .8 Construct access and haul roads necessary.
- .9 Haul roads: constructed with suitable grades and widths; sharp curves, blind corners, and dangerous cross traffic shall be avoided.
- .10 Provide necessary lighting, signs, barricades, and distinctive markings for safe movement of traffic. Also provide competent supervision and /or contract personnel as required during non-working hours to ensure that safety flares, flashing beacons, signs, lights, etc. are in proper working order.
- .11 Keep travelled way clean, free of pot holes and of sufficient width to accommodate one 4.0m wide lane for traffic. The Contractor shall submit a TMP to the Department Representative for review and acceptance prior to commencement of work. The TMP shall take into account all hazards associated with the paving operations and minimize risks to motorists. The TMP shall be updated regularly in response to changes in weather, work, and traffic or otherwise.
- .12 Regardless of type of traffic control being used, maximum period of delay to public traffic shall be 20 minutes. Emergency vehicles must be granted immediate passage at all times. The Department Representative reserves the right to reduce delay time for public traffic at times when specified delay results in excessive backup of public traffic.
- .13 Dust control: adequate to ensure safe operation at all times by cleaning and watering as required.
- .14 Location, grade, width, and alignment of construction and hauling roads: subject to approval by Departmental Representative.
- .15 Lighting: to assure full and clear visibility for full width of haul road and work areas during night work operations.
- .16 Provide snow removal during period of work in the construction area.

- .17 Remove, upon completion of work, haul roads designated by Departmental Representative.

1.12 CLEAN-UP

- .1 Remove construction debris, waste materials, packaging material from work site daily.
- .2 Clean dirt or mud tracked onto paved or surfaced roadways.
- .3 Store materials resulting from demolition activities that are salvageable.
- .4 Stack stored new or salvaged material not in construction facilities.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 TEMPORARY EROSION AND SEDIMENTATION CONTROL

- .1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction.
- .2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
- .3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Canadian General Standards Board (CGSB)
 - .1 CGSB 1.59-[97], Alkyd Exterior Gloss Enamel.
 - .2 CAN/CGSB 1.189-[00], Exterior Alkyd Primer for Wood.
- .2 Canadian Standards Association (CSA International)
 - .1 CSA-O121-[M1978(R2003)], Douglas Fir Plywood.
- .3 Public Works Government Services Canada (PWGSC) Standard Acquisition Clauses and Conditions (SACC)-ID: R0202D, Title: General Conditions 'C', In Effect as Of: May 14, 2004.

1.2 INSTALLATION AND REMOVAL

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

1.3 HOARDING

- .1 Refer to Section 01 51 00 – Temporary Utilities, Clause 1.10.

1.4 GUARD RAILS AND BARRICADES

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

1.5 ACCESS TO SITE

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

1.6 PUBLIC TRAFFIC FLOW

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

1.7 FIRE ROUTES

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

1.8 PROTECTION FOR OFF-SITE AND PUBLIC PROPERTY

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

1.9 PROTECTION OF BUILDING FINISHES

- .1 Provide protection for finished and partially finished building finishes and equipment during performance of Work.
- .2 Provide necessary screens, covers, and hoardings.
- .3 Protect existing operating equipment within the project area.
- .4 Be responsible for damage incurred due to lack of or improper protection.

1.10 WASTE MANAGEMENT AND DISPOSAL

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

END OF SECTION

Part 1 General

1.1 PRODUCTS/MATERIAL AND EQUIPMENT

- .1 Use NEW products/material and equipment unless otherwise specified. The term "products" is referred to throughout the specifications.
- .2 Use products of one manufacturer for material and equipment of the same type or classification unless otherwise specified.
- .3 Unless otherwise specified, comply with manufacturer's latest printed instructions for materials and installation methods.
- .4 Notify Departmental Representative in writing of any conflict between these specifications and manufacturer's instructions. Departmental Representative will designate which document is to be followed.
- .5 Provide metal fastenings and accessories in the same texture, colour and finish as base metal in which they occur.
 - .1 Prevent electrolytic action between dissimilar metals.
 - .2 Use non-corrosive fasteners, anchors and spacers for securing exterior work.
 - .3 Fastenings which cause spalling or cracking are not acceptable.
 - .4 Use fastenings of standard commercial sizes and patterns with material and finish suitable for service.
 - .5 Use heavy hexagon heads, semi-finished unless otherwise specified.
 - .6 Bolts may not project more than 1 diameter beyond nuts.
 - .7 Types of washers as follows:
 - .1 Plain type washers: use on equipment and sheet metal.
 - .2 Soft gasket lock type washers: use where vibrations occur.
 - .3 Resilient washers: use with stainless steel.
 - .8 Deliver, store, and maintain packaged material and equipment with manufacturer's seals and labels intact.
 - .9 Prevent damage, adulteration and soiling of products during delivery, handling and storage. Immediately remove rejected products from site.
 - .10 Store products in accordance with suppliers' instructions.
 - .11 Touch up damaged factory finished surfaces to Departmental Representative's satisfaction.
 - .1 Use primer or enamel to match original.
 - .2 Do not paint over nameplates.

1.2 QUALITY OF PRODUCTS

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

- .2 Defective products will be rejected regardless of previous inspections.
 - .1 Inspection does not relieve responsibility, but is precaution against oversight or error.
 - .2 Remove and replace defective products at own expense and be responsible for delays and expenses caused by rejection.
 - .3 Retain purchase orders, invoices and other documents to prove that all products utilized in this Contract meet the requirements of the specifications. Produce documents when requested by the Departmental Representative.
 - .4 Should any dispute arise as to quality or fitness of products, the decision rests strictly with the Departmental Representative based upon the requirements of the Contract documents.
 - .5 Unless otherwise indicated in the specifications, maintain uniformity of manufacture for any particular or like item throughout the building.
 - .6 Permanent labels, trademarks and nameplates on products are not acceptable in prominent locations, except where required for operating instructions, or when located in mechanical or electrical rooms.

1.3 AVAILABILITY OF PRODUCTS

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

1.4 MANUFACTURER'S INSTRUCTIONS

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

1.5 CONTRACTOR'S OPTIONS FOR SELECTION OF PRODUCTS FOR TENDERING

- .1 Products are specified by "Prescriptive" specifications: select any product meeting or exceeding specifications. Provide supporting details to ascertain compliance with all product not listed within the specifications or drawings.
- .2 Products specified under "Acceptable Products": select any one of the indicated manufacturers, or any other manufacturer meeting or exceeding the Prescriptive specifications and indicated Products.
- .3 Products specified by performance and referenced standard: select any product meeting or exceeding the referenced standard.
- .4 Products specified to meet particular design requirements or to match existing materials: use only material specified Approved Product. Alternative products may be considered
- .5 When products are specified by a referenced standard or by or Performance specifications, upon request of Departmental Representative obtain from manufacturer an independent laboratory report showing that the product meets or exceeds the specified requirements.

1.6 SUBSTITUTION AFTER CONTRACT AWARD

- .1 No substitutions are permitted without prior written approval of the Departmental Representative.
- .2 Proposals for substitution may only be submitted after Contract award. Such request must include statements of respective costs of items originally specified and the proposed substitution.
- .3 Proposals will be considered by the Departmental Representative if:
 - .1 Products selected by tenderer from those specified are not available;
 - .2 Delivery date of products selected from those specified would unduly delay completion of Contract, or
 - .3 Alternative product to that specified, which is brought to the attention of and considered by Departmental Representative as equivalent to the product specified, and will result in a credit to the Contract amount.
 - .4 Should the proposed substitution be accepted either in part or in whole, assume full responsibility and costs when substitution affects other work on the project. Pay for design or drawing changes required as result of substitution.
 - .5 Amounts of all credits arising from approval of the substitutions will be determined by the Departmental Representative and the Contract price will be reduced accordingly.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 A set of construction drawings of existing site conditions in PDF format are available for viewing and reference only upon request. The set of drawings may not be full completed set and do not necessarily represent as-built conditions. All existing conditions measurements need to be verified on site.

1.2 QUALIFICATIONS OF SURVEYOR

- .1 Qualified registered land surveyor, licensed to practice in the Province of British Columbia to Departmental Representative.

1.3 EXISTING SERVICES

- .1 Before commencing work, establish location and extent of service lines in area of Work and notify Departmental Representative of findings.
- .2 Contractor is responsible to provide GPR survey of existing services as required to verify existing underground condition prior to excavation.

1.4 LOCATION OF EQUIPMENT AND FIXTURES

- .1 Locate equipment, fixtures and distribution systems to provide minimum interference and in accordance with manufacturer's recommendations for safety, access and maintenance.
- .2 Inform Departmental Representative of impending installation and obtain approval for actual location.

1.5 RECORDS

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

1.6 SURVEY REQUIREMENTS

- .1 Establish two permanent bench marks on site, referenced to established bench marks by survey control points. Record locations, with horizontal and vertical data in Project Record Documents.
- .2 Establish lines and levels, locate and lay out, by instrumentation.
- .3 Stake for grading, fill and topsoil placement and landscaping features.
- .4 Stake slopes and berms.
- .5 Establish lines and levels for all work.

1.7 EXISTING SERVICES

- .1 Before commencing work, establish location and extent of service lines in area of Work and notify Departmental Representative of findings.
- .2 Remove abandoned service lines within 2m of structures. Cap or otherwise seal lines at cut-off points as directed by Departmental Representative.

1.8 SUBSURFACE CONDITIONS

- .1 Promptly notify Consultant in writing if subsurface conditions at Place of Work differ materially from those indicated in Contract Documents, or a reasonable assumption of probable conditions based thereon.
- .2 After prompt investigation, should Consultant determine that conditions do differ materially, instructions will be issued for changes in Work as provided in Changes and Change Orders.

END OF SECTION

Part 2 General

2.1 SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit written request in advance of cutting or alteration which affects:
 - .1 Structural integrity of elements of project.
 - .2 Integrity of weather-exposed or moisture-resistant elements.
 - .3 Efficiency, maintenance, or safety of operational elements.
 - .4 Visual qualities of sight-exposed elements.
 - .5 Work of Owner or separate contractor.
- .3 Include in request:
 - .1 Identification of project.
 - .2 Location and description of affected Work.
 - .3 Statement on necessity for cutting or alteration.
 - .4 Description of proposed Work, and products to be used.
 - .5 Alternatives to cutting and patching.
 - .6 Effect on Work of Owner or separate contractor.
 - .7 Written permission of affected separate contractor.
 - .8 Date and time work will be executed.

2.2 MATERIALS

- .1 Required for original installation.
- .2 Change in Materials: Submit request for substitution in accordance with Section 01 33 00 - Submittal Procedures.

2.3 PREPARATION

- .1 Inspect existing conditions, including elements subject to damage or movement during cutting and patching.
- .2 After uncovering, inspect conditions affecting performance of Work.
- .3 Beginning of cutting or patching means acceptance of existing conditions.
- .4 Provide supports to assure structural integrity of surroundings; provide devices and methods to protect other portions of project from damage.
- .5 Provide protection from elements for areas which are to be exposed by uncovering work; maintain excavations free of water.

Part 2 EXECUTION

2.1 GENERAL

- .1 Execute cutting, fitting, and patching [including excavation and fill, to complete Work.
- .2 Fit several parts together, to integrate with other Work.
- .3 Uncover Work to install ill-timed Work.
- .4 Remove and replace defective and non-conforming Work.
- .5 Provide openings in non-structural elements of Work for penetrations of electrical Work.
- .6 Execute Work by methods to avoid damage to other Work, and which will provide proper surfaces to receive patching and finishing.
- .7 Employ original installer to perform cutting and patching for weather-exposed and moisture-resistant elements, and sight-exposed surfaces.
- .8 Cut rigid materials using masonry saw or core drill. Pneumatic or impact tools not allowed on masonry work without prior approval.
- .9 Restore work with new products in accordance with requirements of Contract Documents.
- .10 Fit Work airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- .11 Refinish surfaces to match adjacent finishes: Refinish continuous surfaces to nearest intersection. Refinish assemblies by refinishing entire unit.

2.2 WASTE MANAGEMENT AND DISPOSAL

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

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Public Works Government Services Canada (PWGSC) Standard Acquisition Clauses and Conditions (SACC)-ID-2020, Title: General Conditions. In effect as of April 2013.

1.2 PROJECT CLEANLINESS

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

1.3 FINAL CLEANING

- .1 When Work is Substantially Performed remove surplus products, tools, construction machinery and equipment not required for performance of remaining Work.
- .2 Remove waste products and debris other than that caused by others, and leave Work clean and suitable for occupancy.
- .3 Prior to final review remove surplus products, tools, construction machinery and equipment.

- .4 Remove waste products and debris including that caused by Owner or other Contractors.
- .5 Remove waste materials from site at regularly scheduled times or dispose of as directed by Departmental Representative. Do not burn waste materials on site, unless approved by Departmental Representative
- .6 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .7 Remove stains, spots, marks and dirt from electrical equipment.
- .8 Clean lighting reflectors, lenses, and other lighting surfaces.
- .9 Inspect finishes, fitments and equipment and ensure specified workmanship and operation.
- .10 Broom clean and wash exterior walks, steps and surfaces; rake clean other surfaces of grounds.
- .11 Remove dirt and other disfiguration from exterior surfaces.
- .12 Clean and sweep gutters, areaways, and sunken wells.
- .13 Sweep and wash clean paved areas.
- .14 Clean equipment and fixtures to sanitary condition.
- .15 Remove snow and ice from access to building.

1.4 WASTE MANAGEMENT AND DISPOSAL

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

END OF SECTION

PART 1 GENERAL

1.1 WASTE MANAGEMENT GOALS

- .1 Prior to start of Work conduct meeting with Departmental Representative to review and discuss PWGSC's Waste Management Plan and Goals.
- .2 Accomplish maximum control of solid construction waste.
- .3 Preserve environment and prevent pollution and environment damage.

1.2 DEFINITIONS

- .1 Demolition Waste Audit (DWA): Relates to actual waste generated from project.
- .2 Materials Source Separation Program (MSSP): Consists of series of ongoing activities to separate reusable and recyclable waste material into material categories from other types of waste at point of generation.
- .3 Recyclable: Ability of product or material to be recovered at end of its life cycle and re-manufactured into new product for reuse by others.
- .4 Recycle: Process by which waste and recyclable materials are transformed or collected for purpose of being transferred into new products.
- .5 Recycling: Process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for purpose of using in altered form. Recycling does not include burning, incinerating, or thermally destroying waste.
- .6 Reuse: Repeated use of product in same form but not necessarily for same purpose. Reuse includes:
 - .1 Salvaging reusable materials from re-modelling projects, before demolition stage, for resale, reuse on current project or for storage for use on future projects.
 - .2 Returning reusable items including pallets or unused products to vendors.
- .7 Salvage: Removal of structural and non-structural materials from deconstruction/disassembly projects for purpose of reuse or recycling.
- .8 Separate Condition: Refers to waste sorted into individual types.
- .9 Source Separation: Acts of keeping different types of waste materials separate beginning from first time they became waste.

- .10 Waste Management Coordinator (WMC): contractor representative responsible for supervising waste management activities as well as coordinating related, required submittal and reporting requirements.
- .11 Waste Reduction Workplan (WRW): written report which addresses opportunities for reduction, reuse, or recycling of materials. Refer to Schedule B. WRW is based on information acquired from WA (Schedule A).
- .12 Waste Audit (WA): detailed inventory of materials in building. Involves quantifying by volume/weight amounts of materials and wastes generated during construction, demolition, deconstruction, or renovation project. Indicates quantities of reuse, recycling and landfill. Refer to Schedule A.
- .13 Class III: non-hazardous waste - construction renovation and demolition waste.
- .14 Cost/Revenue Analysis Workplan (CRAW): based on information from WRW, and intended as financial tracking tool for determining economic status of waste management practices.
- .15 Inert Fill: inert waste - exclusively asphalt and concrete.

1.3 DOCUMENTS

- .1 Maintain at job site, one copy of following documents:
 - .1 Waste Audit.
 - .2 Waste Reduction Workplan.
 - .3 Material Source Separation Plan.
 - .4 Schedules A, B, C, D, E completed for project.

1.4 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Prepare and submit following prior to project start-up:
 - .1 Submit two (2) copies of completed Waste Reduction Workplan (WRW): Schedule B.
 - .2 Submit two (2) copies of completed Demolition Waste Audit (DWA): Schedule C.
 - .3 Submit two (2) copies of Materials Source Separation Program (MSSP) description.

1.5 WASTE AUDIT (WA) SUBMITTALS

- .1 Conduct WA prior to project start-up.
- .2 Prepare WA: Schedule A.

- .3 Record, on WA - Schedule A, extent to which materials or products used consist of recycled or reused materials or products.

1.6 WASTE REDUCTION WORKPLAN (WRW)

- .1 Prepare WRW prior to project start-up.
- .2 WRW should include but not limited to:
 - .1 Destination of materials listed.
 - .2 Deconstruction/disassembly techniques and sequencing.
 - .3 Schedule for deconstruction/disassembly.
 - .4 Location.
 - .5 Security.
 - .6 Protection.
 - .7 Clear labelling of storage areas.
 - .8 Details on materials handling and removal procedures.
 - .9 Quantities for materials to be salvaged for reuse or recycled and materials sent to landfill.
- .3 Structure WRW to prioritize actions and follow 3R's hierarchy, with Reduction as first priority, followed by Reuse, then Recycle.
- .4 Describe management of waste.
- .5 Identify opportunities for reduction, reuse, and recycling of materials. Based on information acquired from WA.
- .6 Post WRW or summary where workers at site are able to review content.
- .7 Set realistic goals for waste reduction, recognize existing barriers and develop strategies to overcome these barriers.
- .8 Monitor and report on waste reduction by documenting total volume and cost of actual waste removed from project.

1.7 DEMOLITION WASTE AUDIT (DWA)

- .1 Prepare DWA prior to project start-up.
- .2 Complete DWA: Schedule C.
- .3 Provide inventory of quantities of materials to be salvaged for reuse, recycling, or disposal.

1.8 MATERIALS SOURCE SEPARATION PROGRAM (MSSP)

- .1 Prepare MSSP and have ready for use prior to project start-up.
- .2 Implement MSSP for waste generated on project in compliance with approved methods and as reviewed by authorities having jurisdiction.
- .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 Locate containers in locations, to facilitate deposit of materials without hindering daily operations.
- .6 Locate separated materials in areas which minimize material damage.
- .7 Collect, handle, store on-site, and transport off-site, salvaged materials in separate condition.
- .1 Transport to recycling facility.

1.9 STORAGE, HANDLING AND PROTECTION

- .1 Unless specified otherwise, materials for removal become Contractor's property.
- .2 Protect, stockpile, store and catalogue salvaged items.
- .3 Separate non-salvageable materials from salvaged items. Transport and deliver non-salvageable items to approved local facility.
- .4 Protect structural components not removed for demolition from movement or damage.
- .5 Support affected structures. If safety of building is endangered, cease operations and immediately notify Department having jurisdiction.
- .6 Protect surface drainage, mechanical and electrical from damage and blockage.
- .7 Separate and store materials produced during dismantling of structures in designated areas.
- .8 Prevent contamination of materials to be salvaged and recycled and handle materials in accordance with requirements for acceptance by designated facilities.
- .1 On-site source separation is recommended.
- .2 Remove co-mingled materials to off-site processing facility for separation.
- .3 Provide waybills for separated materials.

1.10 DISPOSAL OF WASTES

- .1 Do not bury rubbish or waste materials. There is no disposal site inside the Park. All materials shall be disposed of in approved landfill with waybills provided to PWGSC as proof of safe and proper disposal of the demolished materials.
- .2 Do not dispose of any waste into waterways, storm, or sanitary sewers.
- .3 Remove materials from deconstruction as deconstruction/disassembly Work progresses.
- .4 Prepare project summary to verify destination and quantities on a material-by-material basis as identified in pre-demolition material audit.
- .5 Keep records of construction waste including:
 - .1 Number and size of bins.
 - .2 Waste type of each bin.
 - .3 Total tonnage generated.
 - .4 Tonnage reused or recycled.
 - .5 Reused or recycled waste destination.

1.11 USE OF SITE AND FACILITIES

- .1 Execute work with least possible interference or disturbance to normal use of premises.
- .2 Provide security measures approved by Owner's Representative.

1.12 SCHEDULING

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

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.1 APPLICATION

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

3.2 CLEANING

- .1 Remove tools and waste materials on completion of Work, and leave work area in clean and orderly condition.
- .2 Clean-up work area as work progresses.
- .3 Source separate materials to be reused/recycled into specified sort areas.

3.3 DIVERSION OF MATERIALS

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

Material Type	Recommended Diversion %	Actual Diversion %
Acoustical Insulation	100	
Doors and Frames	100	
Electrical Equipment	80	
Mechanical Equipment	100	
Metals	100	
Rubble	100	
Wood (uncontaminated)	100	
Other		

- .4 Construction Waste:

Material Type	Recommended Diversion %	Actual Diversion %
Cardboard	100	
Plastic Packaging	100	
Rubble	100	
Steel	100	
Wood (uncontaminated)	100	
Other		

3.4 WASTE AUDIT (WA)

- .1 The following pertains to Schedule A - Waste Audit (WA). Column-1 refers to the category of waste, and a physical description of the material (e.g. off-cuts, clean drywall, etc.). Column-2 refers to the total quantity of materials received by the Contractor. Measurement units must be specified. Column-3 refers to the estimated percentage of material that is waste. Column-4 refers to the total quantity of waste (column-2 x column-3). Column-5 refers to the area(s) in which the waste was generated. Column-6 refers to the total percentage of recycled material from the specified total quantity of waste (column-4). Column-7 refers to the total percentage of reused material from the specified total quantity of waste (column-4).

.2 Schedule A - Waste Audit (WA):

(1) Material Category	(2) Material Quantity Unit %	(3) Estimated Waste	(4) Total Quantity of Waste (unit)	(5) Generation Point	(6) % Recycled	(7) % Reused
Wood & Plastics						
Material Description						
Off-Cuts						
Warped						
Plastic						
Cardboard						
Other						
Doors & Windows						
Material Description						
Frames						
Glass						
Wood						
Metal						
Other						

3.5

WASTE REDUCTION WORKPLAN (WRW)

- .1 The following pertains to Schedule B - Waste Reduction Workplan (WRW). Column-1 refers to the category and type of waste materials. Column-2 refers to the persons responsible for completing the WRW. Column-3 refers to Column-4 of Schedule A. Column-4 refers to the amount of reused waste predicted and realized. Column-5 refers to the amount of recycled waste predicted and realized. Column-6 refers to the approved recycling facility.

.2 Schedule B:

(1) Material Quantity Category	(2) Person Amount Responsible Waste	(3) Total of Project (units)	(4) Reused Actual (units)	(5) Recycle Actual(s) Amount	(6) Material Destination(s)
Wood & Plastics					
Material Description					
Chutes					
Warped					
Plastic					
Cardboard Packaging					
Other					
Doors & Windows					
Material Description					
Painted					
Frames					
Glass					
Wood					
Metal					
Other					

3.6 DEMOLITION WASTE AUDIT (DWA)

- .1 The following pertains to Schedule C - Demolition Waste Audit (DWA). Column-1 refers to the type of material salvaged. Column-2 refers to the material quantity shown in column-1. Several columns may be required to identify specific demolition areas. Column-3 refers to the unit of measurement used to describe Column-2. Column-4 refers to the total quantity of salvaged material. Column-5 refers to the cumulative volume of salvaged material. Column-6 refers to the total weight in kilograms. Column-7 refers to remarks and assumptions made about the specified material.
- .2 Schedule C - Demolition Waste Audit (DWA):

(1) Material Description Assumptions	(2) Quantity	(3) Unity	(4) Total	(5) Volume (cum)	(6) Weight (cum)	(7) Remarks & Assumptions
Wood						
Wood						
Stud						
Plywood						
Baseboard-wood						
Door						
Trim-Wood						
Cabinet						
Doors & Windows						
Panel						
Regular						
Slab Regular						
Wood						
Laminate						
Glazing						

3.7 CANADIAN GOVERNMENTAL DEPARTMENTS CHIEF RESPONSIBILITY FOR THE ENVIRONMENT

- .1 Schedule E - Government Chief Responsibility for the Environment:
 - .1 Ministry of Environment Lands and Parks
 810 Blanshard Street, 4th Floor
 Victoria, BC, V8V 1X4
 604-387-1161 / 604-356-6464
 - .2 Waste Reduction Commission Soils and Hazardous Waste
 770 South Pacific Blvd, Suite 303
 Vancouver, BC, V6B 5E7
 604-660-9550 / 604-660-9596

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES:

- .1 Administrative procedures preceding preliminary and final inspections of Work.

1.2 RELATED SECTIONS

- .1 Section 01 78 00 - Closeout Submittals.

1.3 INSPECTION AND DECLARATION

- .1 Contractor's Inspection: Contractor and all Subcontractors shall conduct an inspection of Work, identify deficiencies and defects, and repair as required to conform to Contract Documents.
 - .1 Notify Departmental Representative in writing of satisfactory completion of Contractor's Inspection and that corrections have been made.
 - .2 Request Departmental Representative's Inspection.
 - .3 Departmental Representative's Review: Departmental Representative and Contractor will perform review of Work to identify obvious defects or deficiencies. Contractor shall correct Work accordingly.
 - .4 Completion: submit written certificate that following have been performed:
 - .1 Work has been completed and inspected for compliance with Contract Documents.
 - .2 Defects have been corrected and deficiencies have been completed.
 - .3 Equipment and systems have been tested, adjusted, and balanced and are fully operational.
 - .4 Certificates required by authorities having jurisdiction.
 - .5 Commissioning of all systems: final commissioning reports have been submitted to the Departmental Representative.
 - .6 Operation of systems has been demonstrated to Owner's personnel.
 - .7 All Completion Submittals have been finalized.
 - .8 Work is complete and ready for Final Inspection.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 45 00 - Quality Control
- .2 Section 01 71 00 - Examination and Preparation
- .3 Section 01 77 00 - Closeout Procedures
- .4 Section 01 79 00 - Demonstration and Training
- .5 Section 01 91 31 - General Commissioning (Cx) Requirement

1.2 SUBMISSION

- .1 Prepare instructions and data using personnel experienced in maintenance and operation of described products.
- .2 Copy will be returned after final inspection, with Departmental Representative's comments.
- .3 Revise content of documents as required prior to final submittal.
- .4 Two weeks prior to Completion of the Work, submit to the Departmental Representative, four (4) final copies of operating and maintenance manuals in English.
- .5 An electronic copy Interactive Operating and Maintenance Manual System is required as specified under clause 1.3. Provide four (4) sets of the Electronic Interactive Operating and Maintenance Manual System to the Departmental Representative.
- .6 Hard copies of the Operating and Maintenance Manual System is required as specified under clause 1.4. Provide four (4) sets of the Hard Copy Interactive Operating and Maintenance Manual System to the Departmental Representative.
- .7 Ensure spare parts, maintenance materials and special tools provided are new, undamaged or defective, and of same quality and manufacture as products provided in Work. Refer to individual specification sections
- .8 If requested, furnish evidence as to type, source and quality of products provided.
- .9 Defective products will be rejected, regardless of previous inspections. Replace products at own expense.
- .10 Pay costs of transportation.
- .11 Certificate of Completion.

1.3 INTERACTIVE OPERATING AND MAINTENANCE MANUAL SYSTEM

- .1 In addition to the printed copies, submit provide an Interactive Operating and Maintenance Manual System as specified herein.
- .2 System Description and Requirements;
 - .1 All as constructed drawings and operation and maintenance (O&M) manuals listed under the Scope of Work shall be converted, where necessary, into Portable Data File (PDF) format for viewing using the Adobe Acrobat Reader.

- .2 Documentation storage and retrieval system shall be structured based on a database framework with direct links to the appropriate PDF files. Documents retrieval and viewing shall be executed through a menu driven approach.
- .3 O&M data and as constructed drawings shall be classified by their corresponding disciplines, including:
 - .1 Electrical
 - .2 Structural
 - .3 Civil
 - .4 Communications
 - .5 Under each discipline, data shall be grouped into the following four major categories:
 - .1 Basic Documents
 - .1 'Basic Documents' shall, according to the type of services or disciplines, include the full contents of each hard copy of the O&M manuals with the addition of Miscellaneous Maintenance Reports and Records, or as defined by the user. In general the following shall be included unless specifically excluded by the Departmental Representative:
 - .1 Introduction
 - .2 Consultant/Contractor/Suppliers List
 - .3 System Description
 - .4 Testing and Commissioning (T&C) Reports
 - .5 Misc. Reports
 - .6 Specifications
 - .7 Equipment and/or point schedules as identified in the hard copy documents
 - .8 Others as stipulated by the Departmental Representative
 - .2 All Basic Documents PDF files shall be enhanced with appropriate bookmarks to facilitate searching of information.
 - .2 'As-Constructed' Drawings
 - .1 'As-Constructed' drawings shall be converted from the original electronic files, such as CAD, into PDF format. If only the hard copies of the 'as constructed' drawings are available, they shall be scanned and saved in PDF format. PDF files of the 'As-Constructed' drawings shall be enhanced with the following bookmarks to zoom into legible views on the computer screen as a minimum:
 - .1 Drawing Number and Title
 - .2 Drawing Notes
 - .3 Major Equipment Locations
 - .4 Cross-links to other related drawings

- .5 Revisions
- .3 System Data
 - .1 System data shall be classified into the following categories:
 - .1 System Description
 - .2 Schematic (where applicable)
 - .3 Equipment List
 - .2 Provide hot key buttons, where applicable, for direct access to drawings/data referenced on the schematics. The same shall be applied to listed equipment for direct links to the corresponding equipment data.
- .4 Equipment Data
 - .1 Equipment data shall be classified into the following categories:
 - .1 Equipment submittals
 - .2 T&C Report
 - .3 Maintenance Data
 - .4 Maintenance Records
 - .5 Photo
 - .2 Provide a summary screen to list all equipment classified under a specific system. On the summary screen, provide direct links to the corresponding equipment data under each category with addition links to the relevant 'As Constructed' drawings.
- .7 The Contractor shall provide a minimum of three (3) past job references as proven record of similar undertakings.
- .8 The Contractor shall provide a demonstration of the system to the Departmental Representative to provide verification that the requirements of the specification are fulfilled.

1.4 FORMAT HARD COPY MANUALS

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

1.5 CONTENTS - EACH VOLUME

- .1 Table of Contents: provide title of project;
 - .1 Date of submission;
 - .2 Names, addresses, and telephone and fax numbers of Contractor, Subcontractors, Suppliers with name of responsible parties;
 - .3 Schedule of products and systems, indexed to content of volume;
 - .4 Copy of hardware schedule and paint schedules, complete with the actual manufacturer, supplier and identification names and numbers;
 - .5 All extended guarantees, warranties, maintenance bonds, certificates, letters of guarantees, registration cards, as called for in the various sections of the specification;
 - .6 Complete set of all final reviewed shop drawings;
 - .7 Certificates of inspection by authorities having jurisdiction;
 - .8 Test reports and certificates as applicable;
 - .9 Complete set of as constructed drawings.
- .2 For each product or system:
 - .1 List names, addresses, and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.
- .3 Product Data: mark each sheet to clearly identify specific products and component parts, and data applicable to installation; delete inapplicable information.
- .4 Drawings: supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.

- .5 Typewritten Text: as required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in Section 01 45 00 - Quality Control.
- .6 Training: refer to Section 01 79 00 - Demonstration and Training.

1.6 'AS CONSTRUCTED' DRAWINGS AND SAMPLES

- .1 In addition to requirements in General Conditions, maintain at the site one record copy of:
 - .1 Contract Drawings.
 - .2 Specifications.
 - .3 Addenda.
 - .4 Change Orders and other modifications to the Contract.
 - .5 Reviewed shop drawings, product data, and samples.
 - .6 Field test records.
 - .7 Inspection certificates.
 - .8 Manufacturers' certificates.
- .2 Store record documents and samples in field office apart from documents used for construction. Provide files, racks, and secure storage.
- .3 Label record documents and file in accordance with section number listings in List of Contents of this Project Manual. Label each document "PROJECT RECORD" in neat, large, printed letters.
- .4 Keep record documents and samples available for inspection by Departmental Representative.
- .5 Maintain record documents in clean, dry and legible condition. Do not use record documents for construction purposes.
- .6 Mark changes as work progresses and as changes occur. Include changes to existing mechanical systems, control systems and low voltage control wiring. Transfer information weekly to reproducibles, revising reproducibles to show work as actually installed. Use different colour waterproof ink for each service.
- .7 Provide an electronic copy of as constructed drawings.

1.7 RECORDING ACTUAL SITE CONDITIONS

- .1 Record information on set of black line opaque drawings, provided by Departmental Representative.
- .2 Provide felt tip marking pens, maintaining separate colours for each major system, for recording information.
- .3 Record information concurrently with construction progress. Do not conceal Work until required information is recorded.
- .4 Contract Drawings and shop drawings: legibly mark each item to record actual construction, including:

- .1 Measured depths of elements of foundation in relation to finish first floor datum.
- .2 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
- .3 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.
- .4 Field changes of dimension and detail.
- .5 Changes made by change orders.
- .6 Details not on original Contract Drawings.
- .7 References to related shop drawings and modifications.
- .5 Specifications: legibly mark each item to record actual construction, including:
 - .1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items.
 - .2 Changes made by Addenda and change orders.
- .6 Other Documents: maintain manufacturer's certifications, inspection certifications, field test records, required by individual specifications sections.

1.8 EQUIPMENT AND SYSTEMS

- .1 Each Item of Equipment and Each System: include description of unit or system, and component parts. Give function, normal operation characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.
 - .1 Operation data to include:
 - .1 Control schematics for systems including controls.
 - .2 Description of systems and their controls.
 - .3 Operation instruction for systems and component.
 - .4 Description of actions to be taken in event of equipment failure.
 - .5 Colour coding chart.
 - .2 Maintenance data to include:
 - .1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.
 - .2 Data to include schedules of tasks, frequency, tools required and task time.
 - .3 Performance data to include:
 - .1 Equipment performance verification test results.
 - .2 Special performance data as specified.
- .2 Panel board circuit directories: provide electrical service characteristics, controls, and communications.
- .3 Include installed colour coded wiring diagrams.
- .4 Operating Procedures: include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include any special operating instructions.

- .5 Maintenance Requirements: include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- .6 Provide servicing and lubrication schedule, and list of lubricants required.
- .7 Include manufacturer's printed operation and maintenance instructions.
- .8 Include sequence of operation by controls manufacturer.
- .9 Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- .10 Provide installed control diagrams by controls manufacturer.
- .11 Provide Contractor's coordination drawings, with installed colour coded piping diagrams.
- .12 Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
- .13 Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
- .14 Include test and balancing reports as specified in Section 01 45 00 - Quality Control and Section 01 91 13 – General Commissioning (Cx) Requirements.
- .15 Additional requirements: as specified in individual specification sections.

1.9 MATERIALS AND FINISHES

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

1.10 SPARE PARTS

- .1 Provide spare parts, in quantities specified in individual specification sections.
- .2 Provide items of same manufacture and quality as items in Work.
- .3 Deliver to location as directed; place and store.
- .4 Receive and catalogue all items. Submit inventory listing to Departmental Representative. Include approved listings in Maintenance Manual.
- .5 Obtain receipt for delivered products and submit prior to final payment.

1.11 MAINTENANCE MATERIALS

- .1 Provide maintenance and extra materials, in quantities specified in individual specification sections.
- .2 Provide items of same manufacture and quality as items in Work.
- .3 Deliver to location as directed; place and store.
- .4 Receive and catalogue all items. Submit inventory listing to Departmental representative. Include approved listings in the Operating and Maintenance Manuals.
- .5 Obtain receipt for delivered products and submit prior to final payment.

1.12 SPECIAL TOOLS

- .1 Provide special tools, in quantities specified in individual specification section.
- .2 Provide items with tags identifying their associated function and equipment.
- .3 Deliver to location as directed; place and store.
- .4 Receive and catalogue all items. Submit inventory listing to Departmental Representative. Include approved listings in Maintenance Manual.

1.13 STORAGE, HANDLING AND PROTECTION

- .1 Store spare parts, maintenance materials, and special tools in manner to prevent damage or deterioration.
- .2 Store in original and undamaged condition with manufacturer's seal and labels intact.
- .3 Store components subject to damage from weather in weatherproof enclosures.
- .4 Store paints and freezable materials in a heated and ventilated room.

1.14 WARRANTIES AND BONDS

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

END OF SECTION

Part 1 General

1.1 ADMINISTRATIVE REQUIREMENTS

- .1 Demonstrate scheduled operation and maintenance of equipment and systems to Owner's personnel two weeks prior to date of substantial performance.
- .2 Owner: provide list of personnel to receive instructions, and co-ordinate their attendance at agreed-upon times.
- .3 Preparation:
 - .1 Verify conditions for demonstration and instructions comply with requirements.
 - .2 Verify designated personnel are present.
 - .3 Ensure equipment has been inspected and put into operation in accordance with each division.
 - .4 Ensure testing, adjusting, and balancing has been performed in accordance with Section 01 91 13 - General Commissioning (Cx) Requirements and equipment and systems are fully operational.
- .4 Demonstration and Instructions:
 - .1 Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, and maintenance of each item of equipment at agreed upon times, at the equipment location.
 - .2 Instruct personnel in phases of operation and maintenance using operation and maintenance manuals as basis of instruction.
 - .3 Review contents of manual in detail to explain aspects of operation and maintenance.
 - .4 Prepare and insert additional data in operations and maintenance manuals when needed during instructions.
 - .5 Time Allocated for Instructions: ensure adequate amount of time required for instruction of each item of equipment or system: refer to section 01 91 41 – Commissioning Training.

1.2 SUBMITTALS

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

- .5 Provide electronic and hard copies (refer to Section 01 78 00 – Closeout Submittals) of completed operation and maintenance manuals for use in demonstrations and instructions.

1.3 QUALITY ASSURANCE

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

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Section Includes:
 - .1 General requirements relating to commissioning of project's components and systems, specifying general requirements to performance verification of components, equipment, sub-systems, systems, and integrated systems.
- .2 Related Sections:
 - .1 Section 01 33 00 – Submittal Procedures.
 - .2 Section 01 45 00 – Quality Control.
 - .3 Section 01 91 31 – Commissioning (Cx) Plan.
 - .6 Section 26 05 00 – Common Work Results - Electrical.
- .3 Acronyms:
 - .1 AFD - Alternate Forms of Delivery, service provider.
 - .2 Cx - Commissioning.
 - .3 O M - Operation and Maintenance.
 - .4 PI - Product Information.
 - .5 PV - Performance Verification.
 - .6 TAB - Testing, Adjusting and Balancing.

1.2 REFERENCE

- .1 Public Works and Government Services Canada (PWGSC)
 - .1 PWGSC-Commissioning Manual CP.1 - 2013.
- .2 ANSI/NETA
 - .1 ANSI/NETA Standard for Maintenance Testing Specifications Power Distribution Equipment and Systems.

1.3 GENERAL

- .1 Cx is a planned program of tests, procedures and checks carried out systematically on systems and integrated systems of the finished Project. Cx is performed after systems and integrated systems are completely installed, functional and Contractor's Performance Verification responsibilities have been completed and approved. Objectives:
 - .1 Verify installed equipment, systems and integrated systems operate in accordance with contract documents and design criteria and intent.
 - .2 Effectively train O&M staff.
- .2 Contractor assists in Cx process, operating equipment and systems, troubleshooting and making adjustments as required.

- .1 Systems to be operated at full capacity under various modes to determine if they function correctly and consistently at peak efficiency. Systems to be interactively with each other as intended in accordance with Contract Documents and design criteria.
- .2 During these checks, adjustments to be made to enhance performance to meet environmental or user requirements.
- .3 Design Criteria: as per client's requirements or determined by designer. To meet Project functional and operational requirements.

1.4 COMMISSIONING OVERVIEW

- .1 Section 01 91 31 - Commissioning (Cx) Plan.
- .2 For Cx responsibilities refer to Commissioning (Cx) Plan.
- .3 Cx to be a line item of Contractor's cost breakdown.
- .4 Cx activities supplement field quality and testing procedures described in relevant technical sections.
- .5 Cx is conducted in concert with activities performed during stage of project delivery. Cx identifies issues in Planning and Design stages which are addressed during Construction and Cx stages to ensure the built [facility] is constructed and proven to operate satisfactorily under weather, environmental and occupancy conditions to meet functional and operational requirements. Cx activities includes transfer of critical knowledge to facility operational personnel.
- .6 The Departmental Representative will issue Interim Acceptance Certificate when:
 - .1 Completed Cx documentation has been received, reviewed for suitability and approved by The Consultant.
 - .2 Equipment, components and systems have been commissioned.
 - .3 O&M training has been completed.

1.5 NON-CONFORMANCE TO PERFORMANCE VERIFICATION REQUIREMENTS

- .1 Should equipment, system components, and associated controls be incorrectly installed or malfunction during Cx, correct deficiencies, re-verify equipment and components within the unfunctional system, including related systems as deemed required by Departmental Representative, Departmental Representative to ensure effective performance.
- .2 Costs for corrective work, additional tests, inspections, to determine acceptability and proper performance of such items to be borne by Contractor. The above costs to be in form of progress payment reductions or hold-back assessments.

1.6 PRE-CX REVIEW

- .1 Before Construction:
 - .1 Review contract documents, confirm by writing to The Consultant

- .1 Adequacy of provisions for Cx.
 - .2 Aspects of design and installation pertinent to success of Cx.
- .2 During Construction:
 - .1 Co-ordinate provision, location and installation of provisions for Cx.
- .3 Before start of Cx:
 - .1 Have completed Cx Plan up-to-date.
 - .2 Ensure installation of related components, equipment, sub-systems, systems is complete.
 - .3 Fully understand Cx requirements and procedures.
 - .4 Have Cx documentation shelf-ready.
 - .5 Understand completely design criteria and intent and special features.
 - .6 Submit complete start-up documentation to The Consultant.
 - .7 Have Cx schedules up-to-date.
 - .8 Ensure systems have been cleaned thoroughly.
 - .9 Complete TAB procedures on systems, submit TAB reports to The Consultant for review and approval.
 - .10 Submit factory testing report of Electrical Equipment to Departmental Representative for review and approval.
 - .11 Ensure "As-Built" system schematics are available.
- .4 Inform The Consultant in writing of discrepancies and deficiencies on finished works.

1.7 CONFLICTS

- .1 Report conflicts between requirements of this section and other sections to The Consultant before start-up and obtain clarification.
- .2 Failure to report conflict and obtain clarification will result in application of most stringent requirement.

1.8 SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Submit no later than 4 weeks after award of Contract:
 - .1 Name of Contractor's Cx agent.
 - .2 Draft Cx documentation.
 - .3 Preliminary Cx schedule.
 - .2 Request in writing to Departmental Representative for changes to submittals and obtain written approval at least 8 weeks prior to start of Cx.
 - .3 Submit proposed Cx procedures to Departmental Representative where not specified and obtain written approval at least 8 weeks prior to start of Cx.

- .4 Provide additional documentation relating to Cx process required by Departmental Representative, specifically;
 - .1 Cx Plan and Schedule
 - .2 Accepted Shop drawings
 - .3 Completed PI forms
 - .4 Approved TAB report
 - .5 Approved PV forms
 - .6 Approved O&M manuals
 - .7 Approved System and Integrated System Test Report
 - .8 Approved Training and Attendance forms
 - .9 Accepted “As-built” Plans and Specifications

1.9 COMMISSIONING DOCUMENTATION

- .1 Refer to Section 01 91 33 - Commissioning (Cx) Forms: Installation Check Lists and Product Information (PI) / Performance Verification (PV) Forms for requirements and instructions for use.
- .2 General contractor to review and approve Cx documentation submitted by Cx Agent prior to submission to Departmental Representative for review.
- .3 Provide completed and approved Cx documentation to the Departmental Representative.

1.10 COMMISSIONING SCHEDULE

- .1 Provide detailed Cx schedule as part of construction schedule.
- .2 Provide adequate time for Cx activities prescribed in technical sections and commissioning sections including:
 - .1 Approval of Cx reports.
 - .2 Verification of reported results.
 - .3 Repairs, retesting, re-commissioning, re-verification.
 - .4 Training.

1.11 COMMISSIONING MEETINGS

- .1 Convene Cx meetings following project meetings: as specified herein.
- .2 Purpose: to resolve issues, monitor progress, identify deficiencies, relating to Cx.
- .3 Continue Cx meetings on regular basis until commissioning deliverables have been addressed.
- .4 At 60% construction completion stage. The general to call a separate Cx scope meeting to review progress, discuss schedule of equipment start-up activities and prepare for Cx. Issues at meeting to include:

- .1 Review duties and responsibilities of Contractor and subcontractors, addressing delays and potential problems.
- .2 Determine the degree of involvement of trades and manufacturer's representatives in the commissioning process.
- .5 Thereafter Cx meetings to be held until project completion and as required during equipment start-up and functional testing period.
- .6 Meeting will be chaired by The Contractor, who will record and distribute minutes.
- .7 Ensure subcontractors and relevant manufacturer representatives are present at 60% and subsequent Cx meetings and as required.

1.12 STARTING AND TESTING

- .1 Contractor assumes liabilities and costs for inspections. Including disassembly and re-assembly after approval, starting, testing and adjusting, including supply of testing equipment.

1.13 WITNESSING OF STARTING AND TESTING

- .1 Provide 14 days' notice prior to commencement.
- .2 Commissioning Authority to witness of start-up and testing.
- .3 General Contractor's Cx Agent to be present at tests performed and documented by sub-trades, suppliers and equipment manufacturers.
 - .1 Minimum of 5 years' experience in design, installation, and operation of equipment and systems.
 - .2 Ability to interpret test results accurately.
 - .3 To report results in clear, concise, logical manner.

1.14 PROCEDURES

- .1 Verify that equipment and systems are complete, clean, and operating in normal and safe manner prior to conducting start-up, testing and Cx.
- .2 Conduct start-up and testing in following distinct phases:
 - .1 Included in delivery and installation:
 - .1 Verification of conformity to specification, approved shop drawings and completion of PI report forms.
 - .2 Visual inspection of quality of installation.
 - .2 Start-up: follow accepted start-up procedures.
 - .3 Operational testing: document equipment performance.
 - .4 System PV: include repetition of tests after correcting deficiencies.
 - .5 Post-substantial performance verification: to include fine-tuning.
- .3 Correct deficiencies and obtain approval the consultant after distinct phases have been completed and before commencing next phase.

- .4 Document required tests on approved PV forms.
- .5 Failure to follow accepted start-up procedures will result in re-evaluation of equipment by an independent testing agency selected by the consultant. If results reveal that equipment start-up was not in accordance with requirements, and resulted in damage to equipment, implement following:
 - .1 Minor equipment/systems: implement corrective measures approved by the consultant
 - .2 Major equipment/systems: if evaluation report concludes that damage is minor, implement corrective measures approved by the consultant.
 - .3 If evaluation report concludes that major damage has occurred, The consultant shall reject equipment.
 - .1 Rejected equipment to be remove from site and replace with new.
 - .2 Subject new equipment/systems to specified start-up procedures.

1.15 START-UP DOCUMENTATION

- .1 Assemble start-up documentation and submit to the consultant for approval before commencement of commissioning.
- .2 Start-up documentation to include:
 - .1 Factory and on-site test certificates for specified equipment.
 - .2 Pre-start-up inspection reports.
 - .3 Signed installation/start-up check lists.
 - .4 Start-up reports,
 - .5 Step-by-step, description of complete start-up procedures, to permit Commissioning Authority to repeat start-up at any time.

1.16 OPERATION AND MAINTENANCE OF EQUIPMENT AND SYSTEMS

- .1 After start-up, operate and maintain equipment and systems as directed by equipment/system manufacturer.
- .2 With assistance of manufacturer develop written maintenance program and submit to the owner and consultant for approval before implementation.
- .3 Operate and maintain systems for length of time required for commissioning to be completed.
- .4 After completion of commissioning, operate and maintain systems until issuance of certificate of interim acceptance.

1.17 TEST RESULTS

- .1 If start-up, testing and/or PV produce unacceptable results, repair, replace or repeat specified starting and/or PV procedures until acceptable results are achieved.
- .2 Provide manpower and materials, assume costs for re-commissioning.

1.18 START OF COMMISSIONING

- .1 Notify the consultant at least 4 weeks prior to start of Cx.

1.19 INSTRUMENTS / EQUIPMENT

- .1 Submit to the consultant for review and approval:
 - .1 Complete list of instruments proposed to be used.
 - .2 Listed data including, serial number, current calibration certificate, calibration date, calibration expiry date and calibration accuracy.
- .2 Provide the following equipment as required:
 - .1 2-way radios.
 - .2 Ladders and all necessary access equipment.
 - .3 Equipment as required to complete work.

1.20 COMMISSIONING PERFORMANCE VERIFICATION

- .1 Carry out Cx:
 - .1 Under accepted simulated operating conditions, over entire operating range, in all modes.
 - .2 On independent systems and interacting systems.
- .2 Cx procedures to be repeatable and reported results are to be verifiable.
- .3 Follow equipment manufacturer's operating instructions.
- .4 EMCS trending to be available as supporting documentation for performance verification.

1.21 WITNESSING COMMISSIONING

- .1 Departmental Representative and the consultant to witness activities and verify results.

1.22 AUTHORITIES HAVING JURISDICTION

- .1 Where specified start-up, testing or commissioning procedures duplicate verification requirements of authority having jurisdiction, arrange for authority to witness procedures so as to avoid duplication of tests and to facilitate expedient acceptance of facility.
- .2 Obtain certificates of approval, acceptance and compliance with rules and regulation of authority having jurisdiction.
- .3 Provide copies to the owner and the consultant within 5 days of test and with Cx report.

1.23 COMMISSIONING CONSTRAINTS

- .1 It is necessary to complete Cx of occupancy, weather, and seasonal sensitive equipment and systems before issuance of the Interim Certificate, using, if necessary, simulated thermal loads.

1.24 EXTRAPOLATION OF RESULTS

- .1 Where Cx of weather, occupancy, or seasonal-sensitive equipment or systems cannot be conducted under near-rated or near-design conditions, extrapolate part-load results to design conditions when approved by Departmental Representative in accordance with equipment manufacturer's instructions, using manufacturer's data, with manufacturer's assistance and using approved formulae.

1.25 EXTENT OF VERIFICATION

- .1 Site:
 - .1 Provide manpower and instrumentation to verify up to 30 % of reported results, unless specified otherwise in other sections.
- .2 Number and location to be at discretion of consultant
- .3 Conduct tests repeated during verification under same conditions as original tests, using same test equipment, instrumentation.
- .4 Review and repeat commissioning of systems if inconsistencies found in more than 20% of reported results.

1.26 REPEAT VERIFICATIONS

- .1 Assume costs incurred by the owner and consultant for third and subsequent verifications where:
 - .1 Verification of reported results fail to receive owner and consultant approval.
 - .2 Repetition of second verification again fails to receive approval.
 - .3 The consultant deems Contractor's request for second verification was premature.

1.27 SUNDRY CHECKS AND ADJUSTMENTS

- .1 Make adjustments and changes which become apparent as Cx proceeds.
- .2 Perform static and operational checks as applicable and as required.

1.28 DEFICIENCIES, FAULTS, DEFECTS

- .1 Correct deficiencies found during start-up and Cx to satisfaction of the consultant and owner.
- .2 Report problems, faults or defects affecting Cx to the consultant in writing. Stop Cx until problems are rectified. Proceed with written approval from the consultant.

1.29 COMPLETION OF COMMISSIONING

- .1 Upon completion of Cx leave systems in normal operating mode.
- .2 Except for warranty and seasonal verification activities specified in Cx specifications, complete Cx prior to issuance of Interim Certificate of Completion.

- .3 Cx to be considered complete when contract Cx deliverables have been submitted and accepted by the department's representative.

1.30 ACTIVITIES UPON COMPLETION OF COMMISSIONING

- .1 When changes are made to baseline components or system settings established during Cx process, provide updated Cx form for affected item.

1.31 MAINTENANCE MATERIALS, SPARE PARTS, SPECIAL TOOLS

- .1 Supply, deliver, and document maintenance materials, spare parts, and special tools as specified in contract.

1.32 INSTALLED INSTRUMENTATION

- .1 Use instruments installed under Contract for TAB and PV if:
 - .1 Accuracy complies with these specifications.
 - .2 Calibration certificates have been deposited with department representative
- .2 Calibrated EMCS sensors may be used to obtain performance data provided that sensor calibration has been completed and accepted.

1.33 PERFORMANCE VERIFICATION TOLERANCES

- .1 Application tolerances:
 - .1 Specified range of acceptable deviations of measured values from specified values or specified design criteria. Except for special areas, to be within +/- 10% of specified values.
- .2 Instrument accuracy tolerances:
 - .1 To be of higher order of magnitude than equipment or system being tested.
- .3 Measurement tolerances during verification:
 - .1 Unless otherwise specified actual values to be within +/-2 % of recorded values.

1.34 OWNER'S PERFORMANCE TESTING

- .1 Performance testing of equipment or system by the consultant or owner will not relieve Contractor from compliance with specified start-up and testing procedures.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Section Includes:
 - .1 Description of overall structure of Cx Plan and roles and responsibilities of Cx team.

1.2 REFERENCES

- .1 Public Works and Government Services Canada (PWGSC)
 - .1 PWGSC - Commissioning Guidelines CP.4 -3rd edition-[03].
- .2 Underwriters' Laboratories of Canada (ULC)

1.3 GENERAL

- .1 Provide a fully functional facility:
 - .1 Systems, equipment and components meet user's functional requirements before date of acceptance, and operate consistently at peak efficiencies and within specified energy budgets under normal loads.
 - .2 Facility user and O M personnel have been fully trained in aspects of installed systems.
 - .3 Optimized life cycle costs.
 - .4 Complete documentation relating to installed equipment and systems.
- .2 Term "Cx" in this section means "Commissioning".
- .3 Use this Cx Plan as master planning document for Cx:
 - .1 Outlines organization, scheduling, allocation of resources, documentation, pertaining to implementation of Cx.
 - .2 Communicates responsibilities of team members involved in Cx Scheduling, documentation requirements, and verification procedures.
 - .3 Sets out deliverables relating to O M, process and administration of Cx.
 - .4 Describes process of verification of how built works meet design requirements.
 - .5 Produces a complete functional system prior to issuance of Certificate of Occupancy.
 - .6 Management tool that sets out scope, standards, roles and responsibilities, expectations, deliverables, and provides:
 - .1 Overview of Cx.
 - .2 General description of elements that make up Cx Plan.
 - .3 Process and methodology for successful Cx.
- .4 Acronyms:

- .1 Cx - Commissioning.
- .2 EMCS - Energy Monitoring and Control Systems.
- .3 MSDS - Material Safety Data Sheets.
- .4 PI - Product Information.
- .5 PV - Performance Verification.
- .6 TAB - Testing, Adjusting and Balancing.
- .7 WHMIS - Workplace Hazardous Materials Information System.
- .8 GHS – Globally Harmonized System of Classification and Labelling of Chemicals.
- .9 SDS- Safety Data Sheets
- .5 Commissioning terms used in this Section:
 - .1 Bumping: short term start-up to prove ability to start and prove correct rotation.
 - .2 Deferred Cx - Cx activities delayed for reasons beyond Contractor's control due to lack of occupancy, weather conditions, need for heating/cooling loads.

1.4 DEVELOPMENT OF 100% CX PLAN

- .1 Cx Plan to be 100% completed within 4 weeks of award of contract to take into account:
 - .1 Approved shop drawings and product data.
 - .2 Approved changes to contract.
 - .3 Contractor's project schedule.
 - .4 Cx schedule.
 - .5 Contractor's, sub-contractor's, suppliers' requirements.
 - .6 Project construction team's and Cx team's requirements.
- .2 Submit completed Cx Plan to Departmental Representative Consultant and obtain written approval.

1.5 REFINEMENT OF CX PLAN

- .1 During construction phase, revise, refine and update Cx Plan to include:
 - .1 Changes resulting from Client program modifications.
 - .2 Approved design and construction changes.
- .2 Revise, refine and update every 2 months during construction phase. At each revision, indicate revision number and date.
- .3 Submit each revised Cx Plan to Departmental Representative for review and obtain written approval.
- .4 Include testing parameters at full range of operating conditions and check responses of equipment and systems.

1.6 COMPOSITION, ROLES AND RESPONSIBILITIES OF CX TEAM

- .1 Departmental Representative to maintain overall responsibility for project and is sole point of contact between members of commissioning team.
- .2 Project Manager will select Cx Team consisting of following members:
 - .1 PWGSC Design Quality Review Team: during construction, will conduct periodic site reviews to observe general progress.
 - .2 PWGSC Quality Assurance Commissioning Manager: ensures Cx activities are carried out to ensure delivery of a fully operational project including:
 - .1 Review of Cx documentation from operational perspective.
 - .2 Review for performance, reliability, durability of operation, accessibility, maintainability, operational efficiency under conditions of operation.
 - .3 Protection of health, safety and comfort of occupants and O&M personnel.
 - .4 Monitoring of Cx activities, training, development of Cx documentation.
 - .5 Work closely with members of Cx Team.
 - .3 Authority is responsible for:
 - .1 Organizing Cx.
 - .2 Monitoring operations Cx activities.
 - .3 Witnessing, certifying accuracy of reported results.
 - .4 Witnessing and certifying TAB and other tests.
 - .5 Ensuring implementation of final Cx Plan.
 - .6 Performing verification of performance of installed systems and equipment.
 - .7 Implementation of Training Plan.
 - .4 Construction Team: contractor, sub-contractors, suppliers and support disciplines, is responsible for construction/installation in accordance with contract documents, including:
 - .1 Testing.
 - .2 TAB.
 - .3 Performance of Cx activities.
 - .4 Delivery of training and Cx documentation.
 - .5 Assigning one person as point of contact with Consultant and PWGSC Cx Manager for administrative and coordination purposes.
 - .5 Contractor's Cx agent implements specified Cx activities including:
 - .1 Demonstrations.
 - .2 Training.
 - .3 Testing.
 - .4 Preparation, submission of test reports.

- .6 Property Manager: represents lead role in Operation Phase and onwards and is responsible for:
 - .1 Receiving facility.
 - .2 Day-To-Day operation and maintenance of facility.

1.7 EXTENT OF CX

- .1 The General Contractor shall provide commissioning services for the following items.
 - .1 List of Electrical Equipment and Acceptance Tests:
 - .1 Roadway lighting
 - .2 Car parking lighting
 - .3 Lighting control
 - .2 Roadway lighting, shall include the field adjustable output settings (Q) as indicated on drawings.

1.8 DELIVERABLES RELATING TO O&M PERSPECTIVES

- .1 General requirements:
 - .1 Compile English documentation.
 - .2 Documentation to be computer-compatible format ready for inputting for data management.
- .2 Provide deliverables:
 - .1 Warranties.
 - .2 Project record documentation.
 - .3 Inventory of spare parts, special tools and maintenance materials.
 - .4 Maintenance Management System (MMS) identification system used.
 - .5 WHMIS information.
 - .6 MSDS data sheets
 - .7 SDS data sheets per GHS –Adopted from Q2 of 2017.

1.9 DELIVERABLES RELATING TO THE CX PROCESS

- .1 General:
 - .1 Start-up, testing and Cx requirements, conditions for acceptance and specifications form part of relevant technical sections of these specifications.
- .2 Definitions:
 - .1 Cx as used in this section includes:
 - .1 Cx of components, equipment, systems, subsystems, and integrated systems.
 - .2 Factory inspections and performance verification tests.
- .3 Deliverables: provide:

- .1 Cx Specifications.
- .2 Startup, pre-Cx activities and documentation for systems, and equipment.
- .3 Completed installation checklists (ICL).
- .4 Completed product information (PI) report forms.
- .5 Completed performance verification (PV) report forms.
- .6 Results of Performance Verification Tests and Inspections.
- .7 Description of Cx activities and documentation.
- .8 Description of Cx of integrated systems and documentation.
- .9 Tests of witnessed by Departmental Representative and Cx Authority;
- .10 Training Plans.
- .11 Cx Reports.
- .12 Prescribed activities during warranty period.

1.10 PRE-CX ACTIVITIES AND RELATED DOCUMENTATION

- .1 General:
 - .1 Start-up, testing and Cx requirements, conditions for acceptance and specifications form part of relevant technical sections of these specifications.
- .2 Definitions:
 - .1 Cx as used in this section includes:
 - .1 Cx of components, equipment, systems, subsystems, and integrated system.
 - .2 Factory inspections and performance verification tests.
- .3 Deliverables: provide:
 - .1 Cx Specifications;
 - .2 Startup, pre-Cx activities and documentation for systems, and equipment;
 - .3 Completed installation checklists (ICL);
 - .4 Completed product information (PI) report forms;
 - .5 Completed performance verification (PV) report forms;
 - .6 Results of Performance Verification Tests and Inspections;
 - .7 Description of Cx activities and documentation;
 - .8 Description of Cx of integrated systems and documentation;
 - .9 Tests of following witnessed by PWGSC Design Quality Review Team;
 - .10 Tests performed by Owner/User;
 - .11 Training Plans;
 - .12 Cx Reports;
 - .13 Prescribed activities during warranty period;

- .4 Cx Authority to witness and certify tests and reports of results provided to Departmental Representative.
- .5 Departmental Representative to participate.

1.11 START-UP

- .1 Start up components, equipment and systems.
- .2 Equipment manufacturer, supplier, installing specialist sub-contractor, as appropriate, to start-up, under Contractor's direction, following equipment, systems:
- .3 Cx Authority to monitor some of these start-up activities.
 - .1 Rectify start-up deficiencies to satisfaction of Cx Authority.
- .4 Performance Verification (PV):
 - .1 Approved Cx Agent to perform.
 - .1 Repeat when necessary until results are acceptable to Cx Authority.
 - .2 Use procedures modified generic procedures to suit project requirements.
 - .3 Cx Authority to witness and certify reported results using approved PI and PV forms.
 - .4 Cx Authority to approve completed PV reports and provide to Departmental Representative.
 - .5 Cx Authority reserves the right to verify up to 30% of reported results at random.
 - .6 Failure of randomly selected item shall result in rejection of PV report or report of system startup and testing.

1.12 CX ACTIVITIES AND RELATED DOCUMENTATION

- .1 Perform Cx by specified Cx Agent using procedures developed by Cx Authority and approved by Departmental Representative.
- .2 Cx Authority to monitor Cx activities.
- .3 Upon satisfactory completion, Cx agency performing tests to prepare Cx Report using approved PV forms.
- .4 Cx Authority to witness, certify reported results of, Cx activities and forward to Departmental Representative

Cx Authority reserves the right to verify a percentage of reported results at no cost to contract.

1.13 INSTALLATION CHECK LISTS (ICL)

- .1 Refer to Section [01 91 33 - Commissioning (Cx) Forms: Installation Check Lists and Product Information (PI) / Performance Verification (PV) Forms].

1.14 PRODUCT INFORMATION (PI) REPORT FORMS

- .1 Refer to Section [01 91 33 - Commissioning (Cx) Forms: Installation Check Lists and Product Information (PI) / Performance Verification (PV) Forms].

1.15 PERFORMANCE VERIFICATION (PV) REPORT

- .1 Refer to Section [01 91 33 - Commissioning (Cx) Forms: Installation Check Lists and Product Information (PI) / Performance Verification (PV) Forms].

1.16 DELIVERABLES RELATING TO ADMINISTRATION OF CX

- .1 General:
 - .1 Because of risk assessment, complete Cx of occupancy, weather and seasonal-sensitive equipment and systems in these areas before building is occupied.

1.17 CX SCHEDULES

- .1 Prepare detailed Cx Schedule and submit to Departmental Representative for review and approval same time as project Construction Schedule. Include:
 - .1 Milestones, testing, documentation, training and Cx activities of components, equipment, subsystems, systems and integrated systems, including:
 - .1 Design criteria, design intents.
 - .2 Pre-TAB review: 28 days after contract award, and before construction starts.
 - .3 Cx agents' credentials: 60 days before start of Cx.
 - .4 Cx procedures: 3 months after award of contract.
 - .5 Cx Report format: 3months after contract award.
 - .6 Notification of intention to start TAB: 21 days before start of TAB.
 - .7 TAB: after successful start-up, correction of deficiencies and verification of normal and safe operation.
 - .8 Notification of intention to start Cx: 14 days before start of Cx.
 - .9 Notification of intention to start Cx of integrated systems: after Cx of related systems is completed 14 days before start of integrated system Cx.
 - .10 Identification of deferred Cx.
 - .11 Implementation of training plans.
 - .12 Cx reports: immediately upon successful completion of Cx.
 - .2 Detailed training schedule to demonstrate no conflicts with testing, completion of project and hand-over to Departmental Representative.
 - .3 Six (6) months in Cx schedule for verification of performance in all seasons and wear conditions.
- .2 After approval, incorporate Cx Schedule into Construction Schedule.

- .3 Consultant, Contractor, Contractor's Cx agent, and Departmental Representative will monitor progress of Cx against this schedule.

1.18 CX REPORTS

- .1 Submit reports of tests, witnessed and certified by Cx Authority to Departmental Representative who will verify reported results.
- .2 Include completed and certified PV reports in properly formatted Cx Reports.
- .3 Before reports are accepted, reported results to be subject to verification by Cx Authority.

1.19 ACTIVITIES DURING WARRANTY PERIOD

- .1 Cx activities must be completed before issuance of Interim Certificate, it is anticipated that certain Cx activities may be necessary during Warranty Period, including:
 - .1 Adjustment of lighting controls, including Q settings.

1.20 TESTS TO BE PERFORMED BY OWNER/USER

- .1 None is anticipated on this project.

1.21 TRAINING PLANS

- .1 Refer to Section 01 91 41 - Commissioning (Cx) - Training.

1.22 FINAL SETTINGS

- .1 Upon completion of Cx to satisfaction of Cx Authority and the Departmental Representative lock control devices in their final positions, indelibly mark settings marked and include in Cx Reports.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Section Includes:
 - .1 Commissioning forms to be completed for equipment, system and integrated system.
- .2 Related Requirements
 - .1 Section 01 91 13 - General Commissioning (Cx) Requirements.
 - .2 Section 01 91 31 – Commissioning (Cx) Plan
 - .3 Section 01 91 41 – Commissioning Training

1.2 RELATED WORKS

- .1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.3 INSTALLATION/START-UP CHECK LISTS

- .1 Include the following data:
 - .1 Product manufacturer's installation instructions and recommended checks.
 - .2 Special procedures as specified in relevant technical sections.
 - .3 Items considered good installation and engineering industry practices deemed appropriate for proper and efficient operation.
- .2 Equipment manufacturer's installation/start-up check lists are acceptable for use. As deemed necessary by Departmental Representative supplemental additional data lists will be required for specific project conditions.
- .3 Use check lists for equipment installation. Document check list verifying checks have been made, indicate deficiencies and corrective action taken.
- .4 Installer to sign check lists upon completion, certifying stated checks and inspections have been performed. Return completed check lists to Cx Authority. Check lists will be required during Commissioning and will be included in the Building Maintenance Manual (BMM) at completion of project.
- .5 Use of check lists will not be considered part of commissioning process but will be stringently used for equipment pre-start and start-up procedures.

1.4 PRODUCT INFORMATION (PI) REPORT FORMS

- .1 Product Information (PI) forms compiles gathered data on items of equipment produced by equipment manufacturer, includes nameplate information, parts list, operating instructions, maintenance guidelines and pertinent technical data and recommended checks that is necessary to prepare for start-up and functional testing and used during

operation and maintenance of equipment. This documentation is included in the BMM at completion of work.

- .2 Prior to Performance Verification (PV) of systems complete items on PI forms related to systems and obtain Departmental Representative's approval.

1.5 PERFORMANCE VERIFICATION (PV) FORMS

- .1 PV forms to be used for checks, running dynamic tests and adjustments carried out on equipment and systems to ensure correct operation, efficiently and function independently and interactively with other systems as intended with project requirements.
- .2 PV report forms include those developed by Contractor records measured data and readings taken during functional testing and Performance Verification procedures.
- .3 Prior to PV of integrated system, complete PV forms of related systems and obtain Departmental Representative's approval.

1.6 COMMISSIONING FORMS

- .1 Use Commissioning forms to verify installation and record performance when starting equipment and systems.
- .2 Strategy for Use:
 - .1 Contractor project-specific Commissioning forms with Specification data included.
 - .2 Contractor will provide required shop drawings information and verify correct installation and operation of items indicated on these forms.
 - .3 Confirm operation as per design criteria and intent.
 - .4 Identify variances between design and operation and reasons for variances.
 - .5 Verify operation in specified normal and emergency modes and under specified load conditions.
 - .6 Record analytical and substantiating data.
 - .7 Verify reported results.
 - .8 Form to bear signatures of recording technician.
 - .9 Submit immediately after tests are performed.
 - .10 Reported results in true measured SI unit values.
 - .11 Provide Departmental Representative with originals of completed forms.
 - .12 Maintain copy on site during start-up, testing and commissioning period.
 - .13 Forms to be both hard copy and electronic format with typed written results.

1.7 LANGUAGE

- .1 To suit the language profile of the awarded contract.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Section Includes:
 - .1 This Section specifies roles and responsibilities of Commissioning Training.
- .2 Related Requirements
 - .1 Section 01 91 13 - General Commissioning (Cx) Requirements
 - .2 Section 01 91 31 - Commissioning Plan
 - .3 Section 01 91 33 - Commissioning Forms

1.2 TRAINEES

- .1 Trainees: personnel selected for operating and maintaining the roadway lighting system, Includes Facility Manager, building operators, maintenance staff, security staff, and technical specialists as required.
- .2 Trainees will be available for training during later stages of construction for purposes of familiarization with systems.

1.3 INSTRUCTORS

- .1 Engineer will provide:
 - .1 Descriptions of systems.
 - .2 Instruction on design philosophy, design criteria, and design intent.
- .2 Contractor and certified factory-trained manufacturers' personnel: to provide instruction on the following:
 - .1 Start-Up, operation, shut-down of equipment, components and systems.
 - .2 Control features, reasons for, results of, implications on associated systems of, adjustment of set points of control and safety devices.
 - .3 Instructions on servicing, maintenance and adjustment of systems, equipment and components.
- .3 Contractor and equipment manufacturer to provide instruction on:
 - .1 Start-up, operation, maintenance and shut-down of equipment they have certified installation, started up and carried out PV tests.

1.4 TRAINING OBJECTIVES

- .1 Training to be detailed and duration to ensure:
 - .1 Safe, reliable, cost-effective, energy-efficient operation of systems in normal and emergency modes under all conditions.
 - .2 Effective on-going inspection, measurements of system performance.

- .3 Proper preventive maintenance, diagnosis and trouble-shooting.
- .4 Ability to update documentation.
- .5 Ability to operate equipment and systems under emergency conditions until appropriate qualified assistance arrives.

1.5 TRAINING MATERIALS

- .1 Instructors to be responsible for content and quality.
- .2 Training materials to include:
 - .1 "As-Built" Contract Documents.
 - .2 Operating Manual.
 - .3 Maintenance Manual.
 - .4 TAB and PV Reports.
- .3 Project Manager, Commissioning Manager and Facility Manager will review training manuals.
- .4 Training materials to be in a format that permits future training procedures to same degree of detail.
- .5 Supplement training materials:
 - .1 Transparencies for overhead projectors.
 - .2 Multimedia presentations.
 - .3 Manufacturer's training videos.
 - .4 Equipment models.

1.6 SCHEDULING

- .1 Include in Commissioning Schedule time for training.
- .2 Deliver training during regular working hours, training sessions to be 8 hours in length.
- .3 Training to be completed prior to acceptance of facility.

1.7 RESPONSIBILITIES

- .1 Be responsible for:
 - .1 Implementation of training activities,
 - .2 Coordination among instructors,
 - .3 Quality of training, training materials,
- .2 Departmental Representative will evaluate training and materials.
- .3 Upon completion of training, provide written report, signed by Instructors, witnessed by Departmental Representative.

1.8 ELECTRICAL SYSTEM TRAINING

- .1 Training to include demonstrations by Instructors using the installed equipment and systems.
- .2 Content includes:
 - .1 Functional requirements.
 - .2 System philosophy, limitations of systems.
 - .3 Review of system layout, equipment, components and controls.
 - .4 Maintenance and servicing.
 - .5 Trouble-shooting diagnosis.
 - .6 Inter-Action among systems during integrated operation.
 - .7 Review of O&M documentation.
- .3 Provide specialized training as specified in relevant Technical Sections of the construction specifications.

END OF SECTION

Part 1 General

1.1 SCOPE OF WORK

- .1 The Scope of Work shall include: All Selective Site Demolition related to work required for the Sinclair Canyon Electrical Upgrade and Site Rehabilitation.

1.2 REFERENCES

- .1 Definitions:
 - .1 Demolition: rapid destruction of building following removal of hazardous materials.
 - .2 Hazardous Materials: dangerous substances, dangerous goods, hazardous commodities and hazardous products, may include but not limited to: asbestos PCB's, CFC's, HCFC's, poisons, corrosive agents, flammable substances, ammunition, explosives, radioactive substances, or other material that can endanger human health, or wellbeing or environment if handled improperly.
 - .3 Waste Management Coordinator (WMC): contractor representative responsible for supervising waste management activities as well as coordinating related required submittal and reporting requirements.
 - .4 Waste Reduction Workplan (WRW): written report which addresses opportunities for reduction, reuse, or recycling of materials. WRW is based on information acquired from WA.
- .2 Reference Standards:
 - .1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
 - .2 BC Ministry of Transportation and Infrastructure
 - .1 2012 Standard Specifications for Highway Construction – Section 165 Protection of the Environment.

1.3 ADMINISTRATIVE REQUIREMENTS

- .1 Site Meetings.
 - .1 Schedule pre-demolition meeting one week prior to beginning work of this Section
 - .1 Verify project requirements.
 - .2 Review installation and substrate conditions.
 - .3 Co-ordinate with other building subtrades.
 - .4 Review manufacturer's installation instructions and warranty requirements.
 - .2 Arrange for site visit with Departmental Representative to examine existing site conditions adjacent to demolition work, prior to start of Work.
 - .3 Hold project meetings every week month.
 - .4 Ensure key personnel site supervisor project manager subcontractor representatives WMC attend.
 - .5 Reporting Requirements: WMC to complete.
 - .6 WMC must provide written verbal report on status of waste diversion activity at each meeting.
 - .7 Departmental Representative will provide written verbal notification of change of meeting schedule established upon contract award 24 hours prior to scheduled meeting.
- .2 Scheduling: meet project time lines without compromising specified minimum rates of material diversion.
 - .1 Notify Departmental Representative when unforeseen delays occur.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop Drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered and licensed in Canada.
 - .2 Submit for approval drawings, diagrams or details showing sequence of demolition work and supporting structures and underpinning, where required by authorities having jurisdiction.
- .3 Hazardous Materials:
 - .1 Provide description of Hazardous Materials and Notification of Filing with proper authorities prior to beginning of Work as required.

- .4 Waste Reduction Workplan:
 - .1 Prior to beginning of Work on site submit detailed Waste Reduction Workplan in accordance with Section 01 74 21 - Construction/Demolition Waste Management And Disposal and indicate:
 - .1 Descriptions of and anticipated quantities of materials to be salvaged reused, recycled and landfilled.
 - .2 Schedule of selective demolition.
 - .3 Number and location of dumpsters.
 - .4 Anticipated frequency of tipping.
 - .5 Name and address of haulers and waste facilities.
- .5 Certificates:
 - .1 Submit copies of certified weigh bills from authorized disposal sites and reuse and recycling facilities for material removed from site on weekly basis upon request of Departmental Representative.
 - .2 Written authorization from Departmental Representative is required to deviate from haulers or facilities listed in Waste Reduction Workplan.

1.6 QUALITY ASSURANCE

- .1 Regulatory Requirements: ensure Work is performed in compliance with CEAA, TDGA, and applicable Provincial regulations.

1.7 DELIVERY, STORAGE AND HANDLING

- .1 Storage and Protection.
 - .1 Protect in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling
 - .2 Protect existing items designated to remain and items designated for salvage. In event of damage to such items, immediately replace or make repairs to approval of Departmental Representative and at no cost to Departmental Representative.
 - .3 Remove and store materials to be salvaged, in manner to prevent damage.
 - .4 Store and protect in accordance with requirements for maximum preservation of material.
 - .5 Handle salvaged materials as new materials.
- .2 Develop Waste Reduction Workplan related to Work of this Section.

1.8 SITE CONDITIONS

- .1 Site Environmental Requirements.
 - .1 Ensure that selective demolition work does not adversely affect adjacent watercourses, groundwater and wildlife, or contribute to excess air and noise pollution.
 - .2 Do not dispose of waste of volatile materials including but not limited to, mineral spirits, oil, petroleum based lubricants, or toxic cleaning solutions into watercourses, storm or sanitary sewers.
 - .1 Ensure proper disposal procedures are maintained throughout the project.
 - .3 Do not pump water containing suspended materials into watercourses, storm or sanitary sewers or onto adjacent properties.
 - .4 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with local authorities.
 - .5 Protect trees, plants and foliage on site and adjacent properties where indicated.
- .2 Existing Conditions.
 - .1 Remove contaminated or hazardous materials listed as hazardous from site, prior to start of demolition work, and dispose of at designated disposal facilities in safe manner.

Part 2 Products

2.1 EQUIPMENT

- .1 Leave machinery running only while in use, except where extreme temperatures prohibit shutting machinery down.

Part 3 Execution

3.1 PREPARATION

- .1 Temporary Erosion and Sedimentation Control:
 - .1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and Sinclair Creek; contractor to submit erosion and sediment control drawings and plan, specific to site, that complies with requirements of authorities having jurisdiction or British Columbia Ministry of Transportation 2016 Standard Specifications for Highway Construction - Section 165 – Protection of the Environment, whichever is more stringent.
 - .2 Inspect, repair, and maintain erosion and sedimentation control measures through construction.
 - .3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal after completion of work.
- .2
- .3 Inspect site with Departmental Representative and verify extent and location of items designated for removal, disposal, alternative disposal, recycling, salvage and items to remain.
- .4 Locate and protect utilities. Preserve active utilities traversing site in operating condition.

SELECTIVE SITE NOTIFICATION

- ## 3.2 REMOVAL OF HAZARDOUS WASTES

- ### 3.3 REMOVAL OPERATIONS

- .1 Remove items as indicated.
- .2 Do not disturb items designated to remain in place.
- .3 Removal of pavements, curbs and gutters:
 - .1 Square up adjacent surfaces to remain in place by saw cutting or other method approved by Departmental Representative.
 - .2 Protect adjacent joints and load transfer devices.
- .4 Prevent contamination with base course aggregates, when removing asphalt pavement for subsequent incorporation into hot mix asphalt concrete paving,
- .5 Excavate at least 300 mm below pipe invert, when removing pipes under existing or future pavement area.
- .6 Decommission water wells and monitoring wells in accordance with Provincial regulations.
- .7 Remove designated trees during demolition.
 - .1 Obtain written approval of Departmental Representative prior to removal of trees not designated.
- .8 Stockpile topsoil for final grading and landscaping:
 - .1 Provide erosion control and seeding if not immediately used.
- .9 Disposal of Material:
 - .1 Dispose of materials at authorized facilities approved in Waste Reduction Workplan as instructed by Departmental Representative.
 - .2 Trim disposal areas to approval of Departmental Representative.
- .10 Backfill:
 - .1 Backfill in areas as indicated and in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

3.4 STOCKPILING

- .1 Label stockpiles, indicating material type and quantity.
- .2 Designate appropriate security resources/measures to prevent vandalism, damage and theft.
- .3 Locate stockpiled materials convenient for use in new construction to eliminate double handling wherever possible.
- .4 Stockpile materials designated for alternate disposal in location which facilitates removal from site and examination by potential end markets, and which does not impede disassembly, processing, or hauling procedures.

3.5 REMOVAL FROM SITE

- .1 Remove stockpiled material as directed by Departmental Representative, when it interferes with operations of project.
- .2 Remove stockpiles of like materials by alternate disposal option once collection of materials is complete.
- .3 Transport material designated for alternate disposal using approved haulers facilities receiving organizations listed in Waste Reduction Workplan and in accordance with applicable regulations.
 - .1 Written authorization from Departmental Representative is required to deviate from haulers facilities receiving organizations listed in Waste Reduction Workplan.
- .4 Dispose of materials not designated for alternate disposal in accordance with applicable regulations.
 - .1 Disposal Facilities: approved and listed in Waste Reduction Workplan.
 - .2 Written authorization from Departmental Representative is required to deviate from disposal facilities listed in Waste Reduction Workplan.

3.6 RESTORATION

- .1 Restore areas and existing works outside areas of demolition to conditions that existed prior to beginning of Work.
- .2 Use soil treatments and procedures which are not harmful to health, are not injurious to plants, and do not endanger wildlife, adjacent water courses or ground water.

3.7 FIELD QUALITY CONTROL

- .1 Verification requirements include:
 - .1 Materials and resources.
 - .2 Storage and collection of recyclables.
 - .3 Construction waste management.
 - .4 Resource reuse.
 - .5 Recycled content.
 - .6 Local/regional materials.
 - .7 Wood.
 - .8 Low-emitting materials.

3.8 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
 - .2 Remove debris, trim surfaces and leave work site clean, upon completion of Work
 - .3 Use cleaning solutions and procedures which are not harmful to health, are not injurious to plants, and do not endanger wildlife, adjacent water courses or ground water.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.9 PROTECTION

- .1 Repair damage to adjacent materials or property caused by selective site demolition.

END OF SECTION

Part 1 General

1.1 SCOPE OF WORK

- .1 The Scope of Work shall include: All Structure Demolition related to work required for the Sinclair Canyon Electrical Upgrade and Site Rehabilitation

1.2 REFERENCES

- .1 Definitions:
 - .1 Hazardous Materials: dangerous substances, dangerous goods, hazardous commodities and hazardous products, include but not limited to: poisons, corrosive agents, flammable substances, ammunition, explosives, radioactive substances, or materials that endanger human health or environment if handled improperly.
 - .2 Waste Management Coordinator (WMC): contractor representative responsible for supervising waste management activities as well as coordinating related, required submittal and reporting requirements.
 - .3 Waste Audit (WA): detailed inventory of materials in building. Involves quantifying by volume/weight amounts of materials and wastes generated during construction, demolition, deconstruction, or renovation project. Indicates quantities of reuse, recycling and landfill.
 - .4 Waste Reduction Workplan (WRW): written report which addresses opportunities for reduction, reuse, or recycling of materials. WRW is based on information acquired from WA.
- .2 Reference Standards:
 - .1 CSA International
 - .1 CSA S350-M1980(R2003), Code of Practice for Safety in Demolition of Structures.
 - .2 Department of Justice Canada (Jus)
 - .1 Canadian Environmental Assessment Act (CEAA)
 - .2 Canadian Environmental Protection Act (CEPA), 1999, c. 33.
 - .1 SOR/2003-2, On-Road Vehicle and Engine Emission Regulations.
 - .2 SOR/2006-268, Regulations Amending the On-Road Vehicle and Engine Emission Regulations.
 - .3 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.

1.3 ADMINISTRATIVE REQUIREMENTS

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

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures and Section 01 74 21 - Construction/Demolition Waste Management Disposal.
- .2 WMC is responsible for fulfilment of reporting requirements.
- .3 Submit copies of certified weigh bills, bills of lading receipts from authorized disposal sites and reuse and recycling facilities for material removed from site on a weekly monthly basis upon request of Departmental Representative.
 - .1 Written authorization from Departmental Representative is required to deviate from haulers facilities receiving organizations listed in Waste Reduction Workplan.
- .4 Shop Drawings:
 - .1 Submit for review and approval demolition drawings, diagrams or details showing sequence of demolition work and supporting structures and underpinning.
 - .2 Submit demolition drawings stamped and signed by professional engineer registered or licensed in Canada.

1.5 QUALITY ASSURANCE

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

1.6 SITE CONDITIONS

.1 Environmental Protection

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

1.7 EXISTING CONDITIONS

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

Part 2 Products

2.1 EQUIPMENT

- .1 Equipment and heavy machinery:
 - .1 On-road vehicles to: CEPA-SOR/2003-2, On-Road Vehicle and Engine Emission Regulations CEPA-SOR/2006-268, Regulations Amending the On-Road Vehicle and Engine Emission Regulations.
- .2 Leave machinery running only while in use, except where extreme temperatures prohibit shutting machinery down.

Part 3 Execution

3.1 PREPARATION

- .1 Temporary Erosion and Sedimentation Control:
 - .1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and Sinclair Creek; contractor to submit erosion and sediment control drawings and plan, specific to site, that complies with requirements of authorities having jurisdiction or British Columbia Ministry of Transportation 2016 Standard Specifications for Highway Construction - Section 165 – Protection of the Environment, whichever is more stringent.
 - .2 Inspect, repair, and maintain erosion and sedimentation control measures through construction.
 - .3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal after completion of work.
- .2 Protection of in-place conditions:
 - .1 Prevent movement, settlement or damage of adjacent structures, services, walks, paving, trees, landscaping, adjacent grades properties parts of existing building to remain.
 - .1 Provide bracing, shoring and underpinning as required.
 - .2 Repair damage caused by demolition as directed by Departmental Representative.
 - .2 Support affected structures and, if safety of structure being demolished adjacent structures or services appears to be endangered, take preventative measures, stop Work and immediately notify Departmental Representative.
 - .3 Prevent debris from blocking surface drainage system, elevators, mechanical and electrical systems which must remain in operation.
- .3 Surface Preparation:
 - .2 Disconnect and re-route electrical and telephone service lines entering buildings to be demolished.
 - .1 Post warning signs on electrical lines and equipment which must remain energized to serve other properties during period of demolition.
 - .3 Disconnect and cap designated mechanical services.
 - .1 Natural gas supply lines: remove in accordance with gas company requirements.
 - .2 Sewer and water lines: remove to property line in accordance with authority having jurisdiction as directed by Departmental Representative.
 - .3 Other underground services: remove and dispose of as indicated as directed by Departmental Representative in accordance with Section 33 71 73.02 - Underground Electrical Service.
 - .4 Do not disrupt active or energized utilities traversing premises designated to remain undisturbed.
 - .5 Remove rodent and vermin as required by Departmental Representative.

3.2 DEMOLITION

- .1 Execute demolition work in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.
- .2 Blasting operations not permitted during demolition.
- .3 Remove contaminated or dangerous materials as defined by authorities having jurisdiction, relating to environmental protection, from site and dispose of in safe manner to minimize danger at site or during disposal.
 - .1 Crush concrete generated due to demolition of foundations to size as directed.
 - .2 Demolish foundation walls to below finished grade.
 - .3 Remove existing equipment, services, and obstacles where required for refinishing or making good of existing surfaces, and replace as work progresses.
 - .4 At end of each day's work, leave Work in safe and stable condition.
 - .5 Demolish to minimize dusting. Keep materials wetted as directed by Departmental Representative.
 - .6 Demolish masonry and concrete walls in pieces suitable for reuse as specified.
 - .7 Remove structural framing.
 - .8 Contain fibrous materials to minimize release of airborne fibres while being transported within facility.
 - .9 Only dispose of material specified by selected alternative disposal option for own use as directed by Departmental Representative.
 - .10 Remove and dispose of demolished materials except where noted otherwise and in accordance with authorities having jurisdiction.
 - .11 Use natural lighting to do Work where possible.
 - .1 Shut off lighting except those required for security purposes at end of each day.

3.3 CLEANING

- .1 Develop Waste Reduction Workplan related to work in this section.
- .2 Waste Management: separate waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.
- .3 Divert excess materials from landfill to site approved Departmental Representative
- .4 Designate appropriate security resources / measures to prevent vandalism, damage and theft.
- .5 Locate stockpiled materials convenient for use in new construction. Eliminate double handling wherever possible.
- .6 Stockpile materials designated for alternate disposal in location which facilitates removal from

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site and examination by potential end markets, and which does not impede disassembly, processing, or hauling procedures.

- .7 Separate from general waste stream each of following materials. Stockpile materials in neat and orderly fashion in location and as directed by Departmental Representative for alternate disposal. Stockpile materials in accordance with applicable fire and safety regulations.
- .8 Supply separate, clearly marked disposal bins for categories of waste material. Do not remove bins from site until inspected and approved by Departmental Representative
- .9 Please notify Departmental Representative prior to removal of bins from site.
- .10 Remove stockpiled material as directed by Departmental Representative, when it interferes with operations of project construction.
- .11 Remove stockpiles of like materials by alternate disposal option once collection of materials is complete.
- .12 Transport material designated for alternate disposal using approved haulers facilities receiving organizations listed in Waste Reduction Workplan and in accordance with applicable regulations.
 - .1 Written authorization from Departmental Representative is required to deviate from haulers facilities receiving organizations listed in Waste Reduction Workplan.
- .13 Dispose of materials not designated for alternate disposal in accordance with applicable regulations.
 - .1 Disposal facilities must be those approved of and listed in Waste Reduction Workplan.
 - .2 Written authorization from Departmental Representative is required to deviate from disposal facilities listed in Waste Reduction Workplan.

END OF SECTION

Part 1 General

1.1 SCOPE OF WORK

- .1 The Scope of Work shall include: All Demolition for Minor Works related to work required for the Sinclair Canyon Electrical Upgrade and Site Rehabilitation

1.2 REFERENCES

- .1 CSA International
 - .1 CSA S350-M1980(R2003), Code of Practice for Safety in Demolition of Structures.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 – Submittal Procedures 01 74 21 – Construction/Demolition Waste Management Disposal.
- .2 Submit demolition drawings:
 - .1 Submit for review and approval by Departmental Representative shoring and underpinning drawings stamped and signed by professional engineer registered and licensed in Canada, showing proposed method.

1.4 SITE CONDITIONS

- .1 Review "Designated Substance Report" and take precautions to protect environment.
- .2 If material resembling spray or trowel-applied asbestos or other designated substance listed as hazardous be encountered, stop work, take preventative measures, and notify Departmental Representative immediately.
 - .1 Proceed only after receipt of written instructions have been received from Departmental Representative.
- .3 Notify Departmental Representative before disrupting building access or services.

Part 2 Products

2.1 NOT USED

- .1 Not used.

Part 3 Execution

3.1 EXAMINATION

- .1 Inspect building site with Departmental Representative and verify extent and location of items designated for removal, disposal, alternative disposal, recycling, salvage and items to remain.
- .2 Locate and protect utilities. Preserve active utilities traversing site in operating condition.
- .3 Notify and obtain approval of utility companies before starting demolition.
- .4 Disconnect, cap, plug or divert, as required, existing public utilities within the property where they interfere with the execution of the work, in conformity with the requirements of the authorities having jurisdiction. Mark the location of these and previously capped or plugged services on the site and indicate location (horizontal and vertical) on the record drawings. Support, shore up and maintain pipes and conduits encountered.
 - .1 Immediately notify Departmental Representative and utility company concerned in case of damage to any utility or service, designated to remain in place.
 - .2 Immediately notify the Departmental Representative should uncharted utility or service be encountered, and await instruction in writing regarding remedial action.

3.2 PREPARATION

- .1 Temporary Erosion and Sedimentation Control:
 - .1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and Sinclair Creek; contractor to submit erosion and sediment control drawings and plan, specific to site, that complies with requirements of authorities having jurisdiction or British Columbia Ministry of Transportation 2016 Standard Specifications for Highway Construction - Section 165 – Protection of the Environment, whichever is more stringent.
 - .2 Inspect, repair, and maintain erosion and sedimentation control measures through construction.
 - .3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal after completion of work.
- .2 Protection of In-Place Conditions:
 - .1 Prevent movement, settlement, or damage to adjacent structures, utilities, and landscaping features and parts of building to remain in place. Provide bracing and shoring required.
 - .2 Keep noise, dust, and inconvenience to occupants to minimum.
 - .3 Protect building systems, services and equipment.
 - .4 Provide temporary dust screens, covers, railings, supports and other protection as required.

- .3 Demolition/Removal:
 - .1 Remove items as indicated.
 - .2 Removal of Pavements, Curbs and Gutters:
 - .1 Square-up adjacent surfaces to remain in place by saw cutting or other method approved by Departmental Representative.
 - .2 Protect adjacent joints and load transfer devices.
 - .3 Protect underlying and adjacent granular materials.
 - .3 Remove parts of existing building to permit new construction.
 - .4 Trim edges of partially demolished building elements to tolerances as defined by Departmental Representative to suit future use.

3.3 CLEANING

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

END OF SECTION

Part 1 General

1.1 SCOPE OF WORK

- .1 The Scope of Work shall include: All concrete forming and accessories related to work required for the Sinclair Canyon Electrical Upgrade and Site Rehabilitation.

1.2 RELATED REQUIREMENTS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 01 45 00 – Quality Control
- .3 Section 01 74 21 – Construction/Demolition Waste Management and Disposal
- .4 Section 03 20 00 – Concrete Reinforcing
- .5 Section 03 30 00 – Cast-in-Place Concrete
- .6 Section 31 63 23 – Bored Concrete Piles.

1.3 WORK INSTALLED BUT SUPPLIED UNDER OTHER SECTIONS

- .1 Install materials specified to be supplied under other sections of these project specifications. Materials include but are not limited to:
 - .1 Ensure installation is to the satisfaction of trades concerned and of the Departmental Representative prior to placing concrete.

1.4 REFERENCES

- .1 Perform all work in accordance with the following standards, except where specified otherwise. All standards to be latest issue at time of tender.
 - .1 BCBC 2012, “British Columbia Building Code”.
 - .2 NBC 2010, “National Building Code”.
 - .3 Canadian Standards Association (CSA International)
 - .1 CSA-A23.1-14/CSA-A23.2-14, “Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete”.
 - .2 CSA-A23.3-14, “Design of Concrete Structures”.
 - .3 CSA B111-1974 (R2003), “Wire Nails, Spikes and Staples”.
 - .4 CAN/CSA-O86-09, “Engineering Design in Wood (Limit States Design)”.
 - .5 CSA-O121-08 (R2013), “Douglas Fir Plywood”.
 - .6 CAN/CSA-O141-05 (R2014), “Softwood Lumber”.
 - .7 CSA-O151-09 (R2014), “Canadian Softwood Plywood”.
 - .8 CSA-O153-M1980 (R2008), “Poplar Plywood”.

- .9 CSA-O325-07 (R2012), “Construction Sheathing”.
- .10 CSA-O437 Series-93 (R2011), “Standards on OSB and Waferboard”.
- .11 CSA-S269.1-2016, “Falsework & Formwork”.
- .12 CAN/CSA-S269.3-M92 (R2003), Concrete Formwork, National Standard of Canada
- .4 American Society for Testing and Materials (ASTM) where noted.
- .5 Provincial safety standards where applicable.
- .6 Conform to applicable safety regulations for erection, maintenance and removal of formwork.

1.5 REGULATIONS

- .1 Abide by the current bylaws and regulations of the province and/or municipality in which the work is located, and abide by the current laws and regulations with regard to public safety.
- .2 The regulations of the Minister of Labour, Occupational Health and Safety Act, the Workers’ Compensation Board and other applicable acts administered by the authority having jurisdiction of the province apply to the work of this section.

1.6 SAFETY

- .1 Carry out work in accordance with the current Occupational Health and Safety Act and construction safety regulations.

1.7 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submittals in accordance with Section 013300 - Submittal Procedures.
- .2 Submit shop drawings to Departmental Representative of all architectural exposed concrete formwork if requested by the Departmental Representative indicating placement joints, control joints and false joint patterns and all proposed tie patterns.
- .3 Clearly indicate all pertinent dimensioning, arrangements of joints, location of reglets and reveals and tie patterns.
- .4 Where complicated architectural concrete shapes inward sloped forms are required, indicate construction methods and materials proposed to achieve clean, smooth or straight concrete lines and smooth even surfaces free from bugholes, honeycombs, fins, and cold joints.
- .5 Review of the shop drawings by the Departmental Representative is intended to assist the Contractor and does not relieve the Contractor of responsibility for the completeness and accuracy of the work and its conformance with the contract drawings and specifications.
- .6 Fabrication that commences prior to shop drawing review by the Departmental Representative is at the risk of the Contractor.
- .7
- .8 Submit shop drawings for formwork and falsework.

1.8 DELIVERY, STORAGE AND HANDLING

- .1 Deliver all materials to the site in bundles easily identified and properly marked.
- .2 Store and handle all material on site in a manner to prevent damage and contamination.

1.9 QUALITY CONTROL

- .1 The Contractor's professional engineer responsible for the design of formwork is to inspect the fabrication and erection of formwork.
- .2 The Contractor is not to assign the responsibility of coordination of forming, placing reinforcing steel, placing other required material and placing concrete. Ensure a full-time qualified superintendent representing the Contractor is in attendance to inspect and check all phases of this work.

1.10 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for re-use and recycling in accordance with the Waste Management Plan and Section 01 74 21 – Construction/Demolition Waste Management and Disposal.
- .2 Place materials defined as hazardous or toxic in designated containers.
- .3 Divert wood materials from landfill to a recycling, re-use, or composting facility.
- .4 Divert plastic materials from landfill to a recycling, re-use, or composting facility.
- .5 Divert unused form release material from landfill to an official hazardous material collections site.

1.11 PAYMENT

- .1 Payment for the work of this section shall be on a lump sum basis as tendered which shall be full compensation for all labour, materials, and equipment necessary to complete the work, including all subsidiary and incidental items thereto for which separate payment is not elsewhere provided.

Part 2 Products

2.1 MATERIALS

- .1 Plywood:
 - .1 Douglas fir conforming to CSA-O121 or softwood conforming to CSA-O151 or CSA-O153 as required to resist design loads imposed upon the forming system. Regular grade select tight face. Sound, undamaged sheets with clean, true finish.
- .2 Lumber: SPF species, No. 2 Grade or better, conforming to CSA-O141 and to the design requirements of CAN/CSA-O86.09 to resist applied loads required of the forming system.

- .3 Anchorage devices (including nails, bolts, spikes and lag screws): Sized to ensure all formwork loadings are adequately resisted. Nails, spikes and staples conforming to CSA-B111 galvanized or phosphatized.
- .4 Steel forms: Minimum 1.6 mm well matched, tight fitting and adequately stiffened to support weight of concrete without deflection.
- .5 Form ties for all concrete below grade or exposed to weather:
 - .1 Snap off metal ties with 40 mm length cone to resist all forces.
- .6 Form ties for all concrete with unexposed finishes or concrete covered by an applied architectural finish:
 - .1 Snap off metal ties to resist all forces that will break off approximately 15 mm below the surface and permit a flush finish.
- .7 Form tie hole sealant: Non-Ferrous, Non-Shrink Grout. Natural grey or colour to match concrete.
- .8 Form release agent: Ecologo certified under the Environmental Choice Program (ECP) or, if not Ecologo certified, the Contractor shall:
 - .1 provide a product that conforms to the requirements for concrete release agents in accordance with ECP Certification Criteria Document (CCD) 143 governing Asphalt and Concrete Release Agents, excluding the provisions under Conditions for Ecologo Use and,
 - .2 if requested, provide the Departmental Representative with the same rights as the ECP under CCD 143 with regard to verification of product compliance.
- .9 Fillets for chamfered corners: Minimum 12 mm x 12 mm wood.
- .10 Void form: Closed celled expanded polystyrene complete with void spaces specifically designed to allow frost heave and swelling of soil under concrete without inducing uplift on the concrete. Structurally sufficient to support weight of wet concrete with thickness as noted on the plans.
- .11 Void forms: Moisture-resistant treated paper faces, biodegradable, structurally sufficient to support weight of wet concrete until initial set, 150 mm thick. Use wax mat with minimum compressive strength of 0.12 MPa.
- .12 Grade beam and wall void form protection: Provide polyethylene protection under biodegradable void form as required to protect the void form from moisture and premature failure prior to placing concrete.
- .13 Form stripping agent to be colourless mineral oil, non staining and non volatile. Falsework materials: to CSA-S269.1.
- .14 Sealant: to Section 07 92 00 – Joint Sealers

Part 3 Execution

3.1 FABRICATION AND ERECTION

- .1 Fabricate and erect falsework in accordance with CSA S269.1
- .2 Verify lines, levels and centres before proceeding with formwork. Ensure that dimensions agree with drawings.
- .3 Do not place shores and mud sills on frozen ground.
- .4 Provide site drainage to prevent washout of soil supporting mud sills and shores.
- .5 Fabricate and erect formwork in accordance with CAN/CSA-S269.1 to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CSA-A23.1/A23.2.
- .6 Ensure that supplied equipment, hardware, and items to be cast-in will fit concrete dimensions.
- .7 Construct formwork, shoring and bracing accurately to meet design and code requirements so that resultant finished concrete conforms to shapes, lines, levels and dimensions indicated on drawings.
- .8 Provide bracing to ensure stability of formwork as a whole. Prop or strengthen all previously constructed elements liable to be overstressed by construction loads.
- .9 Arrange and assemble formwork so as to permit easy dismantling and stripping so that concrete is not damaged during its removal.
- .10 Construct formwork to maintain concrete tolerances in accordance with CSA-A23.1, Clause 10 unless closer tolerances are required for special conditions such as elevators.
- .11 Construct formwork to maintain the following minimum tolerances:
 - .1 Variation for cross sections and offsets:
 - .1 Up to 0.3 m ±8 mm.
 - .2 Up to 1.0 m ±12 mm.
 - .3 Maximum ±20 mm.
 - .2 Vertical alignment to be within 1:400 with a maximum 40 mm.
 - .3 Horizontal alignment to be within 1:400 with a maximum of 40 mm.
- .12 Apply form release agent on formwork in accordance with manufacturer's recommendations. Apply prior to placing reinforcing steel, anchoring devices and embedded parts.
- .13 Do not apply form release agent where concrete surfaces are to receive special finishes or applied coverings which are affected by agent. Soak inside surfaces of untreated forms with clean water and keep moist prior to placing concrete.
- .14 Do not re-use formwork with surface defects that will impair the appearance of finished concrete. Do not patch formwork. Meet the requirements of Part 2 of this section when re-using formwork.

- .15 Obtain approval of Departmental Representative for use of earth forms when not shown on drawings. When using earth forms, hand-trim sides and bottoms and remove loose dirt prior to placing concrete. Increase concrete cover as required.
- .16 Verify top of pile elevations. Cut down piles or increase lengths as required to the proper elevations. Ensure piles project into grade beams and pile caps as indicated on drawings.
- .17 Remove all loose concrete from tops of piles. Ensure tops of piles are clean and of sound concrete.
- .18 Provide sufficient space below grade beams and walls for void form and void protection. Place void form prior to reinforcement to ensure specified concrete cover.
- .19 Separate slabs on grade from vertical surfaces with 6 mm thick joint filler where noted on drawings. Extend joint filler from bottom of slab to within 6 mm of finished slab surface.
- .20 Form construction joints in accordance with CSA-A23.1 at locations indicated on the drawings or with the written approval of the Departmental Representative as follows:
 - .1 At centre of span of suspended slabs, beams and joists.
 - .2 In walls directly over centroid of pile or pile cap if applicable.
 - .3 In grade beams at midspan.
 - .4 In walls and columns immediately above and below floor construction joints.
 - .5 At centre of steel beam that supports concrete slab.
- .21 Construction joints at centre of span of suspended slabs, beams and joists to be adequately doweled and keyed. Maximum concrete placement length for structural slabs to be 35 m unless otherwise detailed. Refer to drawings for construction joint details.
- .22 Construction joints in walls and grade beams maximum 12 m or as detailed.
- .23 Construction joints in slabs on grade maximum 24 m or as detailed.
- .24 Proposed construction joint locations and details to be approved by the Departmental Representative.
- .25 Roughen surface of construction joints to sound concrete, dampen surface and apply an epoxy bonding agent prior to placing fresh concrete.
- .26 Form or shore all composite steel deck if noted on the drawings or shop drawings or as directed by the steel deck supplier prior to placing concrete.
- .27 The structural steel frame is designed to support concrete floor toppings without additional shoring unless noted on the drawings.

3.2 CLEANING FORMS

- .1 Clean formwork in accordance with CSA-A23.1/A23.2, before placing concrete.
- .2 Clean forms as erection proceeds to remove foreign matter. Remove cuttings, shavings and debris from within forms. Flush completely with water or compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports. Do not use water to clean forms where hydrophyllic type water stops are specified.

- .3 During cold weather, remove ice and snow from within forms. Do not use de-icing salts. Do not use water to clean out completed forms unless formwork and concrete construction proceed within a heated enclosure. Use compressed air or other means to remove foreign matter.
- .4 Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain. Close temporary ports or openings with tight-fitting panels, flush with inside of forms, neatly fitted so that joints will not be apparent in exposed concrete surfaces.

3.3 INSERTS/EMBEDDED PARTS/OPENINGS

- .1 Provide formed openings/chases or slots where required for pipes, conduits, sleeves and other work to be embedded in and passing through concrete members.
- .2 Refer to architectural, mechanical, and electrical drawings for sleeves and openings required through structural components. These are not to reduce the structural capacity. Locations and sizes not shown on the structural drawings are to be approved in writing by the Departmental Representative.
- .3 Maximum size of electrical conduit in structural slabs is 1/5 of solid portion of the slab thickness, and where more than two are adjacent to each other, they are to be spaced 100 mm apart. Conduit is to be placed in the middle third of the slab unless otherwise specified or approved in writing by the Departmental Representative.
- .4 Provide recesses in top of foundation walls at all doors and openings to allow slab to bear on walls.
- .5 Accurately locate and set in place all items that are to be cast directly in concrete.
- .6 Coordinate work of other sections and cooperate with the trade involved in forming and/or setting openings, slots, recesses, chases, sleeves, bolts, anchors and other inserts. Do not perform work unless specifically indicated on drawings or approved prior to installation.
- .7 Do not place anchor bolts, sleeves and inserts into freshly placed concrete. Tie firmly into place prior to placing concrete.
- .8 Ensure that anchors and inserts will not protrude beyond surfaces designated to receive applied finishes, including paint.
- .9 Install all concrete accessories in accordance with drawings and manufacturer's recommendations, straight, level and plumb. Ensure adequate support to prevent movement during concrete placement.

3.4 FORM REMOVAL AND RESHORING

- .1 Comply with CSA-S269.1 for dismantling all falsework.
- .2 Leave formwork in place for following minimum periods of time after placing concrete.
 - .1 3 days for walls and sides of grade beams.

- .2 14 days for beam soffits, slabs, decks and other structural members, or 2 days when replaced immediately with adequate shoring to standard specified for falsework.
- .3 2 days for footings
- .3 Re-use formwork and falsework subject to requirements of CSA-A23.1/A23.2.
- .4 Do not remove forms, shores and bracing until concrete has gained sufficient strength to carry its own weight, construction loads and the design loads that are liable to be imposed upon it. Verify strength of concrete by compression tests to the satisfaction of the Departmental Representative.
- .5 Remove forms not directly supporting weight of concrete as soon as stripping operations will not damage concrete but not before a minimum of three days from final concrete placement to prevent rapid loss of moisture from concrete.
- .6 Arrange forms to allow removal without removal of principal shores where these are required to remain in place.
- .7 Retain shores and forms under structural members for a minimum of 14 days or until the concrete has attained 75% of the required 28 day strength, whichever occurs later.
- .8 Beams, slabs and joists are to remain shored, or re-shoring sequence is to be controlled, to prevent excessive dead load deflections.
- .9 Verify strength by field cylinders or insert type tests in accordance with ASTM C900-T.
- .10 Remove formwork progressively and in accordance with code requirements so that no shock loads or unbalanced loads are imposed on structure.
- .11 Loosen forms carefully. Do not damage concrete by wedging pry bars, hammers or tools against concrete surfaces.
- .12 Re-shore structural members as required for design or construction conditions. Construction is to be re-shored to carry all future anticipated construction loading unless otherwise approved in writing by the Departmental Representative.

3.5 VOID FORM

- .1 Ensure void form is in place and not damaged prior to placing concrete (top protection may be required – by contractor).
- .2 Install void space protection prior to backfilling walls and grade beams (required for biodegradable void form only).
- .3 Install void form top protection for structural slabs on grade.

End of Section

.4

Part 1 General

1.1 SCOPE OF WORK

- .1 The Scope of Work shall include: All concrete reinforcing related to work required for The Sinclair Canyon Electrical Upgrade and Site Rehabilitation.

1.2 RELATED WORK SPECIFIED IN OTHER SECTIONS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 01 45 00 – Quality Control
- .3 Section 01 74 21 – Construction/Demolition Waste Management and Disposal
- .4 Section 03 10 00 – Concrete Forming and Accessories
- .5 Section 03 30 00 – Cast-in-Place Concrete
- .6 Section 02 36 30 – Tangent Concrete Piles

1.3 PRICE AND PAYMENT PROCEDURES

- .1 Measurement and Payment:
 - .1 Measurement of material shall not be required as part of this fixed price contract.

1.4 REFERENCES

Perform all work in accordance with the following standards, except where specified otherwise. All standards to be latest issue at time of tender.

- .1 BCBC 2012, “British Columbia Building Code”.
- .2 NBC 2010, “National Building Code”.
- .3 American Concrete Institute (ACI)
 - .1 SP-66-04, ACI Detailing Manual 2004.
 - .1 ACI 315-99, “Details and Detailing of Concrete Reinforcement”.
 - .2 ACI 315R-04, “Manual of Structural and Placing Drawings for Reinforced Concrete Structures”.
- .4 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A82/A82M-07, Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
 - .2 ASTM A143/A143M-07 (2014), Standard Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement.
 - .3 ASTM A185/A185M-07, Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.

- .4 ASTM A775/A775M-07b, Standard Specification for Epoxy-Coated Reinforcing Steel Bars.
- .5 ASTM A123 / A123M – 15, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- .5 Canadian Standards Association (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 CAN/CSA-G30.18-M92 (R2007), “Billet-Steel Bars for Concrete Reinforcement, A National Standard of Canada”..
 - .4 CSA-G40.20/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .5 CSA W186-M1990(R2007), Welding of Reinforcing Bars in Reinforced Concrete Construction.
- .6 Reinforcing Steel Institute of Canada (RSIC)
 - .1 RSIC-2004, Reinforcing Steel Manual of Standard Practice.
- .7 Concrete Reinforcing Steel Institute (CRSI) where noted

1.5 REGULATIONS

- .1 Abide by the current bylaws and regulations of the province and/or municipality in which the work is located, and abide by the current laws and regulations with regard to crossing and public safety.
- .2 The regulations of the Minister of Labour, Occupational Health and Safety Act, the Workers’ Compensation Board and other applicable acts administered by the authority having jurisdiction of the province apply to the work of this section.

1.6 SAFETY

- .1 Carry out concrete reinforcing work in accordance with the current Occupational Health and Safety Act and construction safety regulations.

1.7 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Prepare reinforcement drawings in accordance with RSIC Manual of Standard Practice.
- .3 When Chromate solution is used as replacement for galvanizing non-prestressed reinforcement, provide product description for review by Departmental Representative prior to its use.
- .4 Quality Assurance:
 - .1 Mill Test Report: upon request provide Departmental Representative with certified copy of mill test report of reinforcing steel.

- .2 Upon request submit in writing to Departmental Representative proposed source of reinforcement material to be supplied.
- .5 Submit results of ladle analysis of all reinforcement to be spliced by welding, and submit manufacturer's information and test reports for mechanical splices of all reinforcement to be mechanically spliced.
- .6 Submit responses to all site review reports stating that all reported defects and deficiency items were corrected or stating what action was taken.
- .7 Shop Drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Canada.
 - .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 tension lap splices, unless otherwise indicated
 - .2 .

1.8 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.

1.9 DELIVERY, STORAGE AND HANDLING

- .1 Deliver all materials to the site in bundles easily identified and properly marked.
- .2 Store and handle all material on site in a manner to prevent damage and contamination.
- .3 Do not straighten or re-bend any reinforcement.
- .4 Do not use any reinforcement that has been kinked or bent on site.

1.10 INSPECTION AND TESTING OF REINFORCEMENT

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

Part 2 Products

2.1 MATERIALS

- .1 Substitute different size bars only if permitted in writing by Departmental Representative.
- .2 Reinforcing steel for straight reinforcing bars only: To CAN/CSA-G30.18, 400 MPa yield grade deformed billet steel bars.
- .3 Reinforcing steel for welded and bent reinforcing bars: To CAN/CSA-G30.18, 400W MPa yield grade special low alloy deformed billet steel. The equivalent carbon content is not to exceed 0.5.
- .4 Welded steel wire fabric: To A497/A497M.
- .5 Chairs, bolsters, bar supports, spacers to meet requirements of CSA-A23.1/A23.2: Adequate for strength and support of reinforcing. Where concrete is exposed to view, exposed to elements or where rust is possible; use plastic or non-corrosive material, or precast concrete made from concrete of equal strength and durability of concrete to be placed. Chairs used are not to result in voids or unacceptable appearance in exposed concrete surfaces.
- .6 Slab on grade chairs and bar supports: Precast concrete, plastic chairs, or subject to approval concrete masonry block or brick of correct height. Metal pipe, stone or wood are not acceptable. Chairs shall be compatible with void form where applicable.
- .7 Tie wire: Minimum 1.6 mm type or patented system approved by the Departmental Representative.
- .8 Galvanizing of non-prestressed reinforcement: to ASTM A123 / A123M, minimum zinc coating 85 microns.
 - .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.
 - .3 Temperature of solution equal to or greater than 32 degrees and galvanized steels immersed for minimum 20 seconds.
 - .4 If galvanized steels are at ambient temperature, add sulphuric acid as bonding agent at concentration of 0.5% to 1%.
 - .5 In this case, no restriction applies to temperature of solution.

- .6 Chromate solution sold for this purpose may replace solution described above, provided it is of equivalent effectiveness.
- .7 Provide product description as described in Part 1 – SUBMITTALS.

2.2 FABRICATION

- .1 Fabricate reinforcement hooks, bends, laps and similar details to CSA-A23.1, ACI Detailing Manual 315 and Metric Supplement of the Reinforcing Steel Institute of Canada (RISC) Manual of Standard Practice and in accordance with the drawings and specifications and the reviewed shop drawings.
- .2 Verify dimensions of existing work prior to commencing fabrication.
- .3 Verify all drawing dimensions and conditions prior to commencing fabrication.
- .4 Bend all reinforcement cold unless otherwise approved by the Departmental Representative.
- .5 Provide all additional support bars as required to support all main reinforcement indicated.
- .6 Locate reinforcing splices not indicated on drawings at points of minimum stress. Location of splices is to be approved by the Departmental Representative.
- .7 Refer to structural drawings for minimum splices. Splices to be Type B unless noted otherwise.
- .8 Weld reinforcement where indicated and only by an organization certified under the requirements of CSA-W186. Do not weld reinforcing at any location without written approval of the Departmental Representative.
- .9 Lap adjacent sheets of welded steel wire fabric to provide an overlap of at least one cross wire spacing plus 50 mm.

2.3 SOURCE QUALITY CONTROL

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

Part 3 Execution

3.1 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 in accordance with CSA-A23.1/A23.2.
- .2 Place reinforcement within a tolerance of ± 6 mm for slab steel and ± 12 mm for other steel. Bends and end of bars to be within 50 mm of specified location. Adequately support and secure reinforcement to prevent movement within the allowable tolerances before and during placing of concrete.
- .3 Place and secure all reinforcement in its correct position prior to placing any concrete. Do not adjust or place reinforcement in freshly placed concrete.
- .4 Prior to placing concrete, obtain Departmental Representative's approval of reinforcing material and placement.
- .5 Ensure cover to reinforcement is maintained during concrete pour.
- .6 Supply and place all necessary support accessories, whether specifically detailed or not, to ensure proper placement of reinforcing steel.
- .7 Use non-corrosive or non-stain supports for reinforcing when concrete is exposed.
- .8 Supply chairs to support temperature reinforcing or mesh to maintain minimum covers specified.
- .9 Ensure supports are such that they are not forced into the supporting formwork, void form or soil and do not break or collapse from the weight of reinforcement and other construction loads.
- .10 Support reinforcement laterally in pairs on opposite faces of walls, columns and beams.
- .11 Provide minimum concrete cover to reinforcing steel in accordance with CSA-A23.1, except where indicated on the drawings.
- .12 Ensure reinforcing is clean, free of loose scale, dirt, oil, rust and other foreign coatings.
- .13 Obtain written approval from the Departmental Representative prior to cutting of reinforcing to accommodate openings, or embedded items or to accommodate precast concrete, structural steel or timber connections. Allow for additional splice material which may be required to reinforce these cut bars as directed by the Departmental Representative.
- .14 Prior to placing concrete, obtain Departmental Representative's approval of reinforcing material and placement.

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

END OF SECTION

Part 1 General

1.1 SCOPE OF WORK

- .1 The Scope of Work shall include: All cast-in-place concrete related to work required for the Sinclair Canyon Electrical Upgrade and Site Rehabilitation.

1.2 RELATED REQUIREMENTS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 01 45 00 – Quality Control
- .3 Section 01 74 21 – Construction/Demolition Waste Management and Disposal
- .4 Section 03 10 00 – Concrete Forming and Accessories
- .5 Section 03 20 00 – Concrete Reinforcing
- .6 Section 31 00 00 – Earthwork
- .7 Section 31 23 33.01 – Excavating, Trenching and Backfilling
- .8 Section 02 36 30 – Tangent Concrete Piles

1.3 PRICE AND PAYMENT PROCEDURES

- .1 Payment for the work of this section shall be on a lump sum basis as tendered which shall be full compensation for all labour, materials, and equipment necessary to complete the work, including all subsidiary and incidental items thereto for which separate payment is not elsewhere provided.
- .2 Measurement and Payment:
 - .1 Measurement shall not be required. Payment shall be considered inclusive to the single fixed price contract.

1.4 REFERENCES

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

- .1 Type F - with CaO content less than 15%.
- .2 Type CI - with CaO content ranging from 15 to 20%.
- .3 Type CH - with CaO greater than 20%.
- .3 GGBFS - Ground, granulated blast-furnace slag.
- .2 Reference Standards:

Perform cast-in-place concrete work in accordance with the following standards, except where specified otherwise. All standards to be latest issue at time of tender. Provide one copy on site of the first four standards listed below.

 - .1 BCBC 2012, "British Columbia Building Code".
 - .2 NBC 2010, "National Building Code".
 - .3 ASTM International
 - .1 ASTM C260/C260M-10a, Standard Specification for Air-Entraining Admixtures for Concrete.
 - .2 ASTM C309-11, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
 - .3 ASTM C330-11, "Standard Specification for Lightweight Aggregates for Structural Concrete".
 - .4 ASTM C494/C494M-13, Standard Specification for Chemical Admixtures for Concrete.
 - .5 ASTM C1017/C1017M-13, Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
 - .6 ASTM D412-15a, Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension.
 - .7 ASTM D624-00(2012), Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomer.
 - .8 ASTM D1751-04(2013), Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
 - .9 ASTM D1752-04a(2013), Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.
 - .4 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 (R2011), Qualification Code for Concrete Testing Laboratories.
 - .3 CSA A3000-13, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
 - .4 CAN/CSA-A3001-13, "Cementitious Materials or Use in Concrete".

1.5 REGULATIONS

- .1 Abide by the current bylaws and regulations of the province and/or municipality in which the work is located, and abide by the current laws and regulations with regard to public safety.
- .2 The regulations of the Minister of Labour, Occupational Health and Safety Act, the Workers' Compensation Board and other applicable acts administered by the authority having jurisdiction of the province apply to the work of this section.

1.6 SAFETY

- .1 Carry out cast-in-place concrete work in accordance with the current Occupational Health and Safety Act construction safety regulations.

1.7 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit the proposed mix design for all concrete and grout mix types to the Departmental Representative for approval two weeks prior to their initial use.
- .2 Submit data sheets for all proposed pre-mixed grouts to the Departmental Representative for review.
- .3 Submit samples of fine and coarse aggregate and all admixtures proposed for concrete mixes to the testing firm's laboratory, if requested by the Departmental Representative.
- .4 Prior to conducting trial mixes, submit data on all specified or proposed concrete admixtures with the mix design to the Departmental Representative for approval. Data is to confirm the compatibility of the water reducing admixture, the superplasticizer, the air entraining agent, the cement, the fly ash and the silica fume where used.
- .5 Submit copies of mill certificate test reports of cement, silica fume and fly ash, if requested by the Departmental Representative.
- .1 Submit data on all concrete accessories specified or proposed.
- .6 Submit responses to all site review reports stating that all reported defects and deficiency items were corrected or stating what action was taken.
- .7 Provide testing results for review by Departmental Representative and do not proceed without written approval when deviations from mix design or parameters are found.
- .8 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.
- .9 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.

1.8 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 When plant does not hold valid certification, 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 (air temperature above 25°C).
 - .3 Cold weather concrete (air temperature below 5°C).
 - .4 Curing.
 - .5 Finishes.
 - .6 Formwork removal.
- .4 Quality Control Plan: provide written report to Departmental Representative verifying compliance that concrete in place meets performance requirements of concrete as established in PART 2 - PRODUCTS.
- .5 Sustainability Standards Certification:
 - .1 Construction Waste Management: provide copy of plan.

1.9 DELIVERY, STORAGE AND HANDLING

- .1 Delivery and Acceptance Requirements:
 - .1 Concrete hauling time: maximum allowable time for concrete to be delivered to site of Work and discharged not to exceed 2 hours 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.
 - .3 Store cementitious materials in accordance with CSA-A23.1, "Concrete Materials and Methods of Concrete Construction".
- .2 Packaging Waste Management: remove for reuse and return pallets, crates, padding, and packaging materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

1.10 INSPECTION AND TESTING OF CONCRETE

- .1 Test all concrete by a testing firm certified in accordance with CSA-A283, retained and paid for by the Contractor and approved by the Departmental Representative.

- .2 Provide casual labour to the testing firm's field personnel for the purpose of obtaining, handling, and storing sample materials. Provide free access to all portions of the work, and cooperate with the testing firm.
- .3 Advise testing firm 24 hours in advance of concrete placement.
- .4 The Contractor is to provide properly designed temperature-controlled storage boxes for test cylinders, as specified in CSA-A23.2, for a period of at least 24 hours and further protection from adverse weather and mishandling until removed from the site. The Contractor is to provide a max-min thermometer for each storage box. Storage in a portable building that will be used by the Contractor's personnel or the Departmental Representative during the first 24 hour storage period will not be permitted. Storage facilities are to be provided, installed, checked and approved before any concrete may be placed.
- .5 Secure sufficient 3 and 7-day test cylinders for testing of concrete to ensure quality control and sufficient strength for application of construction loads and formwork stripping. Cost for these additional tests to be borne by the Contractor.
- .6 Testing firm to conduct all tests in accordance with CSA-A23.2.
- .7 Samples of concrete to be taken as close to the point of final deposit in the form as possible, at end of pipe when pumping is used.
- .8 Testing firm to take a minimum of three (3) test cylinders for a strength test and not less than one strength test for each 40 m³ of concrete, or portion thereof, for each type of concrete placed and not less than one (1) test for each type of concrete placed in any one day.
- .9 Testing firm to moist cure and test one (1) cylinder in 7 days and to moist cure and test the remaining two (2) cylinders in 28 days or (1) in 7 days, (1) in 28 days and (2) in 56 days.
- .10 Testing firm is to take one additional test cylinder during cold weather concreting and cure on job site under same conditions as the concrete it represents.
- .11 Testing firm is to take at least one slump test and one entrained air test for each set of test cylinders taken.
- .12 Testing firm is to report results of tests immediately to the Contractor. The Contractor is responsible for ensuring that the concrete meets the requirements of the specifications. Report adverse test results to the Departmental Representative immediately.
- .13 Testing firm is not authorized to revoke, relax, enlarge or release any requirements of the specification, nor to approve or disapprove any portion of the work.
- .14 Testing firm is to advise placing crews to halt placing of adverse concrete immediately, and thereafter notify Contractor to reject the concrete. The execution, or lack of execution, of this request is to be recorded.
- .15 Testing firm is to submit to the Departmental Representative and Contractor certified copies of test results. Include the following information with the results:
 - .1 Name of the project.

- .2 Date of sampling.
- .3 Mix design, specified strength, slump and air content.
- .4 Name of supplier, truck and ticket number.
- .5 Time batched and time placed.
- .6 Identification of sampling and testing technician.
- .7 Cement type and admixtures used.
- .8 Exact location in the structure of the concrete sampled, including floor, elevation, and grids where applicable.
- .9 Ambient air and concrete temperatures.
- .10 Nominal aggregate size.
- .11 Water added and personnel authorizing additional water.
- .12 Concrete density.
- .16 Testing firm to certify, in writing, that all concrete meets the specified requirements.
- .17 Testing firm to submit to the Departmental Representative a final report certifying that all concrete is in accordance with the contract documents. Submit the report under the seal and signature of a professional engineer registered in the Province of British Columbia.
- .18 Reject and do not place concrete with slumps greater than maximum specified, air content lower than minimum specified and concrete over 2 hours from batch time.

1.11 INSPECTION AND TESTING OF UNIT MASONRY CORE FILL

- .1 All clauses pertaining to inspection and testing of concrete contained in this specification are to apply to unit masonry grout unless noted otherwise.
- .2 Testing firm to take a minimum of three (3) test cylinders, one slump test and one entrained air test for each 20 m³ placed or portion thereof for a project having more than 20 m³ of grout and for each 10 m³ placed or portion thereof for a project having less than 20 m³ and not less than one (1) test in any one day of grout placed.
- .3 Reject and do not place job site-mixed grout over 1.5 hours from mixing time.

1.12 INSPECTION AND TESTING OF GROUT

- .1 Test all grout by a testing firm certified in accordance with CSA-A283, retained and paid for by the Contractor and approved by the Departmental Representative in accordance with Section 01400 of these specifications.
- .2 In accordance with ASTM C109, provide at least two (2) cube tests on all types of non-shrink grout used. Provide at least 5 tests of cement grout but maximum one (1) test per day.

1.13 INSPECTION AND TESTING OF GUNITE

- .1 Take a minimum of three cores for each day's operation or 200 m³ of material placed, and test in accordance with ASTM C42.

1.14 ACCEPTABILITY

- .1 Failure to comply with the requirements of these specifications will result in the structure being considered potentially deficient.
- .2 Strength evaluation tests and analysis:
 - .1 The Departmental Representative may order an independent testing firm to obtain cores, x-rays or similar non-destructive tests where evidence points to a potentially deficient structure.
 - .2 The Departmental Representative may order a load test and/or analysis, as defined by CSA-A23.3, if the non-destructive tests are impractical or inconclusive.
- .3 Pay all costs for the evaluation tests and additional engineering analysis required:
 - .1 To demonstrate the adequacy of a structure that does not meet the requirements of these specifications or the drawings.
 - .2 For a structure that has been placed before formwork and reinforcing have been made available for review by the Departmental Representative.
- .4 Reinforce by additional construction or replace as directed by the Departmental Representative at Contractor's expense concrete that is judged inadequate by structural analysis or by results of load tests.
- .5 Revise mix design proportions as required for the remainder of the work.
- .6 The Departmental Representative may order further additional testing to the above at any time even though the required tests indicate that the strength requirements have been met. In this instance, the Owner will pay for those tests that meet the specified requirements, and the Contractor will pay for those that do not.
- .7 Concrete in place not meeting air content or slump specifications as tested is to be replaced or protected by remedial measures to the satisfaction of the Departmental Representative at no cost to the Owner.

Part 2 Products

2.1 DESIGN CRITERIA

- .1 Alternative 1 - Performance: in accordance with 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 Cementing materials
- .2 Supplementary cementing materials
 - .1 Silica fume used in the work is to meet all the requirements for a Type U supplementary cementing material as specified in CSA-A3000, with a minimum SiO₂ content of at least 85%, a maximum ignition loss of 6% and a maximum SO₃ content of 1%.
 - .2 Fly ash is to be a Type F or Type CI pozzolan and is to meet the requirements identified in CAN/CSA-A3000 with the following additional requirements:
 - .1 Minimum SiO₂ and Al₂O₃ and Fe₂O₃ content 70%
 - .2 Maximum retained on 45 NM sieve 20%
 - .3 Maximum loss of ignition 4%
 - .4 Maximum Na₂O equivalent 4.5%
 - .5 Maximum CaO content 12%
- .3 Water
 - .1 Water for use in concrete production and curing is to be clean and free from injurious amounts of oil, acid, alkali, soluble chlorides, organic matter, sediment or any other deleterious substances as per CSA-A23.1.
- .4 Aggregates
 - .1 For all concrete mix types, the fine aggregate is to conform to the requirements identified in CSA-A23.1 for the specified exposure class.
 - .2 For all concrete mix types, the coarse aggregate is to conform to the requirements identified in CSA-A23.1 for the specified exposure class. The aggregate is to meet the Group 1 gradation requirements listed in Table II of CSA-A23.1.
 - .3 Aggregates are not to react with alkalis in the cement to an extent that results in excessive expansion of concrete.
 - .4 The source of the aggregate and the method of manufacture or production, including the type of equipment used, is not to be altered for the duration of the project following the acceptance of the aggregate.
- .5 Admixtures:
 - .1 Air-entraining admixtures are to conform to the requirements of ASTM C260. The admixture is to be of uniform consistency and quality within each container and from shipment to shipment.
 - .2 Water-reducing admixtures are to conform to the requirements of ASTM C494, Type A or D. The admixture is to be of uniform consistency and quality within each container and from shipment to shipment.

- .3 Superplasticizers, if approved by the Departmental Representative, (high-range water reducers) are to conform to the requirements of ASTM C494, Type F or G.

2.4 MIXES

.1 Concrete Mixes

- .1 The Contractor is to design all concrete mixes and is to pay for all costs associated with the development of the mix designs.
- .2 The Contractor is to supply concrete in accordance with CSA-A23.1, except that the additional requirements of this specification are also to apply.
- .3 Only such materials or blends of materials that will result in a uniform colour of exposed surfaces are to be used.
- .4 Concrete mixes that will be placed by concrete pump are to be designed for pumping.
- .5 In the event that slump and/or air content are outside the specified tolerance range as determined by the inspection and testing firm appointed by the Contractor and the Departmental Representative may, at his sole discretion, accept a proposal for one adjustment of the deficient condition as an alternate to rejection.
- .6 Supply “Controlled Concrete” in accordance with CSA-A23.1 with properties as noted in the following table:

Concrete Element	Exp. Class	Min. Strength MPa @ days	Coarse Aggregate Size(mm)	Cement Type	Fly Ash %
Footings, Grade Beams	F-1/S-3	30@56	20	MS or HS	40
Piles	F-1/S-3	30@56	20	MS or HS	40
Pavementls & Sidewalks	C-2	32@28	20	GU	15
Curb & Gutter	C-2	32@28	20	GU	15
Site Concrete (Non-Structural)	C-2	32@28	20	GU	15

- .7 Aggregate size specified is maximum nominal allowance. Contractor may use smaller nominal size to ease placing. Air content may have to be increased for smaller aggregate to meet exposure class requirements.
- .8 Ensure aggregate does not react with alkalis in the cement or produce excessive expansion in concrete. Conform to Appendix B of CSA-A23.1.
- .9 Maximum fly ash content as a percentage of the total cementitious material:
- .1 Concrete with exposure classes C-XL, C-1 and C-2: Maximum 15% fly ash.
- .2 Concrete with exposure classes C-3, C-4 and F-1: Maximum 25% fly ash.

- .3 Concrete with exposure classes F-2 and N: Maximum 40% fly ash.
- .10 Slump: No slumps outside the range of maximum or minimum will be permitted without written permission of the Departmental Representative. Supply slumps at 20 mm below maximum.
- .11 Air Content: All mix types with exposure classifications to be air-entrained in accordance with the above table and CSA-A23.1.
- .12 Use a water-reducing agent in all concrete.
- .13 Use accelerating admixtures in cold weather only when approved by the Departmental Representative. If approved, the use of admixtures will not relax cold weather placement requirements.
- .14 Do not use calcium chloride or admixtures containing calcium chloride.
- .15 Use all admixtures in strict accordance with the manufacturer's recommendations.
- .16 Use set-retarding admixtures during hot weather with written approval of the Departmental Representative
- .17 Do not use non-specified admixtures unless approved in writing by the Departmental Representative. Where superplasticizers are thus approved, ensure mix designs are correctly adjusted for placement, strength, durability and air content requirements.
- .18 Documentation indicating the compatibility of the water reducing admixture, the air entraining admixture, the superplasticizing admixture (if any), the cement, the silica fume (if any) and the fly ash (if any) is to be submitted upon request with the mix design for review by the Departmental Representative.

Part 3 Execution

3.1 GENERAL

- .1 Obtain Departmental Representative's written approval before placing concrete.
- .2 Perform cast-in-place concrete work in accordance with requirements of CSA-A23.1 unless indicated otherwise on the drawings.
- .3 Verify top of pile elevations. Cut down piles or increase lengths as required to the proper elevations. Ensure piles project into grade beams and pile caps as indicated on drawings.
- .4 Remove all loose concrete from tops of piles. Ensure tops of piles are clean and of sound concrete.

3.2 PLACING CONCRETE

- .1 Notify Departmental Representative and testing firm a minimum of 48 hours prior to commencement of any concrete placement. Allow time for corrective work for areas of unusual formwork and congested reinforcement.
- .2 Notify geotechnical engineer to inspect and verify all soil conditions and bearing pressures of all foundations prior to placing concrete for mudslabs or foundations.

- .3 Do not place concrete against frozen ground, frozen concrete or frosted forms.
- .4 In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels and set solidly with non-shrink grout or as specified on the drawings. The holes for the inserts are to be thoroughly cleaned.
- .5 Ensure all hardware and all other items to be cast into concrete are placed securely and will not cause undue hardship in placing concrete.
- .6 Ensure reinforcement, inserts, embedded parts, formed expansion and contraction joints and other critical items are not disturbed during concrete placement.
- .7 Revise, re-seat and correct improperly positioned reinforcing hardware and other embedded items immediately before concrete placement.
- .8 Ensure specified concrete cover around reinforcing is maintained.
- .9 Place concrete reinforcing in accordance with Section 03 20 00 – Concrete Reinforcing.
- .10 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.
- .11 Pumping of concrete is permitted only after approval of equipment and mix].
- .12 Ensure reinforcement and inserts are not disturbed during concrete placement.
- .13 Prior to placing of concrete obtain Departmental Representative's approval of proposed method for protection of concrete during placing and curing.
- .14 Protect previous Work from staining.
- .15 Clean and remove stains prior to application for concrete finishes.
- .16 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.
- .17 In locations where new concrete is dowelled to existing work, drill holes in existing concrete.
 - .1 Place steel dowels of deformed steel reinforcing bars and pack solidly with epoxy grout to anchor and hold dowels in positions as indicated.
- .18 Do not place load upon new concrete until authorized by Departmental Representative.

3.3 INSTALLATION/APPLICATION

- .1 Do not place concrete older than 2 hours from batch time.
- .2 Do not add water after batching unless in strict accordance with CSA-A23.1, and such that concrete conforms with the specified mix design parameters.
- .3 Where concrete is placed on an inclined surface, the placing operation is to begin at the lower end of the slope and progress upward unless otherwise permitted by the Departmental Representative.

- .4 Place concrete and screed in accordance with the lines and levels indicated on the drawings.
- .5 Place concrete in approximate horizontal layers such that each lift can be vibrated into the previous lift.
- .6 Maximum vertical free fall of concrete is not to exceed 1200 mm in unexposed work or 800 mm in exposed work. Confine concrete with a suitable vertical drop pipe to prevent segregation.
- .7 Place concrete directly into its final position in forms. Do not spread concrete with vibrators.
- .8 Compact concrete thoroughly by mechanical vibrators. Ensure concrete is worked around reinforcement, embedded items and into all areas and corners of forms.
- .9 Use internal vibrators in all sections that are sufficiently large, and supplement with external type in the event that satisfactory surfaces cannot be obtained.
- .10 Check and re-adjust formwork to required lines and levels during placement of concrete.
- .11 Place concrete as a continuous operation, stopping only at construction joints.
- .12 Allow a minimum of three days between adjacent concrete placements.
- .13 Use cold weather concreting methods in accordance with CSA-A23.1 when the mean daily temperature falls below 5°C, and use hot weather methods when the mean temperature rises above 25°C.
- .14 Maintain accurate records of concrete placement. Record date, location of placement, quantity, air temperature and test samples taken.
- .15 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 approval of modifications from Departmental Representative before placing of concrete.
 - .5 Confirm locations and sizes of sleeves and openings shown on drawings.
 - .6 Set special inserts for strength testing as indicated and as required by non-destructive method of testing concrete.
- .16 Anchor bolts:
 - .1 Set anchor bolts to templates in co-ordination with appropriate trade prior to placing concrete.
 - .2 Protect anchor bolt holes from water accumulations, snow and ice build-ups.

- .3 Set bolts and fill holes with epoxy grout.
- .4 Locate anchor bolts used in connection with expansion shoes, rollers and rockers with due regard to ambient temperature at time of erection.
- .17 Joint fillers:
 - .1 Furnish filler for each joint in single piece for depth and width required for joint, unless otherwise authorized by Departmental Representative.

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 56 days for Class S-3 concrete and 7 and 28 days for Class C-2 concrete.
 - .5 Air and concrete temperature.
- .2 Inspection and testing of concrete and concrete materials will be carried out by testing laboratory designated by Departmental Representative for review to CSA A23.1/A23.2.
 - .1 Ensure testing laboratory is certified to CSA A283.
- .3 Ensure test results are distributed for discussion at pre-pouring concrete meeting between testing laboratory and Departmental Representative.
- .4 Departmental Representative will pay for costs of tests as specified in Section 01 29 83 - Payment Procedures for Testing Laboratory Services.
- .5 Departmental Representative 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 Repair, remove and clean all drips and smears resulting from the work of this section on exposed, finished surfaces or surfaces to be subsequently finished.
- .2 Hose down sandblasted surfaces. Brush thoroughly with a stiff broom to remove all dust and loose particles.

END OF SECTION

Part 1 General

1.1 Scope of Work

- .1 Scope of work shall include: All precast structural concrete related to work required for the Sinclair Canyon Electrical Upgrade and Site Rehabilitation.

1.2 RELATED REQUIREMENTS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 01 45 00 – Quality Control
- .3 Section 01 74 21 – Construction/Demolition Waste Management and Disposal
- .4 Section 03 10 00 – Concrete Forming and Accessories
- .5 Section 03 20 00 – Concrete Reinforcing
- .6 Section 03 30 00 – Cast-in-Place Concrete
- .7 Section 31 63 23 – Bored Concrete Piles.

1.3 Work Installed but Supplied under Other Sections

- .1 Install in accordance with Section 03 30 00 and as noted herein.
- .2 Install materials specified to be supplied under other sections of these project specifications.
- .3 Ensure installation is to the satisfaction of trades concerned and of the Departmental Representative prior to placing concrete.

1.4 MEASUREMENT PROCEDURES

- .1 Measure precast elements in units supplied, delivered, stored and erected.
- .2 Precast elements measured as individual units, will include cost, supply, delivery, storage and erection of all components and materials.

1.5 REFERENCES

- .1 BCBC 2012, “British Columbia Building Code”.
- .2 NBC 2010, “National Building Code”.
- .3 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A1064/A1064M-16a, Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
 - .2 ASTM C260/C260M-10a, Standard Specification for Air-Entraining Admixtures for Concrete.
- .4 Canadian Construction Documents Committee (CCDC)

- .1 CCDC 2-2008, Stipulated Price Contract.
- .5 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.40-97, Anticorrosive Structural Steel Alkyd Primer.
 - .2 CAN/CGSB-1.181-99, Ready Mixed Organic Zinc-Rich Coating.
- .6 Canadian Standards Association (CSA International)
 - .1 CSA-A23.1/A23.2-2014, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 - .2 CSA-A23.3-14, Design of Concrete Structures.
 - .3 CSA-A23.4-16, Precast Concrete - Materials and Construction.
 - .4 CAN/CSA-A3000-13, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
 - .1 CSA-A3001-13, Cementitious Materials for Use in Concrete.
 - .5 CAN/CSA-G30.18-M92(R2007), Billet-Steel Bars for Concrete Reinforcement.
 - .6 CAN/CSA-G164-M92(R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.
 - .7 CSA-W47.1-09 (R2014), Certification of Companies for Fusion Welding for Steel.
 - .8 CAN/CSA W48-14, Filler Metals and Allied Materials for Metal Arc Welding (Developed in co-operation with the Canadian Welding Bureau).
 - .9 CSA-W59-13, Welded Steel Construction (Metal Arc Welding) (Metric version).
 - .10 CSA-W186-M1990(R2012), Welding of Reinforcing Bars in Reinforced Concrete Construction.

1.6 DESIGN REQUIREMENTS

- .1 Design precast concrete products in accordance with the British Columbia Building Code under the direct supervision of a professional engineer registered in the Province of British Columbia, fully experienced in the design of precast concrete products.
- .2 Design products and supports to withstand their own weight for stripping, handling and erection to prevent any cracking or damage. Temperature is likely to fall below 5°C.
- .3 Design products to withstand all forces and design loads due to wind, temperature, earthquake, live and dead loads.
- .4 Design component connections to provide for foundation settlement and building movement. Provide adjustment connections and tolerance to accommodate misalignment of the structure.
- .5 Provide expansion/construction joints to accommodate movement in the structure itself and between the cladding elements and the structure (deflection, wracking, etc.) without permanent distortion, damage to components, wracking of joint connections, breakage of seals or moisture penetration.
- .6 Design connections/attachments of precast elements to load/forces specified by Departmental Representative.

- .7 Provide detailed calculations and design drawings for typical precast elements and connections as described in PART 1 - SUBMITTALS.

1.7 PERFORMANCE REQUIREMENTS

- .1 Tolerance of precast elements to CSA-A23.4.

1.8 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit WHMIS MSDS - Material Safety Data Sheets. Submit Safety Data Sheets (SDS) per Globally Harmonized System (GHS) applicable from Q2 of 2017.
- .3 Co-ordinate submittal requirements and provide submittals required by Section 01 47 15 - Sustainable Requirements: Construction.
- .4 Shop Drawings: submit drawings stamped and signed by qualified professional engineer registered in Province of British Columbia, Canada.
- .5 Submit samples in accordance with Section 01 33 00 - Submittal Procedures and provide sample and sample number of each finish to be used on project to Departmental Representative.

1.9 QUALITY ASSURANCE

- .1 Quality Control Plan: submit written report, as described in PART 3 - VERIFICATION, to Departmental Representative verifying compliance that concrete provided meets performance requirements of concrete as established in PART 2 - PRODUCTS.

1.10 QUALIFICATIONS

- .1 Fabricate and erect precast concrete elements by manufacturing plant certified in appropriate categories according to CSA-A23.4
- .2 Precast concrete manufacturer to be certified in accordance with CSA's certification procedures for precast concrete plants prior to submitting tender and to specifically verify as part of tender that plant is currently certified in appropriate categories, Trenches.
- .3 Only precast elements fabricated in such certified plants to be acceptable to Departmental Representative and plant certification to be maintained for duration of fabrication, erection until warranty expires.
- .4 Welding companies certified to CSA-W47.1.

1.11 DELIVERY, STORAGE AND HANDLING

- .1 Store and manage hazardous materials in accordance with Section 01 47 15 - Sustainable Requirements: Construction.
- .2 Deliver, handle and store precast/prestressed units according to manufacturer's instructions.
- .3 Protect unit corners from contacting earth to prevent from staining.
- .4 Waste Management and Disposal:

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

1.12 WARRANTY

- .1 The manufacturer hereby warrants that the precast structural products will not spall or show visible evidence of cracking in accordance with parameters outlined in the General Conditions of these specifications for five years.

Part 2 Products

2.1 MATERIALS

- .1 Concrete materials to be as noted in Section 03 30 00 and as noted herein.
- .2 SPEC NOTE: Use of supplementary cementing materials can affect properties of plastic and hardened concrete and hence their use must be evaluated before use.
- .3 hydraulic cement: type GU or HS (depending on soil conditions) to CAN/CSA-A3001.
- .4 Supplementary cementing materials: with minimum 20% Type F fly ash replacement, by mass of total cementitious materials to CAN/CSA A3001.
- .5 Water: to CSA-A23.1/A23.2.
- .6 Reinforcing steel: to CAN/CSA-G30.18.
- .7 Welded wire fabric: to ASTM A1064/A1064M.
- .8 Hardware and miscellaneous materials: to CSA-A23.1/A23.2.
- .9 Forms: to CSA-A23.4.
- .10 Anchors and supports: to CAN/CSA-G40.21 Type 300 W galvanized after fabrication.
- .11 Welding materials: to CSA W48.
- .12 Welding electrodes: to CSA W48 certified by Canadian Welding Bureau.
- .13 Galvanizing: hot dipped galvanizing with minimum zinc coating to ASTM A123.
- .14 Epoxy coating: to ASTM A775/A775M.
- .15 Post-tensioning ducts: to CSA-A23.1/A23.2.
- .16 Air entrainment admixtures: to ASTM C260/C260M.

2.2 MANUFACTURED UNITS

- .1 Manufacture units in accordance with CSA-A23.4.
- .2 Mark each precast unit to correspond to identification mark on shop drawings for location with date cast on part of unit not be exposed.
- .3 Provide hardware suitable for handling elements.

2.3 SOURCE QUALITY CONTROL

- .1 Provide Departmental Representative with certified copies of quality control tests related to this project as specified in CSA-A23.4.
- .2 Provide records from in-house quality control programme based upon plant certification requirements to Departmental Representative for inspection and review.
- .3 Upon request, provide Departmental Representative with certified copy of mill test report of reinforcing steel supplied, showing physical and chemical analysis.
- .4 Precast plants should keep complete records of supply source of concrete material, steel reinforcement, prestressing steel and provide to Departmental Representative for review upon request.

Part 3 Execution

3.1 ERECTION

- .1 Do precast concrete work in accordance with CSA-A23.4.
- .2 Do welding in accordance with CSA-W59, for welding to steel structures and CSA-W186, for welding of reinforcement.
- .3 Non-cumulative erection tolerances in accordance with CSA-A23.4.
- .4 Set elevations and alignment between units to within allowable tolerances before connecting units.
- .5 Grout underside of unit bearing plates with shrinkage compensating grout.
- .6 Fasten precast units in place as indicated on [reviewed] [approved] shop drawings.
- .7 Secure with bolts using lockwashers.
- .8 Uniformly tighten bolted connections with torque indicated.
- .9 Do not weld or secure bearing plates at sliding joints.
- .10 Install precast concrete closures between stems of flanged units where indicated.

3.2 VERIFICATION

- .1 Quality Control Plan: ensure concrete supplier meets performance criteria of concrete as established in PART 2 - PRODUCTS, by Departmental Representative and provide verification of compliance as described in PART 1 - QUALITY ASSURANCE.

3.3 CLEANING

- .1 Use cleaning methods as reviewed by Departmental Representative before cleaning soiled precast concrete surfaces.

END OF SECTION

Part 1 GENERAL

1.1 SCOPE

- .1 Remove and replace all vacant stone in accordance with Specifications for entirety of wall along visible side of wall from road.
- .2 Remove and replace top cap, as needed.
- .3 Remove existing luminaire housings and replace with stone.
- .4 Provide shop drawings indicating required structural integration of top cap sealed by engineer registered in the province of British Columbia.
- .5 Condition of wall upon completion shall be considered “as-new” with no vacant stonework, grout, or top cap upon completion.

1.2 RELATED REQUIREMENTS

- .1 Section 02 41 19 – Selective Structure Demolition
- .2 Section 04 05 10 – Common Work Results for Masonry

1.3 ADMINISTRATIVE REQUIREMENTS

- .1 Conduct a pre-dismantling meeting with Departmental Representative to verify project requirements, equipment, procedures and assigned storage areas. Comply with Section 01 31 19.

1.3 QUALITY ASSURANCE

- .1 Quality assurance in accordance with Section Sections 01 45 00 and 04 05 10.
- .2 Qualifications:
 - .1 Mason: in accordance with Section 04 05 10.
 - .2 Site Superintendent: in accordance with Section 04 05 10.
 - .3 Dismantlers:
 - .1 Experience: minimum 3 year record of successful masonry dismantling on projects of similar size and complexity as this project.
- .3 Mock-ups:
 - .1 Construct mock-up in accordance with Sections 01 45 00 and 04 05 10 and as follows:
 - .1 Perform mock-up 1.0 m x 1.0 m to demonstrate dismantling procedures for above grade exterior non-bearing wall masonry condition specified in locations designated by Departmental Representative.
 - .2 Perform mock-up under supervision of Departmental Representative to demonstrate a full understanding of specified procedures and techniques is achieved before work commences.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 and Section 04 05 10.
- .2 Protect and store stones to facilitate their resetting.
 - .1 Store dismantled masonry units on wood platforms or pallets, protected from exposure to water, elements, and potential mechanical damage fully covered under polyethylene.
 - .2 Be responsible and pay costs for crating, transportation and storage of stones off site.
 - .1 Store stone units off site until they are required to be returned to the Site.
- .3 Salvage existing stones for stone repair materials:
 - .1 Stone units designated for replacement are to be selected and used for repair of stone units to remain and as repair materials.
 - .2 Unused salvaged stone units are to be turned over to the Departmental Representative.
- .4 Obtain Departmental Representative's approval before disposing of stone units off site.
- .5 Packaging Waste Management: Separate waste for reuse and recycling and divert unused or damaged stone in accordance with Section 04 05 10.

1.5 SITE CONDITIONS

- .1 Ambient conditions:
 - .1 Loosen wet masonry only when temperature is above 5°C.
 - .2 In temperature 5°C and below:
 - .1 Keep stones dry.
 - .2 Protect wet stones from freezing.
- .2 Existing pointing mortars are assumed to contain substantial quantities of silica and lead classifying it as a hazardous material.

Part 2 PRODUCTS

2.1 NOT USED

- .1 Not Used.

Part 3 EXECUTION

3.1 EXAMINATION

- .1 Examine masonry, staging and storage areas and notify Departmental Representative in writing of conditions detrimental to acceptable and timely completion of Work.

3.2 SITE VERIFICATION OF CONDITIONS

- .1 Report in writing, to Departmental Representative areas of deteriorated stone not identified in the documents. Obtain Departmental Representative's approval and instructions for repair of stone before proceeding.
- .2 Stop work in that area and report to Departmental Representative immediately evidence of hazardous materials.

3.3 PREPARATION

- .1 Obtain Departmental Representative's approval for alternative methodology and tools to be employed before commencing the work.
- .2 Clean stone surface of dust and stone chips.

3.4 PROTECTION

- .1 Prevent damage to building which is to remain. Make good damage incurred.
- .2 Protect surrounding components from damage during work.
- .3 Obtain Departmental Representative's approval for repair methodology.

3.5 SPECIAL TECHNIQUES

- .1 Before dismantling stones, indicate dimensions of each stone in removal area on a drawing and chart or index card.
- .2 Temporary Marking and Recording:
 - .1 Mark stone, on face, before removal using marking product which can be completely erased when required without damaging masonry unit:
 - .1 Ball-point pen on diachylon, attached to stone.
 - .2 Waxless chalk directly on stone.
 - .2 Tracking relocated stones and other masonry units:
 - .1 Use numbering, marking, and positioning system to approval of Departmental Representative.

- .3 Mark/Identify:
 - .1 Stones and other elements or components to show identity and position.
 - .2 Wood platforms or other equipment used to transport and store stones.
 - .3 Work and storage areas.
 - .4 Location from which stones are removed on drawings, photographs and chart or card-index.
- .4 Stone location recording system.
 - .1 Prepare chart or card index to:
 - .1 Help locate stones or units when necessary.
 - .2 To manage availability of platforms.
 - .3 To manage work and storage areas.
 - .2 Keep chart or card index up-to-date and, if required, produce copy every day.
 - .3 Prepare chart or card index to contain relevant information system to approval of Departmental Representative.
- .5 Ensure that temporary marking will remain in use resistant to weather, handling and cleaning until final marking of stones.
- .6 Remove markings and adhesive without damaging units:
 - .1 Brush with vegetable fibre brush: either dry or with water.
 - .2 Use no solvent, acid or other chemical product

3.6 SALVAGE AND REUSE

- .1 Removed stones intended to be replaced must be salvaged. They may be used for repairs if each individual unit meets the following criteria:
 - .1 Sound.
 - .2 Free of salts.
 - .3 Cut to new profile.

3.7 AS DIRECTED BY DEPARTMENTAL REPRESENTATIVE METHOD FOR LOOSENING STONES

- .1 Use approved methods to loosen stones which will cause no damage either to stones or to other architectural elements.
- .2 Use hand tools only.
- .3 Obtain Departmental Representative's approval for use of power tools before commencing work.

3.8 DISMANTLING AND MOVING STONES

- .1 Avoid damaging arises of stone when removing mortar and freeing up.
- .2 Remove excess mortar using hand tools.
- .3 Use wood wedges where required to remove or dislocate stone.
 - .1 Use flat pry bars protected with impact absorbing protection (burlap, cardboard).
- .4 Use nylon hoisting belts. Use minimum 2 belts per stone.
- .5 Protect stone from damage when hoisting and lifting from position.
 - .1 Use wood shims to isolate units from hoisting belts.
- .6 Where damage occurs to stone, report to Departmental Representative and repair stone in accordance with Section 04 03 41.
- .7 Make good damage incurred at no additional cost to Contract.
- .8 Obtain review and approval of repaired damage by Departmental Representative.

3.9 HANDLING

- .1 Usage of Lewis bolts for handling stone is permitted.
- .2 Place detached stones on wood surfaces during handling. Prevent contact with metal.
- .3 When stones are lowered to ground, place directly on wooden platform used for transport or storage.
- .4 Transport and keep stones on wooden platforms.
- .5 Ensure that sharp edges of stones do not come into contact with hard objects.

3.10 TEMPORARY STORAGE STAGING AREA

- .1 Place stones in designated area of site for detailed inspection and for final marking, before storage.
- .2 Make stones accessible and retrievable when required.
- .3 If sufficient area is not available on site based on area designated for storage, arrange and pay for off-site storage of dismantled stone, including all transportation costs associated with moving stone to storage facility and delivery back to site for reinstallation.
 - .1 Ensure sufficient and appropriate protection and packaging of stone to prevent damage to stone during transportation and storage.

3.11 FINAL MARKING

- .1 Do final marking on surface that supports good adhesion and legibility and will not be visible after resetting.
- .2 Do marking in colour. Dimensions: legible from distance of 2 metres.
- .3 Ensure that marking product used will not affect mortar to stone adhesion when resetting.
- .4 Ensure marking product used will survive storage until resetting of stone.

3.12 FINAL STORAGE

- .1 When stones are placed under shelter:
 - .1 Design and ventilate shelter to keep condensation from forming on internal surfaces.
- .2 Lay out storage so that each stone will have its numbered face visible, and be accessible or removable without having to move adjacent stones.

END OF SECTION

Part 1 GENERAL

1.1 SCOPE

- .1 Remove and replace all vacant stone in accordance with Specifications for entirety of wall along visible side of wall from the highway.
- .2 Remove and replace top cap, as needed.
- .3 Remove existing luminaire housings and replace with stone.
- .4 Provide shop drawings indicating required structural integration of top cap sealed by engineer registered in the province of British Columbia.
- .5 Condition of wall upon completion shall be considered “as-new” with no vacant stonework, grout, or top cap completion.

1.2 RELATED REQUIREMENTS

- .1 Section 02 41 19 – Selective Structure Demolition
- .2 Section 04 05 12 – Masonry Mortar and Grout
- .3 Section 04 05 19 – Masonry Anchorage and Reinforcing.

1.3 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CAN/CSA A23.1/A23.2-09, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices For Concrete.
 - .2 CAN/CSA-A371-04(R2014), Masonry Construction for Buildings.
- .2 International Masonry Industry All-Weather Council (IMIAC)
 - .1 Recommended Practices and Guide Specifications for Cold Weather Masonry Construction.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Pre-installation meetings: comply with Section 01 31 19. Conduct pre-installation meeting one week prior to commencing work of this Contract to:
 - .1 Masonry protection, ambient temperature and humidity requirements as well as photographic, record and reporting requirements for masonry.
 - .1 Recording requirements for minimum and maximum temperature and relative humidity (RH) within the work area.
 - .2 Verify project requirements, including mock-up requirements.
 - .1 Review masonry protection, ambient temperature and humidity requirements as well as photographic, record and reporting requirements for masonry.
 - .3 Verify substrate conditions.
 - .4 Co-ordinate products, installation methods and techniques.

- .5 Sequence work of related sections.
- .6 Co-ordinate with other building subtrades.
- .7 Review manufacturer's installation instructions.
- .8 Review masonry cutting operations, methods and tools and determine worker safety and protection from dust during cutting operations.
- .9 Review warranty requirements.
- .2 Sequencing: sequence with other work in accordance with Section 01 32 16. Comply with manufacturer's written recommendations for sequencing construction operations.
- .3 Scheduling: schedule with other work in accordance with Section 01 32 16.

1.5 ACTION SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00.
- .2 Product Data: Provide in accordance with detailed information specified in Related Requirements.
- .3 Samples: Provide in accordance with detailed information specified in Related Requirements.
- .4 Shop Drawings:
 - .1 Where existing masonry becomes laterally unsupported during restoration work, provide shop drawings for temporary bracing, stamped by a Professional Engineer registered in the Province of B.C.
 - .2 Provide other specific shop drawings in accordance with detailed information specified in Related Requirements.
- .6 Masonry Subcontractor Qualifications.
 - .1 Submit resumes of principal stone mason and site superintendent engaged by the Masonry Subcontractor.
 - .2 Any proposed changes to the masonry team must be documented by submitting an updated list as work progresses.

1.5 INFORMATION SUBMITTALS

- .1 Certificates: Provide in accordance with detailed information specified in Related Requirements.
- .2 Test and Evaluation Reports: Provide in accordance with detailed information specified in Related Requirements.
- .3 Installation Instructions: Provide in accordance with detailed information specified in Related Requirements.
- .4 Manufacturer's Reports: Provide in accordance with detailed information specified in Related Requirements.

1.6 QUALITY ASSURANCE

- .1 Quality assurance in accordance with Section Sections 01 45 00.
- .2 Mock-ups:
 - .1 Construct mock-ups in accordance with Section 01 45 00.
 - .2 Notify Departmental Representative minimum of 72 hours prior to construction of the mock-up.
 - .3 Construct mock-ups where directed by Departmental Representative and to demonstrate the following:
 - .1 Stone Repair:
 - .1 Fissure Repairs
 - .2 Deep crack repairs
 - .3 Restoration mortar repair
 - .4 Stone resettling repair
 - .5 In-situ fracture repair
 - .6 Fracture repair, with stone removed
 - .7 Stone Restoration repair
 - .8 Dutchman repair
 - .9 Pin and fill stone consolidation treatment
 - .10 Repair mortar replacement.
 - .2 Sawcutting of joints using power tools, where permitted.
 - .3 Raking out of mortar: 4 lineal metres of each type of stonework including horizontal and vertical joints both above grade and below grade.
 - .4 Repointing: Each type of stonework and mortar type, including junctions at differing stonework and methodology to meet environmental requirements for mortar curing. Location and extents as indicated.
 - .5 Backpointing: Each type of stonework and mortar type, including junctions at differing stonework and methodology to meet environmental requirements for mortar curing. Location and extents as indicated.
 - .6 Cleaning: Each type of stone to level specified in 04 03 06. Illustrate protection of openings in walls, cleaning techniques required representative of full range of soiling or stains. Locations to be determined.
 - .7 Stone: Demonstrate typical laying conditions including: coursing or bond pattern, joints between units, and movement control joints.
 - .8 Conduct Mock-Up demonstrating procedures for loosening and removal of stones. Demonstrate use of each type of connectors and accessories.

- .9 Dismantling procedures: 1.0 m x 1.0 m.
- .5 Allow 72 hours for inspection of mock-ups by Departmental Representative before proceeding with work.
- .6 When accepted by Departmental Representative, mock-up will demonstrate minimum standard for this work. Mock-up may remain as part of finished work.
- .7 Start work only upon receipt of written acceptance of mock-up by Departmental Representative.

1.7 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Storage and Handling Protection:
 - .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
 - .1 Ensure that manufacturer's labels and seals are intact upon delivery.
 - .2 Keep material dry until use. Protect from weather, freezing and contamination.
 - .1 Store cementitious materials and aggregates in accordance with CSA A23.1/A23.2.
 - .3 Remove rejected or contaminated material from site.
 - .4 Store under waterproof cover on pallets or plank platforms held off ground by means of plank or timber skids.
- .3 Packaging Waste Management: Remove for reuse and return by manufacturer of pallets, crates, paddling, and packaging materials in accordance with Section 01 74 20.

1.8 SITE CONDITIONS

- .1 Ambient Conditions: assemble and erect components when temperatures are above 8°C.
- .2 Weather Requirements: to CAN/CSA-A371 and to IMIAC - Recommended Practices and Guide Specifications for Cold Weather Masonry Construction.
- .3 Masonry Repairing and Replacing Stone, Mortaring, Repointing and Cleaning Weather Requirements:
- .4 Cold weather requirements:
 - .1 Supplement Clause 6.7.2 of CAN/CSA-A371 with following requirements.
 - .1 Maintain temperature of mortar between 5°C and 30°C until batch is used or becomes stable.
 - .2 Maintain ambient temperature of masonry work and its constituent materials between 5°C and 30°C and protect site from Windchill.
 - .3 Cover mortar less than 7 days old with tarpaulins when temperature is forecast to fall below 5°C, and insulated tarpaulins when

- temperature is forecast to fall below 0°C.
- .4 Provide heating of masonry work when air temperature falls below -4°C.
- .5 Do not repoint if the temperature is forecast to drop below -7°C in the following 24 hours.
- .6 Maintain temperature of masonry above 0°C for minimum of 7 days, after mortar is installed.
- .7 Preheat unheated wall sections in enclosure above 10°C for minimum 72 hours, before applying mortar.
- .2 Hot weather requirements:
 - .1 Protect freshly laid masonry from drying too rapidly, by means of waterproof, non-staining coverings.
 - .2 Keep masonry dry using waterproof, non-staining coverings that extend over walls and down sides sufficient to protect walls from wind driven rain, until masonry work is completed and protected by flashings or other permanent construction.
- .5 Additional Requirements for Masonry Dismantling Stone, Repairing and Replacing Stone, Stone Mortaring, Repointing and Cleaning Work:
 - .1 Ambient Conditions and Environmental Requirements:
 - .1 When exterior or interior face of building wall temperature is 10 degrees Celsius or less:
 - .1 Store binders, and sands for immediate use within heated enclosure. Allow these materials to reach minimum temperature of 10 degrees Celsius (that is equilibrium with air temperature in enclosure).
 - .2 Heat water to minimum of 20 °C and maximum of 25 °C. At time of use temperature of mortar to be minimum of 10 °C and maximum of 27 °C.
 - .2 Do not mix, Portland cement, hydraulic lime or hydrated lime with water or with sand or with water-sand mixtures having higher temperature than 25 °C.
 - .3 Relative Humidity (RH) must be greater than 50 % within the scaffolding enclosure during installation.
 - .1 Curing conditions for Hydraulic Lime mortar: maintain humidity levels above 80% for a period of seven (7) days. Maintain 50% relative humidity (RH) for an additional period of seven (7) days. Maintain ambient temperature of 15 °C for mortar.
 - .2 Curing conditions for cement, lime, sand mortar: maintain relative humidity levels above 80% for a period of three (3) days, Maintain 50% relative humidity for an additional period of four

(4) days. Maintain ambient temperature of 15 °C for the mortar.

- .4 Prepare and maintain temperature of mortar between 10°C and 27 °C until used.
- .5 Execute work when masonry surface temperature is minimum 15°C and scaffold enclosure temperature is between 10°C and 27 °C and relative humidity exceeds 50%. When masonry surface temperature is below 15°C, cure and heat work as directed by Departmental Representative. Maintain relative humidity of 30%.
- .6 For mortars placed after the first day of the month of August, maintain ambient temperature of mortar at 15°C and relative humidity above 30% until the middle of the month of April of the following year.
- .7 Spray mortar surface at intervals and keep moist for maximum of three days after installation.
- .8 Record minimum and maximum temperature and relative humidity (RH) levels every two hours within the work area.
- .9 Maintain ambient temperature of minimum 10 degrees C after repointing masonry for:
 - .1 Minimum 7 days in summer.
 - .2 Minimum 30 days in cold weather conditions using dry heated enclosures.

1.9 PERFORMANCE

- .1 The following will be considered deficiencies in the work in addition to any failure to meet other provisions of these specifications:
 - .1 Mortar shrinkage cracks between units.
 - .2 Under-filled or unfilled joints.
 - .3 Spalling of units or joints.
 - .4 Failure of anchors of built-in items.
 - .5 Failure to match adjacent work or failure to match mock-up area.
 - .6 Failure to adequately cure the mortar.
 - .7 Dusting, efflorescence of joints or units.
 - .8 Poor colour or texture blending of joints or units.
 - .9 Surface discolouration, discoloration, variance of colour or crumbling of mortar.
 - .10 Sloppy fitting, or otherwise poor workmanship in leveling, bedding or jointing of units.

Part 2 PRODUCTS

2.1 MATERIALS

- .1 Masonry materials are specified elsewhere in Related Requirements.

Part 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 RECORDS AND REPORTS

- .1 Provide masonry conservation documentation and reports of the work in accordance with Section 01 32 00.
- .2 Provide masonry conservation final report containing project record information as specified in Section 01 78 00.

3.3 EXAMINATION

- .1 Examine conditions, substrates and work to receive work specified in Related Requirements.
 - .1 Co-ordinate with Section 01 71 00.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation after unacceptable conditions have been remedied and after receipt of written approval from Departmental Representative.
- .2 Examine openings to receive masonry units. Verify opening size, location, and that opening is square and plumb, and ready to receive work of this Section.
- .3 Verification of Conditions:
 - .1 Verify that:
 - .1 Substrate conditions which have been previously installed under other sections or contracts, are acceptable for product installation in accordance with manufacturer's instructions prior to installation of concrete block or re-installation of dismantled stone masonry.
 - .2 Field conditions are acceptable and are ready to receive work.
 - .3 Built-in items are in proper location, and ready for roughing into masonry work.
 - .2 Commencing installation means acceptance of existing substrates and conditions.
- .4 Site Photographs of Masonry and Conservation:
 - .3 Prior to commencement of surface treatment, document with archival photographic document the work areas in accordance with Section 01 32 00.

3.4 PREPARATION

- .1 Establish and protect lines, levels, and coursing.
- .2 Support:
 - .1 Contractor to submit documents and shop drawings to Departmental Representative for review, demonstrating sequence of removal and re-building including limitations, sequencing and schedule of removal areas, and must provide and construct shoring and temporary framing work to support structure and wall elements during removal and resetting operations, in accordance with approved shop drawings. Drawings to be stamped and signed by a Professional Engineer experienced with masonry structures and registered in Province of B.C. Schedule and sequence of work must account for required adjacent works, wall depth and composition, as well as required curing, setting and hardening time for mortars of other new work.
 - .2 Leave work in safe condition when work is not in progress.
- .3 Protect adjacent materials from damage and disfiguration.
- .4 Provide temporary bracing of masonry work during and after erection until permanent lateral support is in place.
 - .1 Bracing must be approved by Departmental Representative.
 - .2 Brace masonry walls as necessary to resist wind pressure and lateral forces during construction.
- .5 Winter Heating:
 - .1 Maintain ambient humidity levels.
 - .2 The use of open flame to provide heating is forbidden.

3.6 INSTALLATION

- .1 Do masonry work in accordance with CAN/CSA-A371 except where specified otherwise.
- .2 Build masonry plumb, level, and true to line, with vertical joints in alignment, respecting construction tolerances permitted by CAN/CSA-A371.
- .3 Layout coursing and bond to achieve correct coursing heights, and continuity of bond above and below openings, with minimum of cutting.
- .4 Limitations on Work Sequence and Timing:
 - .1 Install the structural steel and anchors only in restored masonry. Restore the back up masonry before mounting the steel frame.
 - .2 Allow for 28-day curing period before coring in the newly restored masonry.
 - .3 Allow for 14-day curing period before coring in masonry within a 3 m radius of newly restored masonry.
 - .4 Restore the stone in vertical order starting from the lower sections.

- .5 Maintain stability of existing wall by implementing the following measures:
 - .1 Limit contiguous dismantled stone areas to three courses in height, unless otherwise approved by the Departmental Representative.
 - .2 Limit stone rebuilding areas to three courses in height per day.
 - .3 Coordinate brick dismantling with rebuilding activities to ensure large areas of brick are not left dismantled for prolonged periods of time.
- .6 Ensure cavity is properly prepared. Remove mortar to expose brick core.
- .7 Thoroughly humidify the core by dampening with water prior to placing mortar.
- .8 Mortar to be placed into bedding location for each stone
- .9 Maintain original joint dimensions/widths.
- .10 Ensure stone is level and plumb.
- .11 Ensure that all new stones are premeasured to fit the exact dimensions in which they will be set.
- .12 Gauge mortars to make certain stone is 100% bedded on all joint sides.
- .13 Ram mortar with thin metal tool in preparation for front pointing.
- .14 Top stone or course of stones of rebuilt area must be thoroughly packed, rammed with mortar to ensure no voids and temporarily shimmed to maintain correct position and alignment.
- .15 Set stones in their natural bedding orientation and in their original orientation (i.e. top up).
- .16 Perform front pointing and mortar repairs after cleaning. Perform Cleaning under Section 04 03 06 after rebuilding and repairs.

3.7 TOP CAP INSTALLATION

- .1 Top cap of masonry wall to be replaced with concrete top cap. Cap to follow 03 30 00 – Cast-In-Place Concrete specification for installation and materials. In locations where Concrete Cap is installed the cap is to be repaired if necessary.
- .2 Masonry on wall to be replaced at minimum height as necessary in order to compensate the installation of the Concrete Top Cap.
- .3 Contractor to submit documents and shop drawings to Departmental Representative for review, demonstrating sequence of removal and re-building including limitations, sequencing and schedule of removal areas, in accordance with approved shop drawings. Drawings to be stamped and signed by a Professional Engineer experienced with masonry structures and registered in Province of B.C. Schedule and sequence of work must account for required adjacent works, wall depth and composition, as well as required curing, setting and hardening time for mortars of other new work.

3.8 SITE TOLERANCES

- .1 Tolerances in notes to CAN/CSA-A371 apply.

3.9 SCAFFOLDING ANCHORAGE

- .1 As each level of work is completed and cured for a minimum periods indicated in 1.8.5 above, remove embedded scaffold anchors.
- .2 Reinstall anchors into new masonry joints adjacent to existing anchorage location, until scaffold removal is required.
- .3 Rake out and repoint joints affected by anchors in accordance with Section 04 03 07.
- .4 Repointed joints must be inspected by Departmental Representative prior to removal of scaffold deck.
- .5 Upon final removal of anchors, repoint the joints where the anchor has been removed. Colour of mortar to match colour of mortar already installed.

3.10 SITE QUALITY CONTROL

- .1 Testing and inspection agency will be appointed by Departmental Representative.
 - .1 Testing on all types of mortars and grouts in the project (grouting, bedding mortar, front pointing mortar and backpointing mortar) shall be carried out by a Testing Laboratory designated by the Departmental Representative and engaged by PWGSC. The laboratory tests shall occur once a week (2 tests on each type of mortar) during the entire grouting and mortaring operations throughout the project on all types of mortars and grouts. The tests shall be done with on-site fresh mixed samples and shall include the compressive strength at 7 days, 28, and 90 days, air entrainment percentage, Vicat cone testing (mortar only) and flexural strength.

3.11 CLEANING

- .1 Progress Cleaning: in accordance with related masonry Sections.
- .2 Final Cleaning:
 - .1 Upon completion of installation and verification of performance of installation, remove surplus materials, rubbish, tools and equipment barriers.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.
 - .1 Remove for reuse and return of pallets, crates, padding and packaging materials.
 - .2 Divert unused or damaged masonry units from landfill.

3.12 PROTECTION

- .1 Cover completed and partially completed work not enclosed or sheltered at end of each work day.
 - .1 Extend membranes 0.5 m beyond surface area of work.
 - .1 Prevent finished work from drying out too rapidly.
- .2 Cover with waterproof tarps to prevent weather from eroding recently repointed material.
 - .1 Maintain tarps in place for minimum of 2 weeks after repointing.
 - .2 Ensure that bottoms of tarps permit airflow to reach mortar in joints.
- .3 Anchor coverings securely in position.
- .4 Protect from drying winds. Pay particular attention at corners. Moisture Protection:
 - .1 Keep masonry dry using waterproof, nonstaining coverings that extend over walls and down sides sufficient to protect walls from wind driven rain, until completed and protected by flashing or other permanent construction.
 - .2 Cover completed and partially completed work not enclosed or sheltered with waterproof covering at end of each work day. Anchor securely in position.
- .5 Ambient Air Temperature and Relative Humid Requirements for Masonry:
 - .1 Provide thermal protection and fabric enclosures to protect completed masonry as recommended in Article 1.8 above.

END OF SECTION

Part 1 GENERAL

1.1 SCOPE

- .1 Remove and replace all vacant stone in accordance with Specifications for entirety of wall along visible side of wall from the highway.
- .2 Remove and replace top cap as needed.
- .3 Remove existing luminaire housings and replace with stone.
- .4 Provide shop drawings indicating required structural integration of top cap sealed by engineer registered in the province of British Columbia.
- .5 Condition of wall upon completion shall be considered “as-new” with no vacant stonework, grout, or top cap completion.

1.2 RELATED REQUIREMENTS

- .1 Section 04 05 10 – Common Work Results for Masonry.
- .2 Section 04 05 19 – Masonry Anchorage and Reinforcing.
- .3 Section 04 22 00 – Concrete Unit Masonry.

1.3 REFERENCES

- .1 CSA Group
 - .1 CSA A23.1-14/A23.2-14, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
 - .2 CSA A179-14, Mortar and Grout for Unit Masonry.
 - .3 CSA A371-14, Masonry Construction for Buildings.
 - .4 CAN/CSA-A3000-13, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
- .2 International Masonry Industry All-Weather Council (IMIAC)
 - .1 Recommended Practices and Guide Specifications for Cold Weather Masonry Construction.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for masonry mortar and grout and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit 2 copies of WHMIS MSDS in accordance with Section 01 35 29 and 01 35 43. Indicate VOC's mortar, grout, parging, colour additives and admixtures. Expressed as grams per litre (g/L).

- .3 Manufacturers' Instructions: submit manufacturer's installation instructions.

1.5 QUALITY ASSURANCE

- .1 Test Reports: submit certified test reports [including sand gradation tests in accordance with CSA A179 showing compliance with specified performance characteristics and physical properties, and in accordance with Section 04 05 10.
- .2 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground, indoors and in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect masonry mortar and grout from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Develop Waste Reduction Workplan related to Work of this Section and in accordance with Section 01 74 20.
- .5 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials as specified in Waste Reduction Workplan in accordance with Section 01 74 20.

1.7 SITE CONDITIONS

- .1 Ambient Conditions: maintain materials and surrounding air temperature to:
 - .1 Minimum 5 degrees C prior to, during, and 48 hours after completion of masonry work.
 - .2 Maximum 32 degrees C prior to, during, and 48 hours after completion of masonry work.
- .2 Weather Requirements: CSA A371 with the following requirements:
 - .1 Cold weather requirements:
 - .1 Maintain temperature of mortar between 5 degrees C and 50 degrees C until batch is used or becomes stable.
 - .2 Maintain ambient temperature of masonry work and its constituent materials between 5 degrees C and 50 degrees C and protect site from windchill.
 - .3 Maintain temperature of masonry above 0 degrees C for minimum

of 3 days, after mortar is installed.

- .4 Preheat unheated wall sections in enclosure for minimum 72 hours above 10 degrees C, before applying mortar.
- .2 Hot weather requirements:
 - .1 Protect freshly laid masonry from drying too rapidly by means of waterproof, non-staining coverings.
 - .2 Keep masonry dry using waterproof, non-staining coverings that extend over walls and down sides sufficient to protect walls from wind driven rain, until masonry work is completed and protected by flashings or other permanent construction.
- .3 Spray mortar surface at intervals and keep moist for maximum of 3 days after installation.

Part 2 PRODUCTS

2.1 MATERIALS

- .1 Use same brands of materials and source of aggregate for entire project.
- .2 Cement:
 - .1 Portland Cement: to CAN/CSA-A3000, Type GU - General use hydraulic cement (Type 10) gray colour.
 - .1 Use low VOC products in compliance with SCAQMD Rule 1168.
 - .2 Masonry Cement: to CAN/CSA-A3002 and CSA A179, Type N.
 - .3 Mortar Cement: to CAN/CSA-A3002 and CSA A179, Type N.
 - .1 Use low VOC products in compliance with SCAQMD Rule 1168.
 - .4 Packaged Dry Combined Materials for mortar: to CSA A179, Type N, using gray colour cement.
- .3 Aggregate: supplied by one supplier.
 - .1 Fine Aggregate: to CSA A179, natural sand.
 - .2 Course Aggregate: to CSA A179.
- .4 Water: clean and potable.
- .5 Lime:
 - .1 Hydrated Lime: to CSA A179, Type S.
- .6 Bonding Agent: latex type.
- .7 Polymer Latex: organic polymer latex admixture of butadiene-styrene type non-emulsifiable bonding admixture.

2.2 MORTAR MIXES

- .1 Mortar for exterior masonry above grade:
 - .1 Load Bearing: S based on property specifications, CSA A179 Table A.1.

- .2 Mortar for Parapet walls: S based on property specifications, CSA A179 Table A.1.
- .3 Parging Mortar: type N to CSA A179.

2.3 MORTAR MIXING

- .1 Use pre-blended, pre-coloured mortar prepackaged under controlled factory conditions. Ingredients batching limitations to be within 1% accuracy.
- .2 Mix mortar ingredients in accordance with CSA A179 in quantities needed for immediate use.
- .3 Maintain sand uniformly damp immediately before mixing process.
- .4 Do not use anti-freeze compounds including calcium chloride or chloride based compounds.
- .5 Do not add air entraining admixture to mortar mix.
- .6 Use a batch type mixer in accordance with CSA A179.
- .7 Re-temper mortar only within two hours of mixing, when water is lost by evaporation.
- .8 Use mortar within 2 hours after mixing at temperatures of 32 degrees C, or 2-1/2 hours at temperatures under 5 degrees C.

2.4 GROUT MIXES

- .1 Grout: Minimum compressive strength of 12.5 MPa at 28 days. Maximum aggregate size and grout slump: CSA A179.

2.5 GROUT MIXING

- .1 Mix grout ingredients in quantities needed for immediate use in accordance with CSA A179 fine grout.
- .2 Add admixtures in accordance with manufacturer's instructions; mix uniformly.
- .3 Do not use calcium chloride or chloride based admixtures.

2.6 MIX TESTS

- .1 Testing Mortar Mix:
 - .1 Test mortar to requirements of Sections 01 45 00 and 04 05 210, and in accordance with CSA A1 79, for mortar based on property specification. Test prior to construction and during construction for:
 - .1 Compressive strength.
 - .2 Consistency.
 - .3 Mortar aggregate ratio.
 - .4 Sand/cement ratio.
 - .5 Water content and water/cement ratio.
 - .6 Air content.
 - .7 Splitting tensile strength.

.2 Testing Grout Mix:

- .1 Test grout to requirements of Section 01 45 00 and in accordance with CSA A179, for grout based on property specification. Test prior to construction and during construction for:
 - .1 Compressive strength.
 - .2 Sand/cement ratio.
 - .3 Water content and water/cement ratio.
 - .4 Slump.

Part 3 EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

- .1 Apply bonding agent to existing concrete surfaces.
- .2 Plug clean-out holes with block masonry units. Brace masonry for wet grout pressure.

3.3 CONSTRUCTION

- .1 Do masonry mortar and grout work in accordance with CSA A179 except where specified otherwise.

3.4 MIXING

- .1 Clean all mixing boards and mechanical mixing machine between batches.
- .2 Mortar must be weaker than the units it is binding.
- .3 Contractor to appoint one individual to mix mortar, for duration of project. In the event that this individual must be changed, mortar mixing must cease until the new individual is trained, and mortar mix is tested.

3.5 MORTAR PLACEMENT

- .1 Install mortar to requirements of CSA A179.
- .2 Remove excess mortar from grout spaces.

3.6 GROUT PLACEMENT

- .1 Install grout in accordance with manufacturer's instructions.
- .2 Install grout in accordance with CSA A179.
- .3 Work grout into masonry cores and cavities to eliminate voids.
- .4 Do not install grout in lifts greater than 400 mm, without consolidating grout by rodding.
- .5 Do not displace reinforcement while placing grout.

3.7 PARGING PLACEMENT

- .1 Parge exterior faces of masonry core walls in multiple coats to a total thickness of 12 mm.
- .2 Dampen wall before applying first coat and scarify first coat to enhance bond of subsequent coat.
- .3 Use a steel trowel finish to produce a smooth, flat, dense surface with a maximum surface variation of 3 mm in 300 mm.
- .4 Damp cure parging and protect parging until cured.

3.8 SITE QUALITY CONTROL

- .1 Testing and inspection agency will be appointed by Departmental Representative and will be paid for in accordance with Section 01 29 83.
- .2 Site Tests, Inspection: in accordance with Section 04 05 10 supplemented as follows:
 - .1 Test and evaluate mortar prior to construction and during construction in accordance with CSA A179.
 - .2 Test and evaluate grout prior to construction and during construction to CSA A179; test in conjunction with masonry unit sections specified.

3.9 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11.
 - .1 Leave Work area clean at end of each day.
- .2 Remove droppings and splashings using clean sponge and water.
- .3 Clean masonry with low pressure clean water and soft natural bristle brush.
- .4 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11.

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- .5 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.
- .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.10 PROTECTION

- .1 Cover completed and partially completed work not enclosed or sheltered with waterproof covering at end of each work day. Anchor securely in position.

END OF SECTION

Part 1 GENERAL

1.1 SCOPE

- .1 Remove and replace all vacant stone in accordance with Specifications for entirety of wall along visible side of wall from the highway.
- .2 Remove and replace top cap, as needed.
- .3 Remove existing luminaire housings and replace with stone.
- .4 Provide shop drawings indicating required structural integration of top cap sealed by engineer registered in the province of British Columbia.
- .5 Condition of wall upon completion shall be considered “as-new” with no vacant stonework, grout, or top cap upon completion.

1.2 RELATED REQUIREMENTS

- .1 Section 04 22 00 Concrete Masonry Units
- .2 Section 05 05 24 Fasteners – Epoxy Adhesive

1.3 REFERENCES

- .1 ASTM International
 - .1 ASTM A36/A36M-14, Standard Specification for Carbon Structural Steel.
 - .2 ASTM A82/A82M-07, Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
 - .3 ASTM A167-99(2009), Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
 - .4 ASTM A307-14, Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60000 PSI Tensile Strength.
 - .5 ASTM A580/A580M-14, Standard Specification for Stainless Steel Wire.
 - .6 ASTM A641/A641M-09a(2014), Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.
 - .7 ASTM A666-15, Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
 - .8 ASTM A1064/A1064M-15, Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
- .2 CSA Group
 - .1 CSA A23.1-14/A23.2-14, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
 - .2 CSA A179-14, Mortar and Grout for Unit Masonry.
 - .3 CSA A370-14, Connectors for Masonry.
 - .4 CSA A371-14, Masonry Construction for Buildings.
 - .5 CSA G30.18-09(R2014), Carbon Steel Bars for Concrete Reinforcement.

- .6 CSA S304.1-14, Design of Masonry Structures.
- .7 CSA W186-M1990(R2012), Welding of Reinforcing Bars in Reinforced Concrete Construction.
- .3 Reinforcing Steel Institute of Canada (RSIC)
 - .1 Reinforcing Steel Manual of Standard Practice, 2004.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for anchorage and reinforcing materials and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of B.C., Canada.
 - .2 Submit drawings detailing bar bending details, anchorage details lists and placement drawings
 - .3 On placement drawings, indicate sizes, spacing, location and quantities of reinforcement and connectors.
- .4 Manufacturers' Instructions: submit manufacturer's installation instructions.

1.5 QUALITY ASSURANCE

- .1 Test Reports: submit certified test reports showing compliance with specified performance characteristics and physical properties, and in accordance with Section 04 05 10.
- .2 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .3 Mock-ups:
 - .1 Construct mock-ups in accordance with Section 01 45 00 and requirements of Section 04 05 10.

1.6 SITE MEASUREMENTS

- .1 Make site measurements necessary to ensure proper fit of members.

1.7 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

- .3 Storage and Handling Requirements:
 - .1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect anchorage and reinforcing materials from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials as specified in Section 01 74 20.

Part 2 PRODUCTS

2.1 DESIGN CRITERIA

- .1 General: design, fabricate stone anchors and ties to withstand normal loads from wind, gravity, movement of building structure, seismic forces and thermally induced movement, as well as to resist deterioration under conditions of normal use including exposure to weather, without failure.
- .2 Design connections and attachments for limestone to CSA A370.
- .3 Design, detail and fabricate connections to provide allowance for fabrication tolerances, erection tolerances and structural deflections. Control of Corrosion: prevent galvanic and other forms of corrosion by insulating metals and other materials from direct contact with non-compatible materials, or by suitable coating.

2.2 MATERIALS

- .1 Bar reinforcement: Steel to CSA A371 and CSA G30.18, Grade 400.
- .2 Connectors: to CSA A370 and CSA S304.1.
- .3 Corrosion protection: to CSA S304.1, galvanized to CSA S304.1 and CSA A370.
- .4 Fasteners: installed post-construction:
 - .1 Bolts and Screws: size and type to suit application, locate where indicated.
 - .2 Adhesives: epoxies, mastics and contact cements for fastening applications, use in accordance with manufacturers' recommendations.
- .5 Masonry Ties: hot dip galvanized to CSA A370 Table 5.2 steel finish.
 - .1 Unit ties, to CSA A370: rectangular, fabricated form wire stainless steel, size to suit application.
 - .2 Adjustable Unit Ties: to CSA A370: proprietary type ties, type, style and size to suit application in accordance with manufacturer's recommendations.
- .6 Masonry Joint Reinforcement: In accordance with to CSA A371 and ASTM A496, with corrosion protection in accordance with CSA S304 and CSA A370, and as follows:
 - .1 Single Wythe Joint Reinforcement: ladder type:
 - .1 Stainless steel conforming to ASTM A580/A580M, Type 304, 4.8 mm side rods with 4.8 mm cross ties.

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- .7 Anchors:
 - .1 Ties and anchors specified in this section shall be designed in accordance with CSA A370 for non-conventional masonry connectors as follows:
 - .1 Deflection: Maximum 2 mm, including free play, when acted upon by a lateral load of 0.45 kN, in all possible positions of adjustment.
 - .2 Positive restraint at position of maximum adjustment.
 - .3 Free play of multi-component ties maximum 1.2 mm when assembled in all possible configurations.
 - .4 Anchors shall allow vertical adjustment but resist tension and compression forces perpendicular to plane of wall.
 - .2 Tie Systems for Stone Masonry Cladding to Concrete Masonry Unit or Steel Stud Substrates: Three Piece Tie System (Rod Adjustable Plate System), comprised as follows:
 - .1 Strap Tie Support: ASTM Type 304 stainless steel anchor consisting of steel plate as follows:
 - .1 Length allowing tie support to span thickness of wall cavity and stone veneer support.
 - .2 Strap Tie Support with Rod: ASTM Type 304 stainless steel anchor consisting of steel plate with threaded rod as indicated on Drawings and as follows:
 - .1 Length allowing tie support to span thickness of wall cavity and stone veneer support.
- .8 Epoxy Adhesive Anchors: As specified in Section 05 05 24.

2.3 FABRICATION

- .1 Fabricate reinforcing in accordance with CSA A23.1/A23.2 and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada.
- .2 Fabricate connectors in accordance with CSA A370.
- .3 Obtain Departmental Representative's approval for locations of reinforcement splices other than shown on placing drawings.
- .4 Upon approval of Departmental Representative, weld reinforcement in accordance with CSA W186.
- .5 Ship reinforcement and connectors, clearly identified in accordance with drawings.

2.4 SOURCE QUALITY CONTROL

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

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Part 3 EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

- .1 Direct and coordinate placement of metal anchors for masonry supplied to other Sections.

3.3 INSTALLATION

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

3.4 BONDING AND TYING

- .1 Install unit, adjustable, single wythe and multiple wythe joint reinforcement where indicated and in accordance with CSA A370 and CSA A371 and manufacturer's instructions.
 - .1 Install horizontal joint reinforcement 200 mm on centre.
 - .2 Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 400 mm each side of opening.
 - .3 Place joint reinforcement continuous in first and second joint below top of walls.
 - .4 Lap joint reinforcement ends minimum 150 mm.
 - .5 Connect stack bonded unit joint corners and intersections with strap anchors 400 mm on centre.

3.5 REINFORCED LINTELS AND BOND BEAMS

- .1 Reinforce masonry beams, masonry lintels and bond beams as indicated.
- .2 Place and grout reinforcement in accordance with CSA S304.1, CSA A371, and CSA A179.
- .3 Support and position reinforcing bars in accordance with CSA A371.

3.6 GROUTING

- .1 Grout masonry in accordance with CSA S304.1, CSA A371 and CSA A179 and as indicated.

3.7 ANCHORS

- .1 Supply and install metal anchors in accordance with CSA A370 and CSA A371 and as indicated.

3.8 LATERAL SUPPORT AND ANCHORAGE

- .1 Supply and install lateral support and anchorage in accordance with CSA S304.1 and as indicated.

3.9 MOVEMENT JOINTS

- .1 Reinforcement will not be continuous across movement joints unless otherwise indicated.

3.10 FIELD BENDING

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

3.11 FIELD QUALITY CONTROL

- .1 Site inspections in accordance with Section 04 05 10.
- .2 Obtain Departmental Representative approval of placement of reinforcement and connectors, prior to placing mortar, grout.

3.12 FIELD TOUCH-UP

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

3.13 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.

END OF SECTION

Part 1 GENERAL

1.1 SCOPE

- .1 Remove and replace all vacant stone in accordance with Specifications for entirety of wall along visible side of wall from the highway.
- .2 Remove and replace top cap, as needed.
- .3 Remove existing luminaire housings and replace with stone.
- .4 Provide shop drawings indicating required structural integration of top cap sealed by engineer registered in the province of British Columbia.
- .5 Condition of wall upon completion shall be considered “as-new” with no vacant stonework, grout, or top cap upon completion.

1.2 RELATED REQUIREMENTS

- .1 Section 04 22 00 – Concrete Unit Masonry

1.3 REFERENCES

- .1 CSA Group
 - .1 CAN/CSA-A371-14, Masonry Construction for Buildings.
 - .2 CAN/CSA-ISO 14021-00(R2009), Environmental Labels and Declarations - Self Declared Environmental Claims (Type II Environmental Labelling).

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for masonry accessories and include product characteristics, performance criteria, physical size, finish and limitations.
- .2 Shop Drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of B.C., Canada.
 - .2 Indicate on drawings:
 - .1 Flashing, installation details, sizes, spacing, location and quantities of fasteners.
- .3 Samples:
 - .1 Submit 2 samples of masonry accessories as follows:
 - .1 Materials:
 - .1 Movement joint filler.
 - .2 Lap adhesive.

- .3 Mechanical fasteners.
- .2 Moisture control material samples, illustrating colour and colour range, size, and shape. Include:
 - .1 Mortar diverters.
 - .2 Grout screens.
- .3 Flashing material samples, illustrating colour and colour range, size, shape, and profile.

1.5 QUALITY ASSURANCE

- .1 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .2 Manufacturer's Instructions: submit manufacturer's instructions as follows:
 - .1 Submit installation instructions for fillers, adhesives, diverters, screens and flashings.

1.6 SITE MEASUREMENTS

- .1 Make site measurements necessary to ensure proper fit of members.

1.7 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect masonry accessories from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: remove for reuse and return of pallets, crates, padding and packaging materials as specified in Waste Reduction Workplan in accordance with Section 01 74 20.

Part 2 PRODUCTS

2.1 MATERIALS

- .1 Movement joint filler: purpose-made elastomer 55 durometer hardness to ASTM D2240 of size and shape indicated.
 - .1 Use low VOC products in compliance with the SCAQMD Rule 1168
 - .2 Material type: closed cell neoprene.
- .2 Lap adhesive: recommended by masonry flashing manufacturer.
- .3 Mechanical fasteners: Stainless steel types recommended by flashing manufacturer to suit project requirements.

2.2 MOISTURE CONTROL

- .1 Grout Screens: 6 mm square monofilament screen is fabricated from high-strength, non-corrosive polypropylene polymers to isolate flow of grout in designated areas.
 - .1 Size: Width to suit block dimensions x 30 m.

2.3 FLASHINGS

- .1 Lead sheet: EN 12588
 - .1 Thickness: 2.65 mm.

2.4 ACCESSORIES

- .1 Underlay /Slip Sheet:
 - .1 For Lead Sheeting: Geotextile underlay, needle punched non-woven polyester minimum weight 210 g/m².
- .2 Cleats:
 - .1 Same material, temper and thickness as sheet metal being secured, minimum 50 mm wide.

Part 3 EXECUTION

3.1 EXAMINATION

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

3.2 INSTALLATION: MATERIALS

- .1 Install continuous movement joint fillers in movement joints at locations indicated on drawings.
- .2 Lap adhesive: apply adhesive to flashing lap joints.
- .3 Mechanical fasteners: install fasteners to suit application and in accordance with manufacturer's written installation instructions.

3.3 INSTALLATION: MOISTURE CONTROL

- .1 Grout screens: install purpose made diverters in cavities where indicated and as directed, size and shape to suit purpose and function.

3.4 INSTALLATION: FLASHINGS

- .1 Build in flashings in masonry in accordance with CAN/CSA-A371.
 - .1 Install flashings under parapet coping stones on composite concrete and stone masonry walls as indicated.
 - .2 Carry flashings from front edge of exterior masonry, under parapet coping stones, then down over roofing membrane, not less than 300 mm.
 - .3 Seal joints with adhesive.
- .2 Form flashing (end dams) at lintels, sills and wall ends to prevent water from travelling horizontally past flashing ends.

3.5 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 GENERAL

1.1 SCOPE

- .1 Remove and replace all vacant stone in accordance with Specifications for entirety of wall along visible side of wall from the highway.
- .2 Remove and replace top cap , as needed.
- .3 Remove existing luminaire housings and replace with stone.
- .4 Provide shop drawings indicating required structural integration of top cap sealed by engineer registered in the province of British Columbia.
- .5 Condition of wall upon completion shall be considered “as-new” with no vacant stonework, grout, or top cap completion.

1.2 RELATED REQUIREMENTS

- .1 Section 04 05 10 - Common Work Results for Masonry.
- .2 Section 04 05 19 - Masonry Anchorage and Reinforcing.

1.3 REFERENCES

- .1 ASTM International
 - .1 ASTM C119-14, Standard Terminology Relating to Dimension Stone.
 - .2 ASTM C568/C568M-10, Standard Specification for Limestone Dimension Stone.
 - .3 ASTM C1242-14a, Standard Guide for Selection, Design, and Installation of Dimension Stone Attachment Systems.
- .2 CSA Group
 - .1 CSA A371-14, Masonry Construction for Buildings.
 - .2 CAN/CSA-A3000-13, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
- .3 International Masonry Industry All-Weather Council (IMIAC)
 - .1 Recommended Practices and Guide Specifications for Cold Weather Masonry Construction.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for quarried stone and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of B.C., Canada.
 - .2 Indicate sizes and sections of stone veneer, arrangements of joints and bonding, anchoring, dowelling and cramping.
 - .3 Each section of stone indicated on shop drawings must bear corresponding number marked on its back or bed.
- .4 Samples:
 - .1 Submit sample for each finish product specified, 2 complete sets representing manufacturer's full range of available colours, textures, and patterns.

1.5 QUALITY ASSURANCE

- .1 Test Reports: submit certified test reports showing compliance with specified performance characteristics and physical properties, and in accordance with Section 04 05 10.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 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 Mark each stone quarry bed or direction of bedding and location of stone on building referenced to submittals. Use concealed permanent markings.
- .4 Storage and Handling Requirements:
 - .1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect quarried stone from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .5 Packaging Waste Management: remove for reuse and return of pallets, crates, padding and packaging material as specified in Waste Reduction Workplan in accordance with Section 01 74 20.

1.7 SITE CONDITIONS

- .1 Ambient Conditions: In accordance with Section 04 05 10.
- .2 Field Measurements:
 - .1 Make site measurements necessary to ensure proper fit of members.

Part 2 PRODUCTS

2.1 DESIGN CRITERIA

- .1 General: design, fabricate and install stonework to withstand normal loads from wind, gravity, movement of building structure, seismic forces and thermally induced movement, as well as to resist deterioration under conditions of normal use including exposure to weather, without failure.
- .2 Design connections and attachments for limestone to CSA A370.
- .3 Design, detail and fabricate connections to provide allowance for fabrication tolerances, erection tolerances and structural deflections.

2.2 MATERIALS

- .1 Limestone: to ASTM C568/C568M, category II - Medium Density; colour and texture to match existing building.
 - .1 Finish: rubbed.

2.3 REINFORCEMENT AND ANCHORAGES

- .1 Anchors, Cramps, Dowels: stainless steel in accordance with Section 04 05 19.

2.4 FLASHING

- .1 Sheet Metal: Lead sheet in accordance with Section 04 05 23.

2.5 ACCESSORIES

- .1 Setting Buttons: lead type; non-staining; sized to suit joint thicknesses and bed depths without intruding into required depths of joint sealants or causing third-side adhesion between sealant and setting button.

2.6 MORTAR MATERIALS

- .1 Mortar: in accordance with Section 04 03 08.

2.7 FABRICATION

- .1 Cut stone to shape and dimensions obtained from measurements and profiles taken from existing stone.
- .2 Cut stone to lay on its natural quarry bed. Lay arch stones at right angles to thrust.
- .3 Dress beds and joints same thickness as existing and at right angles to face.
- .4 Match appearance and profile of existing stone.
- .5 Match finish variations to existing stone and to approval of Departmental Representative.
- .6 Cut stone pieces to within tolerances exhibited by similar existing stones.
- .7 Cut, dress, rub stones to accommodate existing materials and work of other Sections, using methods approved by Departmental Representative.
- .8 Retain and store stone off-cuts for re-use as wall material.
- .9 Dress backs of stone to match original shape and keying into the core of wall.

2.8 FINISHES

- .1 Machine dress exposed surfaces of stone to rubbed finish without tool marks or ridges.
- .2 Machine tool exposed surfaces of stone.

Part 3 EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

- .1 Protect adjacent finished materials from damage due to masonry work.
- .2 Make joints width to match existing.
- .3 Cut-in reglets for flashings where indicated.
- .4 Execute moulded work from full size details. Make exposed arrises in true alignment and ease slightly to prevent snipping.
- .5 Back-check stone contacting structural members as indicated. Allow minimum of 25 mm clearance between back of stone and steel and concrete structural members. Shape beds of stone resting on structural work to fit supports.
- .6 Cut stones for anchors, clamps, dowels and support systems. Provide Lewis pin and clamp holes in pieces which cannot be manually lifted. Do not cut holes in exposed surfaces.

3.3 INSTALLATION/TOLERANCES

- .1 Variation from Plumb: plus or minus 6 mm per 3 metres maximum.
- .2 Variation from Level: plus or minus 13 mm per 6 metres maximum.
- .3 Variation from Linear Building Line: plus or minus 13 mm per 6 metres maximum.
- .4 Variation in Cross-Sectional Dimensions: plus 13 mm or minus 6 mm.

3.4 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11.
 - .1 Leave Work area clean at end of each day.
- .2 At end of each working day, brush off loose mortar from stone face.
- .3 At completion, wash stonework with stiff-fibre brushes and clean water.
- .4 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.5 PROTECTION

- .1 Brace and protect quarried stone veneer cladding in accordance with Section 04 05 10.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 01 45 00 – Quality Control
- .3 Section 01 61 00 – Common Product Requirements
- .4 Section 01 74 11 – Cleaning
- .5 Section 01 74 21 – Construction/Demolition Waste Management and Disposal
- .6 Section 00 21 13 – Instructions to Bidders
- .7 Section 03 10 00 – Concrete Forming and Accessories
- .8 Section 03 20 00 – Concrete Reinforcing
- .9 Section 03 30 00 – Cast-in-Place Concrete

1.2 REFERENCES

- .1 BCBC 2012, “British Columbia Building Code”.
- .2 NBC 2015, “National Building Code”.
- .3 ASTM International
 - .1 ASTM A36/A36M-14, “Standard Specification for Carbon Structural Steel”.
 - .2 ASTM A53/A53M-12, “Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless”.
 - .3 ASTM A108-13, “Standard Specification for Steel Bar, Carbon, and Alloy, Cold-Finished”.
 - .4 ASTM A123/ A123M-15, “Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Product”.
 - .5 ASTM A269/A269M-15a, “Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service”.
 - .6 ASTM A307-14, “Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60,000 psi Tensile Strength”.
 - .7 ASTM A780/780M – 09 (2015), “Standard Specification for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanize Coatings”.
- .4 Canadian General Standards Board (CGSB)
- .5 Canadian Institute of Steel Construction (CISC)/Canadian Paint Manufacturer’s Association (CPMA)
 - .1 CISC/CPMA 1-73a, “Quick-Drying, One-Coat Paint for Use on Structural Steel”.
 - .2 CISC/CPMA 2-75, “Quick-Drying, Primer for Use on Structural Steel”.

- .6 CSA International
 - .1 CAN/CSA-G40.20/G40.21-13, “General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel”.
 - .2 CAN/CSA-S16-14, “Design of Steel Structures”.
 - .3 CAN/CSA-S136-12, “North American Specifications for the Design of Cold-Formed Steel Structural Members”.
 - .4 CSA- W47.1-09 (R2014), “Certification of Companies for Fusion Welding of Steel”.
 - .5 CSA-W48-14, “Filler Metals and Allied Materials for Metal Arc Welding”.
 - .6 CSA-W55.3-08 (R2013), “Certification of Companies for Resistance Welding of Steel and Aluminum”.
 - .7 CSA-W59-13, “Welded Steel Construction (Metal Arc Welding)”.
 - .8 CSA-W178.1-14, “Certification of Welding Inspection Organizations”.
 - .9 CSA-W178.2-14, “Certification of Welding Inspectors”.
 - .10 CSA-W186-M1990 (R2012), “Welding of Reinforcing Bars in Reinforced Concrete Construction”.
- .7 Master Painters Institute
 - .1 MPI-INT 5.1-10, “Structural Steel and Metal Fabrications”.
 - .2 MPI-EXT 5.1-10, “Structural Steel and Metal Fabrications”.
- .8 The Society of Protective Coatings - Steel Structures Painting Council (SSPC), Surface Preparation Standards.
 - .1 SSPC SP3, “Power Tool Cleaning”.
 - .2 SSPC SP6, “Commercial Blast Cleaning”.
- .9 Environmental Choice Program
 - .1 UL 2768 “Architectural Surface Coatings”.
 - .2 UL 2760, “Surface Coatings - Recycled Water-borne”.
- .10 Green Seal Environmental Standards (GS)
 - .1 GS-11-2008, 2nd Edition, Paints and Coatings.
- .11 Health Canada / Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
 - .2 SDS (Safety Data Sheets) per GHS (applicable from Q2 of 2017).
- .12 The Master Painters Institute (MPI)
 - .1 Architectural Painting Specification Manual - current edition.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:

- .1 Submit manufacturer's instructions, printed product literature and data sheets for, plates, tubing, bolts and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Submit drawings in accordance with Section 01 33 00 – Submittal Procedures signed and sealed by professional engineer registered or licensed in Province of British Columbia, Canada.
 - .2 Indicate materials, core thicknesses, finishes, connections, joints, method of anchorage, number of anchors, supports, reinforcement, details, and accessories.
 - .3 Clearly indicate sizes, spacing and locations of all structural members, connections, and cambers.
 - .4 Indicate welded connections using standard welding symbols. Clearly indicate net weld lengths.
 - .5 Clearly show method of torquing bolts on the shop drawings.
 - .6 Indicate all surfaces that are to be galvanized. Specify primer, with colours and number of coats to be used, for each member that has a finish painted surface.
 - .7 Indicate surface preparation on the shop drawings when blast cleaning is called for.
 - .8 Review of the shop drawings by the Departmental Representative is intended as an assistance to the Contractor and does not relieve the Contractor of his or her responsibility for the completeness and accuracy of his or her work and its conformance with the contract drawings and specifications.
 - .9 Fabrication that commences prior to shop drawing review by the Departmental Representative is at the risk of the Contractor.

1.4 QUALITY ASSURANCE

- .1 The Contractor's professional engineer responsible for the design of connections and other components is to inspect the fabrication and erection of these components in accordance with APEGBC "Guidelines for Professional Structural Engineering Services for Part 3 Building Projects" dated February 2011. Supporting Registered Professional Schedules S-B and S-C shall be submitted in accordance with APEGBC "Practice Note 16: Professional Design and Field Review by Supporting Registered Professionals" dated September 2010. "
- .2 Test Reports: submit certified test reports showing compliance with specified performance characteristics and physical properties.
- .3 Certifications: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.5 DELIVERY, STORAGE AND HANDLING

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

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

1.6 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal
- .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .3 Divert unused metal materials from landfill to metal recycling facility approved by Departmental Representative.
- .4 Divert unused paint material from landfill to official hazardous material collections site approved by Departmental Representative.
- .5 Do not dispose of unused paint materials into sewer systems, into lakes, streams, onto ground, or in other location where it will pose health or environmental hazard.

1.7 INSPECTION AND TESTING

- .1 Materials and workmanship are to be subject to inspection and testing by an inspection and testing firm certified in accordance with CSA-W178.1, retained and paid for by the Contractor and approved by the Departmental Representative in accordance with Section 01 45 00 of these specifications.
- .2 Provide access for inspection to all places where work is being done or stockpiled prior to shipment.
- .3 Inspection and testing firm to test 1 in 10 welds. Testing of welds to include visual examination of all welding procedures, at the plant and in the field, plus magnetic particle, x-ray, or other means deemed necessary by the testing agency to permit certification of welds. However a visual inspection of all welds is required.
- .4 The Departmental Representative may request additional testing of welds to ascertain the full amount of defects if the test noted above indicates excessive deficiencies. Additional costs for extra testing to be borne by the Contractor.
- .5 Inspection and testing firm to inspect surface preparation and cleaning for painted and galvanized steel.
- .6 Inspection and testing firm to inspect and verify one coat paint, primer, zinc coat, and galvanizing thickness.
- .7 Pay for all costs for re-testing and re-inspection as a result of defective workmanship.
- .8 Pay for all costs of repairs to correct defective work.
- .9 Inspection and testing firm to submit to the Departmental Representative a final report certifying all welds and connections, including confirmation that required repairs have

been completed. This report to be submitted under the seal and signature of a professional structural engineer registered in the Province of British Columbia.

- .10 Notify Departmental Representative and inspection and testing firm 48 hours prior to commencement of shop work for all testing and inspection.

1.8 ACCEPTABILITY

- .1 Pay all costs for additional testing, inspection and analysis required to demonstrate the adequacy of a structure that does not meet the requirements of the contract documents.
- .2 Reinforce by additional construction or replace as directed by the Departmental Representative at Contractor's expense all structure or material judged inadequate by structural analysis or by testing and inspection.

1.9 PAYMENT

- .1 Payment for the work in this section shall be on a lump sum basis as tendered which shall be full compensation for all labour, materials, and equipment necessary to complete the work, including all subsidiary and incidental items thereto for which separate payment is not elsewhere provided.

Part 2 Products

2.1 MATERIALS

- .1 Structural steel members and plates: To CAN/CSA-G40.21 of Type W weldable steel. The minimum yield strength is 350 MPa for hollow structural steel members and wide flange sections, and 300 MPa for other rolled sections and plates.
- .2 Structural steel angles with 80 mm legs or less: To CAN/CSA-G40.21 of Type W weldable steel. The minimum yield strength is 300 MPa.
- .3 Bolts and required nuts and washers: High strength type recommended for structural steel joints to ASTM A325, medium-carbon steel. Nuts for galvanized bolts to be A563 Grade DH or A194 Grade 2H.
- .4 Steel pipe: to ASTM A53/A53M extra strong or double extra strong, galvanized finish.
- .5 Shear stud connections: Headed concrete anchors conforming to ASTM A108.
- .6 Anchor bolts: To ASTM A307 unless otherwise indicated on the drawings.
- .7 Grout: non-shrink, non-metallic, flowable, 15 MPa at 24 hours.
- .8 Welding materials: to CSA W59.
- .9 Welding electrodes: to CSA W48 Series.

2.2 FABRICATION

- .1 Notify Departmental Representative and inspection and testing firm a minimum of 48 hours prior to fabricating steel to allow for inspection.

- .2 Fabricate steel in accordance with CAN/CSA-S16, CAN/CSA-S136, the drawings and specifications, and the reviewed shop drawings.
- .3 Where work of other Sections is to be attached to work of this Section, prepare work by drilling and tapping holes as required to facilitate installation of such work.
- .4 Work of this Section, supplied for installation under other Sections, shall be prepared as required ready for installation.
- .5 Verify dimensions of existing work prior to commencing fabrication.
- .6 Verify all drawing dimensions and conditions prior to commencing fabrication.
- .7 Welding to conform to the requirements of CSA W59. Do not splice materials without the written consent of the Departmental Representative. Where granted, a 100% X-ray inspection, paid for by the Contractor, will be mandatory. Show all splices on the shop drawings.
- .8 Accurately cut and mill bearing plates to assure full contact of bearing surfaces prior to welding.
- .9 Seal all hollow structural sections with suitable cap plates or by welding all around adjoining members.
- .10 Grind all welds smooth, and grind all groove welds flush on exposed steel.
- .11 Do not place any unspecified holes or openings in steel members without the written approval of the Departmental Representative. Where approval is granted, provide reinforcing plates around all openings to maintain design strength.
- .12 Weld reinforcement where indicated. Weld in accordance with applicable requirements of CSA W186. Do not weld reinforcing at any location without written approval of the Departmental Representative.
- .13 Weld shear stud connectors in strict accordance with manufacturer's instructions by electrical resistance only.
- .14 Fabricate work square, true, straight and accurate to required size, with joints closely fitted and properly secured.
- .15 Where possible, fit and shop assemble work, ready for erection.

2.3 FINISHES

- .1 Galvanizing: hot dipped galvanizing with zinc coating 100microns to ASTM A53 / A53M-12.
- .2 Zinc primer:
 - .1 Exterior: zinc rich, ready mix to MPI-EXT 5.3L.
- .3 Make good corrosive protection after welding where burnt by welding operations and where removed to facilitate welding operations, using 2 coats of zinc rich touch-up primer conforming to CAN/CGSB-1.181-99 PIPE RAILINGS

- .4 Steel pipe: DN40x9.56 XXS OR DN50x5.54 XS Posts and Guardrail with DN32x4.85 XS Railings. DN40 to be 48.3 mm nominal outside diameter, DN 50 to be 60.3mm Outside Diameter, formed to shapes and sizes as indicated.
- .5 Galvanize exterior pipe railings after fabrication.

Part 3 Execution

3.1 EXAMINATION

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

3.2 ERECTION

- .1 Do welding work in accordance with CSA W59 unless specified otherwise.
- .2 Erect metalwork square, plumb, straight, and true, accurately fitted, with tight joints and intersections.
- .3 Provide suitable means of anchorage acceptable to Departmental Representative such as dowels, anchor clips, bar anchors, expansion bolts and shields, and toggles.
- .4 Exposed fastening devices to match finish and be compatible with material through which they pass.
- .5 Supply components for work by other trades in accordance with shop drawings and schedule.
- .6 Weld field connection.
- .7 Deliver items over for casting into concrete and building into masonry together with setting templates to appropriate location and construction personnel.
- .8 Touch-up rivets, field welds, bolts and burnt or scratched surfaces with 2 coats of zinc rich primer after completion
- .9 Touch-up galvanized surfaces with 2 coats of zinc rich primer where burned by field welding.

3.3 PIPE RAILINGS

- .1 Install pipe railings as indicated.
- .2 Set railing standards in concrete using embed plates. [Grout to fill hole. Trowel surface smooth and flush with adjacent surfaces].

3.4 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

3.5 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by metal fabrications installation.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Definitions:
 - .1 Electrical and electronic terms: unless otherwise specified or indicated, terms used in these specifications, and on drawings, are those defined by IEEE SP1122.
- .2 Reference Standards:
 - .1 CSA Group
 - .1 CSA C22.1-15, Canadian Electrical Code, Part 1 (23rd Edition), Safety Standard for Electrical Installations.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for equipment and devices and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in British Columbia, Canada.
 - .2 Submit wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, accessories, and other items that must be shown to ensure co-ordinated installation.
 - .3 Submit 3 number of copies of [600 x 600] mm minimum size drawings and product data to authority having jurisdiction.
 - .4 If changes are required, notify Departmental Representative of these changes before they are made.
- .4 Certificates:
 - .1 Provide CSA certified equipment, and/or material.
 - .2 Where CSA certified equipment or material is not available, submit such equipment or material to inspection authorities for special approval before delivery to site.
 - .3 Submit test results of installed electrical systems and instrumentation.
 - .4 Permits and fees: in accordance with General Conditions of contract.
 - .5 Submit, upon completion of Work, load balance report as described in PART 3 - LOAD BALANCE.

- .6 Submit certificate of acceptance from authority having jurisdiction upon completion of Work to Departmental Representative.
- .5 Manufacturer's Field Reports: submit to Departmental Representative manufacturer's written report, within [3] days of review, verifying compliance of Work [and electrical system and instrumentation testing], as described in PART 3 - FIELD QUALITY CONTROL.
- .6 Sustainable Design Submittals:
 - .1 Construction Waste Management:
 - .1 Submit project Waste Management Plan highlighting recycling requirements.
 - .2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating that 75% of construction wastes were recycled or salvaged.

1.3 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for project for incorporation into manual.
 - .1 Provide for each system and principal item of equipment as specified in technical sections for use by operation and maintenance personnel.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect equipment and materials from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan related to Work of this Section.
- .5 Packaging Waste Management: remove and return of pallets, crates, padding, packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 DESIGN REQUIREMENTS

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

2.2 MATERIALS AND EQUIPMENT

- .1 Provide material and equipment in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Material or equipment to be CSA certified. Where CSA certified material or equipment are not available, obtain special approval from authority having jurisdiction before delivery to site and submit such approval as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
- .3 Factory assemble control panels and component assemblies.

2.3 WARNING SIGNS

- .1 Warning Signs: in accordance with requirements of Departmental Representative.
- .2 Signs, minimum size [175 x 250 mm].

2.4 WIRING TERMINATIONS

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

2.5 EQUIPMENT IDENTIFICATION

- .1 Identify electrical equipment with labels as follows:
 - .1 Nameplates: lamicoid [3] mm thick plastic engraving sheet] [matt white finish face, black core, lettering accurately aligned and engraved into core mechanically attached with self- tapping screws.
 - .2 Sizes as follows:

NAMEPLATE SIZES			
Size 1	10 x 50 mm	1 line	3 mm high letters
Size 2	12 x 70 mm	1 line	5 mm high letters
Size 3	12 x 70 mm	2 lines	3 mm high letters

Size 4	20 x 90 mm	1 line	8 mm high letters
Size 5	20 x 90 mm	2 lines	5 mm high letters
Size 6	25 x 100 mm	1 line	12 mm high letters
Size 7	25 x 100 mm	2 lines	6 mm high letters

- .2 Labels: embossed plastic labels with [6] mm high letters unless specified otherwise.
- .3 Wording on labels to be approved by Departmental Representative prior to manufacture.
- .4 Allow for minimum of twenty-five (25) letters per label.
- .5 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.
- .6 Identify equipment with Size 3 labels engraved "ASSET INVENTORY NO. [____]" as directed by Departmental Representative
- .7 Disconnects, starters and contactors: indicate equipment being controlled and voltage.
- .8 Terminal cabinets and pull boxes: indicate system and voltage.

2.6 WIRING IDENTIFICATION

- .1 Identify wiring with permanent indelible identifying markings, [numbered] [coloured plastic tapes], on both ends of phase conductors of feeders and branch circuit wiring.
- .2 Maintain phase sequence and colour coding throughout.
- .3 Colour coding: to CSA C22.1.

2.7 CONDUIT AND CABLE IDENTIFICATION

- .1 Colour code conduits, boxes and metallic sheathed cables.
- .2 Colours: 25 mm wide prime colour and 20 mm wide auxiliary colour.

Prime	Auxiliary	
up to 250 V	Yellow	
up to 600 V	Yellow	Green
Communication Systems	Green	Blue

2.8 FINISHES

- .1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.
 - .1 Paint outdoor electrical equipment "equipment green" finish.

Part 3 Execution

3.1 EXAMINATION

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

3.2 INSTALLATION

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

3.3 NAMEPLATES AND LABELS

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

3.4 CONDUIT AND CABLE INSTALLATION

- .1 Install conduit and sleeves prior to pouring of concrete.
 - .1 Sleeves through concrete: sized for free passage of conduit, and/or Teck 90 cable and protruding 50 mm.

3.5 FIELD QUALITY CONTROL

- .1 Load Balance:
 - .1 Measure phase current to panelboards with normal loads (lighting) operating at time of acceptance; adjust branch circuit connections as required to obtain best balance of current between phases and record changes.
 - .2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.
 - .3 Provide upon completion of work, load balance report as directed in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS, phase and neutral currents on panelboards, operating under normal load, as well as hour and date on which each load was measured, and voltage at time of test.
- .2 Conduct following tests in accordance with Section 01 45 00 - Quality Control.

- .1 Power distribution system including phasing, voltage, grounding and load balancing.
- .2 Circuits originating from branch distribution panels.
- .3 Lighting and its control.
- .4 Insulation resistance testing:
 - .1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.
 - .2 Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument.
 - .3 Check resistance to ground before energizing.
- .3 Carry out tests in presence of Departmental Representative.
- .4 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.
- .5 Manufacturer's Field Services:
 - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
 - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

3.6 SYSTEM STARTUP

- .1 Instruct Departmental Representative in operation, care and maintenance of systems, system equipment and components.
- .2 Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components and instruct operating personnel.
- .3 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with aspects of its care and operation.

3.7 CLEANING

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

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

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 CSA International
 - .1 CAN/CSA-C22.2 No.18-[98(R2003)], Outlet Boxes, Conduit Boxes and Fittings.
 - .2 CAN/CSA-C22.2 No.65-[03(R2008)], Wire Connectors (Tri-National Standard with UL 486A-486B and NMX-J-543-ANCE-03).
- .2 Electrical and Electronic Manufacturers' Association of Canada (EEMAC)
 - .1 EEMAC 1Y-2-[1961], Bushing Stud Connectors and Aluminum Adapters (1200 Ampere Maximum Rating).
- .3 National Electrical Manufacturers Association (NEMA)

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for wire and box connectors and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Sustainable Design Submittals:
 - .1 Construction Waste Management:
 - .1 Submit project Waste Management Plan highlighting recycling requirements.
 - .2 Submit calculations on end-of-project recycling rates, and landfill rates demonstrating that 75% of construction wastes were recycled or salvaged.

1.3 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for wire and box connectors for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements with manufacturer's written instructions.
- .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 indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
- .2 Store and protect wire and box connectors from nicks, scratches, and blemishes.
- .3 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan related to Work of this Section.
- .5 Packaging Waste Management: remove for reuse and return of pallets, crates, padding, packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 MATERIALS

- .1 Pressure type wire connectors to: [CAN/CSA-C22.2 No.65], with current carrying parts of copper, or copper alloy, or aluminum sized to fit copper or aluminum conductors as required.
- .2 Fixture type splicing connectors to: [CAN/CSA-C22.2 No.65], with current carrying parts of copper, copper alloy sized to fit copper conductors 10 AWG or less.
- .3 Bushing stud connectors: to EEMAC 1Y-2 to consist of:
 - .1 Connector body and stud clamp for copper, or aluminum conductors.
 - .2 Clamp for stranded copper conductors.
 - .3 Clamp for stranded aluminum, or ACSR conductors.
 - .4 Stud clamp bolts.
 - .5 Bolts for copper conductors.
 - .6 Bolts for aluminum conductors.
 - .7 Sized for conductors as indicated.
- .4 Clamps or connectors for armoured cable, or TECK cable as required to: CAN/CSA-C22.2 No.18.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for wire and box connector's installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

- .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

- .1 Remove insulation carefully from ends of conductors and/or cables and:
 - .1 Apply coat of zinc joint compound on aluminum conductors prior to installation of connectors.
 - .2 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CAN/CSA-C22.2 No.65.
 - .3 Install fixture type connectors and tighten to [CAN/CSA-C22.2 No.65]. Replace insulating cap.
 - .4 Install bushing stud connectors in accordance with EEMAC 1Y-2.

3.3 CLEANING

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

END OF SECTION

Part 1 General

1.1 PRODUCT DATA

- .1 Provide product data in accordance with Section 01 33 00 - Submittal Procedures.

1.2 DELIVERY, STORAGE AND HANDLING

- .1 Packaging Waste Management: remove for reuse and return of pallets, crates, padding, packaging materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 BUILDING WIRES

- .1 Conductors: stranded for [10] AWG and larger. Minimum size: [12] AWG.
- .2 Copper conductors: size as indicated, with 600 V insulation of cross-linked thermosetting polyethylene material rated RW90 XLPE.
- .3 Copper conductors: size as indicated, with thermoplastic insulation type TWH T90 Nylon rated at 600 V.
- .4 Neutral supported cable 3 phase insulated conductors of Copper and one neutral conductor of Copper steel reinforced, size as indicated. Type: NS90 Insulation: Type NS-1 rated 300 V or Type NSF-2 flame retardant rated 600 V, as indicated.

2.2 TECK 90 CABLE

- .1 Conductors:
 - .1 Grounding conductor: copper.
 - .2 Circuit conductors: copper.
- .2 Insulation:
 - .1 Cross-linked polyethylene XLPE.
 - .2 Rating: 1000 V.
- .3 Inner jacket: polyvinyl chloride material.
- .4 Armour: Interlocking galvanized steel
- .5 Overall covering: thermoplastic polyvinyl chloride, compliant to applicable Building Code classification for this project.
- .6 Fastenings:
 - .1 One hole steel or aluminum straps to secure surface cables 50 mm and smaller. Two hole steel straps for cables larger than 50 mm.

- .2 Threaded rods: 6 mm diameter to support suspended channels.
- .7 Connectors:
 - .1 Watertight, approved for TECK cable.

Part 3 Execution

3.1 FIELD QUALITY CONTROL

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

3.2 GENERAL CABLE INSTALLATION

- .1 Install cable in trenches in accordance with Section 26 05 43.01 – Installation of Cables in Trenches and in Ducts.
- .2 Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors - (0-1000 V).
- .3 Cable Colour Coding: to Section 26 05 00 - Common Work Results for Electrical.
- .4 Conductor length for parallel feeders to be identical.
- .5 Lace or clip groups of feeder cables at distribution centres, pull boxes, and termination points.
- .6 Provide numbered wire collars for control wiring. Numbers to correspond to control shop drawing legend. Obtain wiring diagram for control wiring.

3.3 INSTALLATION OF BUILDING WIRES

- .1 Install wiring as follows:
 - .1 In conduit systems in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

3.4 INSTALLATION OF TECK90 CABLE (0 -1000 V)

- .1 Group cables wherever possible on channels.
- .2 Install cable exposed, securely supported by staples or hangers.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 CSA Group
 - .1 CSA C22.1-[12], Canadian Electrical Code, Part 1 (23RD Edition), Safety Standard for Electrical Installations.
 - .2 CSA C22.2 No.41-[13], Grounding and Bonding Equipment (Tri-National Standard, with NMX-J-590ANCE and UL 467).
 - .3 CSA C22.2 No.65-[13], Wire connectors (Tri-National Standard, with UL 486A-486B NMX-J-543-ANCE).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for connectors and terminations and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Certificates: obtain inspection certificate of compliance covering high voltage stress from Departmental Representative and include it with as-built drawings.
- .4 Sustainable Design Submittals:
 - .1 Construction Waste Management:
 - .1 Submit project Waste Management Plan highlighting recycling requirements.
 - .2 Submit calculations on end-of-project recycling rates, and landfill rates demonstrating that 75% of construction wastes were recycled or salvaged.

1.3 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for connectors and terminations for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:

- .1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
- .2 Store and protect connectors and terminations from nicks, scratches, and blemishes.
- .3 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: remove for reuse and return of pallets, crates, padding, packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 CONNECTORS AND TERMINATIONS

- .1 Copper or Aluminum long barrel compression connectors to [CSA C22.2 No.65] as required sized for conductors.
- .2 Contact aid for aluminum cables where applicable.

Part 3 Execution

3.1 EXAMINATION

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

3.2 INSTALLATION

- .1 Install stress cones, terminations, and splices in accordance with manufacturer's instructions.
- .2 Bond and ground as required to CSA C22.2No.41.

3.3 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

- .3 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 26 05 00.

1.2 REFERENCES

- .1 American National Standards Institute /Institute of Electrical and Electronics Engineers (ANSI/IEEE)
 - .1 ANSI/IEEE 837-[02], IEEE Standard for Qualifying Permanent Connections Used in Substation Grounding.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Sustainable Design Submittals:
 - .1 Construction Waste Management:
 - .1 Submit project Waste Management Plan highlighting recycling and salvage requirements.
 - .2 Submit calculations on end-of-project recycling rates, and landfill rates demonstrating that 75% of construction wastes were recycled.

1.4 CLOSEOUT SUBMITTALS

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

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect grounding equipment from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan related to Work of this Section.
- .5 Packaging Waste Management: remove for reuse and return of pallets, crates, padding, packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 EQUIPMENT

- .1 Clamps for grounding of conductor: size as required to electrically conductive underground water pipe.
- .2 Rod electrodes: copper clad steel 19 mm diameter by minimum 3 m long.
- .3 Grounding conductors: bare stranded copper, tinned, soft annealed, size [as indicated].
- .4 Insulated grounding conductors: green, copper conductors, size [as indicated].
- .5 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:
 - .1 Grounding and bonding bushings.
 - .2 Protective type clamps.
 - .3 Bolted type conductor connectors.
 - .4 Thermit welded type conductor connectors.
 - .5 Bonding jumpers, straps.
 - .6 Pressure wire connectors.

Part 3 Execution

3.1 EXAMINATION

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

3.2 INSTALLATION GENERAL

- .1 Install complete permanent, continuous grounding system including, electrodes, conductors, connectors, accessories. [Where EMT is used, run ground wire in conduit.]
- .2 Install connectors in accordance with manufacturer's instructions.
- .3 Protect exposed grounding conductors from mechanical injury.
- .4 Use mechanical connectors for grounding connections to equipment provided with lugs.
- .5 Soldered joints not permitted.
- .6 Install separate ground conductor to outdoor lighting standards.

- .7 Bond single conductor, metallic armoured cables to cabinet at supply end, and provide non-metallic entry plate at load end.
- .8 Ground secondary service pedestals.

3.3 ELECTRODES

- .1 Install rod, electrodes and make grounding connections as indicated.
- .2 Bond separate, multiple electrodes together.
- .3 Use size copper conductors for connections to electrodes, as indicated.
- .4 Make special provision for installing electrodes that will give [acceptable] resistance to ground value where rock or sand terrain prevails. Ground as indicated.

3.4 SYSTEM AND CIRCUIT GROUNDING

- .1 Install system and circuit grounding connections to neutral of 600 V system,

3.5 EQUIPMENT GROUNDING

- .1 Install grounding connections to typical equipment included in, but not necessarily limited to following list. Service equipment, transformers, distribution panels, outdoor lighting.

3.6 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of Departmental Representative local authority having jurisdiction over installation.
- .3 Perform tests before energizing electrical system.
- .4 Disconnect ground fault indicator during tests.

3.7 CLEANING

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

END OF SECTION

Part 1 General

1.1 REFERENCES

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for hangers and supports and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Sustainable Design Submittals:
 - .1 Construction Waste Management:
 - .1 Submit project Waste Management Plan highlighting recycling and salvage requirements.
 - .2 Submit calculations on end-of-project recycling rates, and landfill rates demonstrating that 75% of construction wastes were recycled.

1.3 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect hangers and supports from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan related to Work of this Section
- .5 Packaging Waste Management: remove for reuse and return of pallets, crates, padding, packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Not used

Part 3 Execution

3.1 EXAMINATION

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

3.2 INSTALLATION

- .1 Secure equipment to poured concrete with expandable inserts.
- .2 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.
- .3 Fasten exposed conduit or cables to building construction or support system using straps.
 - .1 One-hole steel straps to secure surface conduits and cables 50 mm and smaller.
 - .2 Two-hole steel straps for conduits and cables larger than 50 mm.
 - .3 Beam clamps to secure conduit to exposed steel work.
- .4 Suspended support systems.
 - .1 Support individual cable or conduit runs with 6 mm diameter threaded rods and spring clips.
 - .2 Support 2 or more cables or conduits on channels supported by 6 mm diameter threaded rod hangers where direct fastening to building construction is impractical.
- .5 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.
- .6 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.
- .7 Do not use wire lashing or perforated strap to support or secure raceways or cables.
- .8 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Departmental Representative
- .9 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

3.3 CLEANING

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

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA C22.1-[15], Canadian Electrical Code, Part 1, 23rd Edition.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Provide shop drawings: in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Provide drawings stamped and signed by professional engineer registered or licensed in British Columbia, Province of Canada.

1.3 DELIVERY, STORAGE AND HANDLING

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

Part 2 Products

2.1 JUNCTION AND PULL BOXES

- .1 Construction: welded steel enclosure.
- .2 Covers Flush Mounted: 25 mm minimum extension all around.
- .3 Covers Surface Mounted: screw-on flat covers.

2.2 CABINETS

- .1 Construction: as indicated, hinged door, handle, latch, lock 2 keys and catch.
- .2 Type T Terminal: as indicated containing sheet steel backboard.

Part 3 Execution

3.1 JUNCTION, PULL BOXES AND CABINETS INSTALLATION

- .1 Install pull boxes in inconspicuous but accessible locations.

- .2 Mount cabinets with top not higher than 2 m above finished floor except where indicated otherwise.
- .3 Install as indicated in Type T cabinets.
- .4 Only main junction and pull boxes are indicated. Install additional pull boxes as required by CSA C22.1.

3.2 IDENTIFICATION

- .1 Equipment Identification: to Section 26 05 00 - Common Work Results for Electrical.
- .2 Identification Labels: Lamacoid labels , size 2 indicating system name, voltage and phase or as indicated.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA C22.1-[15], Canadian Electrical Code, Part 1, 23rd Edition.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.

1.3 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Waste Management and Disposal:
 - .1 Separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 OUTLET AND CONDUIT BOXES GENERAL

- .1 Size boxes in accordance with CSA C22.1.
- .2 102 mm square or larger outlet boxes as required.

2.2 GALVANIZED STEEL OUTLET BOXES

- .1 One-piece electro-galvanized construction.
- .2 Single and/or multi gang flush device boxes for flush installation, minimum size 76 x 50 x 38 mm or as indicated. 102 mm square outlet boxes when more than one conduit enters one side with extension and plaster rings as required.

2.3 CONDUIT BOXES

- .1 Cast FS, FD or aluminum boxes with factory-threaded hubs and mounting feet for surface wiring of devices.

2.4 OUTLET BOXES FOR NON-METALLIC SHEATHED CABLE

- .1 Electro-galvanized, sectional, screw ganging steel boxes, minimum size [76 x 50 x 63] mm with two double clamps to take non-metallic sheathed cables.

2.5 FITTINGS - GENERAL

- .1 Bushing and connectors with nylon insulated throats.

- .2 Knock-out fillers to prevent entry of debris.
- .3 Conduit outlet bodies for conduit up to 35mm and pull boxes for larger conduits.
- .4 Double locknuts and insulated bushings on sheet metal boxes.

Part 3 Execution

3.1 INSTALLATION

- .1 Support boxes independently of connecting conduits.
- .2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.
- .3 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.
- .4 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Do not install reducing washers.
- .5 Vacuum clean interior of outlet boxes before installation of wiring devices.
- .6 Identify systems for outlet boxes as required.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CAN/CSA C22.2 No. 18-[98(R2003)], Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware, A National Standard of Canada.
 - .2 CSA C22.2 No. 45-[M1981(R2003)], Rigid Metal Conduit.
 - .3 CSA C22.2 No. 56-[04], Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
 - .4 CSA C22.2 No. 211.2-[M1984(R2003)], Rigid PVC (Unplasticized) Conduit.
 - .5 CAN/CSA C22.2 No. 227.3-[05], Nonmetallic Mechanical Protection Tubing (NMPT), A National Standard of Canada (February 2006).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product data: submit manufacturer's printed product literature, specifications and datasheets.
 - .1 Submit cable manufacturing data.
- .3 Quality assurance submittals:
 - .1 Test reports: submit certified test reports.
 - .2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .3 Instructions: submit manufacturer's installation instructions.

1.3 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .2 Place materials defined as hazardous or toxic waste in designated containers.
- .3 Ensure emptied containers are sealed and stored safely for disposal away from children.

Part 2 Products

2.1 CABLES AND REELS

- .1 Provide cables on reels or coils.
 - .1 Mark or tag each cable and outside of each reel or coil, to indicate cable length, voltage rating, conductor size, and manufacturer's lot number and reel number.

- .2 Each coil or reel of cable to contain only one continuous cable without splices.
- .3 Identify cables for exclusively dc applications.

2.2 CONDUITS

- .1 HDPE conduit: to UL 651B
- .2 Rigid metal conduit: to CSA C22.2 No. 45, galvanized steel or hot dipped galvanized steel, or aluminum threaded.
- .3 Epoxy coated conduit: to CSA C22.2 No. 45, with zinc coating and corrosion resistant epoxy finish inside and outside.
- .4 Rigid PVC conduit: to CSA C22.2 No. 211.2.
- .5 Flexible PVC conduit: to CAN/CSA-C22.2 No. 227.3

2.3 CONDUIT FASTENINGS

- .1 One hole steel straps to secure surface conduits 50 mm and smaller.
 - .1 Two hole steel straps for conduits larger than 50 mm.
- .2 Beam clamps to secure conduits to exposed steel work.
- .3 Threaded rods, 6 mm diameter, to support suspended channels.

2.4 CONDUIT FITTINGS

- .1 Fittings: to CAN/CSA C22.2 No. 18, manufactured for use with conduit specified. Coating: same as conduit.
- .2 Ensure factory "ells" where 90 degrees bends for 27 mm and larger conduits.
- .3 Watertight connectors and couplings for EMT.
 - .1 Set-screws are not acceptable.

2.5 EXPANSION FITTINGS FOR RIGID CONDUIT

- .1 Weatherproof expansion fittings with internal bonding assembly suitable for linear expansion.
- .2 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 21 mm deflection.
- .3 Weatherproof expansion fittings for linear expansion at entry to panel.

2.6 FISH CORD

- .1 Polypropylene: minimum #8 AWG.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

- .1 Use HDPE conduit underground of size as indicated on drawings.
- .2 Minimum conduit size for lighting and power circuits: NPS 3/4 (21 mm).
- .3 Bend conduit cold:
 - .1 Replace conduit if kinked or flattened more than 1/10th of its original diameter.
- .4 Mechanically bend steel conduit over 21 mm diameter.
- .5 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.
- .6 Install fish cord in empty conduits.
- .7 Remove and replace blocked conduit sections.
 - .1 Do not use liquids to clean out conduits.
- .8 Dry conduits out before installing wire.

3.3 CONDUITS UNDERGROUND

- .1 Slope conduits to provide drainage.
- .2 Waterproof joints (PVC excepted) with heavy coat of bituminous paint.

3.4 CLEANING

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

END OF SECTION

PART 1 - GENERAL

1.1 Related Work

- .1 Excavation and Backfilling: Division 02

1.2 Waste Management and Disposal

- .1 Refer to Section 26 05 00 11 – Electrical General Requirements.

PART 2 - PRODUCTS

2.1 Cable Protection

- .1 38 x 140 mm planks pressure treated with clear copper naphthenate or 5% pentachlorophenol solution, water repellent preservative.

2.2 Markers

- .1 Concrete type cable markers: 600 x 600 x 100 mm with words: “cable”, “joint” or “conduit” impressed in top surface, with arrows to indicate change in direction of cable and duct runs.

PART 3 - EXECUTION

3.1 Cable Installation in Ducts

- .1 Install cables as indicated in ducts.
- .2 Do not pull spliced cables inside ducts.
- .3 Install multiple cables in duct simultaneously.
- .4 Use CSA approved lubricants of type compatible with cable jacket to reduce pulling tension.
- .5 To facilitate matching of colour coded multiconductor control cables reel off in same direction during installation.
- .6 Before pulling cable into ducts and until cables properly terminated, seal ends of lead covered cable with wiping solder; seal ends of non-leaded cables with moisture seal tape.
- .7 After installation of cables, seal duct ends with duct sealing compound.

3.2 Markers

- .1 Mark cable every 150 m along duct runs and changes in direction.
- .2 Where markers are removed to permit installation of additional cables, reinstall existing markers.

3.3 Field Quality Control

- .1 Perform tests using qualified personnel. Provide necessary instruments and equipment.
- .2 Check phase rotation and identify each phase conductor of each feeder.
- .3 Check each feeder for continuity, short circuits and grounds. Ensure resistance to ground of circuits is not less than 50 megohms.
- .4 Pre-acceptance test.
 - .1 After installing cable but before splicing and terminating, perform insulation resistance test with 1000 V megger on each phase conductor.
 - .2 Check insulation resistance after each splice and/or termination to ensure that cable system is ready for acceptance testing.
- .5 Acceptance Tests
 - .1 Ensure that terminations and accessory equipment are disconnected.
 - .2 Ground shields, ground wires, metallic armour and conductors not under test.
 - .3 High Potential (Hipot) Testing.
 - .1 Conduct hipot testing in accordance with manufacturer's recommendations.
 - .4 Provide Consultant with list of test results showing location at which each test was made, circuit tested and result of each test.
 - .5 Remove and replace entire length of cable if cable fails to meet any of test criteria.

END OF SECTION

PART 1 GENERAL

1.1 Description

1. This section covers the providing and installation of distribution panelboards.

1.2 Related Documents

1. All sections of the Bidding Requirements, contract Conditions and Division 1 are part of this section.
2. Applicable sections of Division 26 are part of this section of the Specifications.

PART 2 PRODUCTS

2.1 Panelboards, Circuit Breaker Type, 347/600V, 3 Phase, 4 Wire

1. Shall be dead front type with or surface mounted steel cabinet as required and an internal assembly of circuit breakers. Trims shall have hinged and locked doors with glass or heavy plastic covered circuit directories. All locks shall be keyed alike. Boxes shall be galvanized, and front assembly shall be painted with a prime and a finish coat of manufacturers standard finish. Panels shall have 3 phase, 4 Wire, solid neutral mains of capacities indicated on the Drawings with main lugs or main circuit breaker as required.
2. Panelboards shall have suitable gutter space to accommodate separate neutrals conductors for all branch circuits.
3. Circuit breakers shall be molded plastic case type, quick-make, quick-break, with trip free common operating handle, position indication and common trip from thermal-magnetic trip device. Trip ratings shall be as indicated on the Drawings.

PART 3 EXECUTION

3.1 Installation

1. Panelboards shall be surface mounted inside NEMA 4 enclosure as indicated on plan drawings.
2. Install panelboards plumb and level.

3.2 Grounding

1. Bond all panelboards per C.E.C.

3.3 Identification

1. Provide name plates per Section 26 05 00.
2. Paint panelboards as required per Section 26 05 00.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 CSA International
 - .1 CSA C22.2 No.14-[10], Industrial Control Equipment.
- .2 National Electrical Manufacturers Association (NEMA)
 - .1 NEMA ICS 2-[2000 (R2005)], Controllers, Contactors and Overload Relays Rated 600 V.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

1.3 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals
- .2 Operation and Maintenance Data: submit operation and maintenance data for contactors for incorporation into manual.
- .3 Include operating information required for start-up, synchronizing and shut-down of generating units.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements with manufacturer's written instructions.
- .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 indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect contactors from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan related to Work of this Section.
- .5 Packaging Waste Management: remove and return of pallets, crates, padding, packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 CONTACTORS

- .1 Contactors: to CSA C22.2 No.14.
- .2 Electrically held Permanent magnet latch type or Mechanically held controlled by pilot devices and rated for type of load controlled. Half size contactors not accepted.
- .3 Complete with 2 normally open and 2 normally closed auxiliary contacts unless indicated otherwise.
- .4 Mount in NEMA Enclosure as indicated.
- .5 Include following options in cover:
 - .1 Red indicating lamp.
 - .2 Hand-Off-Auto selector switch.
- .6 Control transformer: factory wired and installed in contactor enclosure.

2.2 EQUIPMENT IDENTIFICATION

- .1 Identify equipment in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Size 4 nameplate indicating as indicated.

Part 3 Execution

3.1 INSTALLATION

- .1 Install contactors and connect power wires and auxiliary control devices.
- .2 Identify contactors with nameplates or labels indicating panel and circuit number.
- .3 Test contactors in accordance with 26 05 00 - Common Work Results for Electrical.

3.2 CLEANING

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

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WESTERN PROJECT # R.079636.001
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CONTACTORS

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3.3 PROTECTION

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

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 CSA Group
 - .1 CSA C22.2 No.206-[13], Lighting Poles.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for roadway lighting and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Sustainable Design Submittals:
 - .1 Construction Waste Management:
 - .1 Submit project Waste Management Plan highlighting recycling and salvage requirements.
 - .2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating that 75% of construction wastes were recycled or salvaged.

1.3 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements with manufacturer's written instructions.
- .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 indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect roadway lighting from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan related to Work of this Section.
- .5 Packaging Waste Management: remove and return by manufacturer of pallets, crates, padding, packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 STEEL POLES

- .1 Roadway Steel poles: to CSA C22.2 No.206 designed for underground wiring and:
 - .1 Mounting on concrete anchor base.
 - .2 Single davit pole,
 - .3 Style: monotube, minimum 3.0 mm thick, round.
 - .4 Straight for 1 luminaire mounting bracket.
 - .5 Terminating in single curved davit.
 - .6 Access handhole 300 mm above pole base for wiring connections, with welded-on reinforcing frame and bolted-on cover.
 - .7 Finish: Galvanized Steel.
 - .8 Grounding lug.
 - .9 Height, 9m c/w 2.5m arm.
 - .10 Manufacturer
 - .1 Minimum Acceptable: CECO

2.2 STEEL POLES

- .1 Visitor Car Parking Steel poles: to CSA C22.2 No.206 designed for underground wiring and:
 - .1 Mounting on concrete anchor base.
 - .2 Style: monotube, minimum 3.0 mm thick, straight.
 - .3 Straight for 1 or 2 luminaire mounting bracket[s], as indicated.
 - .4 Access handhole 300 mm above pole base for wiring connections, with welded-on reinforcing frame and bolted-on cover.
 - .5 Finish: Galvanized Steel.
 - .6 Grounding lug.
 - .7 Height, 9m and 4m
 - .8 Manufacturer
 - .1 Minimum Acceptable: CECO
- .2 Visitor Car Parking Steel poles complete with camera rough in: to CSA C22.2 No.206 designed for underground wiring and:
 - .1 Mounting on concrete anchor base.
 - .2 Style: monotube, minimum 3.0 mm thick, straight.
 - .3 Straight for 1 or 2 luminaire mounting bracket[s], as indicated.
 - .4 Access handhole 300 mm above pole base for wiring connections, with welded-on reinforcing frame and bolted-on cover.
 - .5 Access handhole 500 mm below mounting arm for wiring connections, with welded-on reinforcing frame and bolted-on cover.

- .6 1" NPT Pre drilled and threaded connection to be located 450mm below mounting arm for future camera feed complete with 1" bolt to secure entry in advance of future camera installation.
- .7 Finish: Galvanized Steel.
- .8 Grounding lug.
- .9 Height, 9m and 4m
- .10 Manufacturer
 - .1 Minimum Acceptable: CECO

2.3 LUMINAIRE MOUNTING BRACKETS

- .1 Mounting brackets steel for specified luminaires:
 - .1 Brackets as indicated.
 - .2 Arm extension length: as indicated.
 - .3 Type: as indicated.
 - .4 Single tapered davit type.

2.4 LUMINAIRES

- .1 Luminaire with die cast aluminum weatherproof housing and LED driver compartment:
 - .1 Lamp type: LED, voltage: 347V.
 - .2 Light Distribution: IES distribution Type II and III
 - .3 BUG rating – No greater than 3, 0 and 3.
 - .4 Minimum CRI - 70
 - .5 Color temperature – 4000° K (+/- 300K)
 - .6 Tool-less entry
 - .7 Power Factor > 0.9 at full load
 - .8 Total harmonic Distortion <20% at full load
 - .9 10kV surge suppression protection
 - .10 Field Adjustable output option to adjust luminaire output (For Roadway/Visitor Parking)
 - .11 Warranty – 10 years on luminaires/10 years on finish.

Minimum Acceptable for Roadway/ Visitor Parking -
CREE LED, XSP Series Street Luminaire, XSP2 LED – Double Module-Version B.
Product number as specified on drawings.

Minimum Acceptable for West Parking -
CREE LED, EDGE Series Area Luminaire

Product number as specified on drawings.

Minimum Acceptable for Pathway -
SISTEMALUX Miniblinker Bollards
Product number as specified on drawings.

Part 3 Execution

3.1 EXAMINATION

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

3.2 INSTALLATION

- .1 Install poles true and plumb, complete with brackets in accordance with manufacturer's instructions.
- .2 Install luminaires on pole davits.
- .3 Adjust Field adjustable output settings for luminaires as indicated on drawings.
- .4 Check luminaire orientation, level and tilt.
- .5 Connect luminaire to lighting circuit.
- .6 Lighting Controls: Roadway, Parking lot and Pool side pathway lighting to be controlled through existing Astronomical clock and Photocell installed at the pool building electrical room.

Wiring of lighting controls shall be as per schematic outlined on drawings. Astronomical clock shall be used as primary control to regulate operation schedule. Photocell shall be used as secondary control to further allow for on/off operation.

Astronomical clock shall facilitate on/off operation of lights 2 hours before pool opening and 2 hours after pool closing. In-line Photocell shall further control the operation based on need.
- .7 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.

3.3 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.
 - .2 Do not dispose of preservative treated wood through incineration.
 - .3 Do not dispose of preservative treated wood with other materials destined for recycling or reuse.
 - .4 Dispose of treated wood, end pieces, wood scraps and sawdust at sanitary landfill approved by Departmental Representative.
 - .5 Dispose of unused wood preservative material at official hazardous material collections site approved by Departmental Representative.
 - .6 Do not dispose of unused preservative material into sewer system, into streams, lakes, onto ground or in any other location where they will pose health or environmental hazard.
 - .7 Divert unused concrete materials from landfill to local facility approved by Departmental Representative.

END OF SECTION

Part 1 General

1.1 REFERENCES

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for communication raceway systems and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Sustainable Design Submittals:
 - .1 Construction Waste Management:
 - .1 Submit project Waste Management Plan highlighting recycling and salvage requirements.
 - .2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating that 75% of construction wastes were recycled or salvaged.

1.3 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect communication raceway systems from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan related to Work of this Section
- .5 Packaging Waste Management: remove and return by manufacturer of pallets, crates, padding, packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 SYSTEM DESCRIPTION

- .1 Empty telecommunications raceways system consists of conduits, pull boxes, sleeves and caps, fish wires.

2.2 MATERIAL

- .1 Conduits: HDPE type, in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.
- .2 Sleeves: DB2 sleeves for road crossings as indicated on drawings.
- .3 Fish wire: polypropylene type, minimum #8.
- .4 Pull Boxes : Rectangular concrete pull boxes as per details on drawings.

Part 3 Execution

3.1 EXAMINATION

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

3.2 INSTALLATION

- .1 Install empty raceway system, including fish wire, pull boxes, conduit, sleeves and caps, miscellaneous and positioning material to constitute complete system.

3.3 CLEANING

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

3.4 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by pathways for communications systems installation.

END OF SECTION

Part 1 General

1.1 SCOPE OF WORK

- .1 The Scope of Work shall include: All Clearing and Grubbing related to work required for the Sinclair Canyon Electrical Upgrade and Site Rehabilitation

1.2 REFERENCES

- .1 B.C. Ministry of Transportation and Infrastructure
 - .1 Section 200 – Clearing and Grubbing, 2012 Standard Specifications for Highway Construction.

1.3 DEFINITIONS

- .1 Clearing consists of cutting off trees and brush vegetative growth to not more than specified height above ground and disposing of felled trees, previously uprooted trees and stumps, and surface debris.
- .2 Close-cut clearing consists of cutting off standing trees, brush, scrub, roots, stumps and embedded logs, removing at, or close to, existing grade and disposing of fallen timber and surface debris.
- .3 Clearing isolated trees consists of cutting off to not more than specified height above ground of designated trees, and disposing of felled trees and debris.
- .4 Underbrush clearing consists of removal from treed areas of undergrowth, deadwood, and trees smaller than 50 mm trunk diameter and disposing of fallen timber and surface debris.

- .5 Grubbing consists of excavation and disposal of stumps and roots boulders and rock fragments of specified size to not less than specified depth below existing ground surface.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Samples:
 - .1 Submit 3 samples of each material listed below for approval prior to delivery of materials to project site.
 - .2 Tree wound paint: one liter can with manufacturer's label.
 - .3 Herbicide: one liter can with manufacturer's label.
 - .4 Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .3 Submit manufacturer's installation instructions.

1.6 QUALITY ASSURANCE

- .1 Do construction occupational health and safety in accordance with Contractors Best Management Practice
- .2 Safety Requirements: worker protection.
 - .1 Workers must wear gloves respirators dust masks long sleeved clothing eye protection protective clothing when applying herbicide materials.
 - .2 Workers must not eat, drink or smoke while applying herbicide material.
 - .3 Clean up spills of preservative materials immediately with absorbent material and safely discard to landfill.

1.7 STORAGE AND PROTECTION

- .1 Prevent damage to fencing trees landscaping natural features bench marks existing buildings existing pavement utility lines site appurtenances water courses root systems of trees which are to remain.
 - .1 Repair damaged items to approval of Departmental Representative.
 - .2 Replace trees designated to remain, if damaged, as directed by Departmental Representative.

1.8 WASTE MANAGEMENT AND DISPOSAL

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

Part 2 Products

2.1 MATERIALS

- .1 Bituminous based paint of standard manufacture specially formulated for tree wounds.
- .2 Herbicide: effective for killing annual and perennial weeds, and bamboo grass, by being absorbed through roots and foliage.
 - .1 Sprays applied on non-crop land areas.
- .3 Soil Material for Fill:
 - .1 Excavated soil material: free of debris, roots, wood, scrap material, vegetable matter, refuse, soft unsound particles, deleterious, or objectionable materials.
 - .2 Remove and store soil material for reused.

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 Sinclair Creek; contractor to submit erosion and sediment control drawings and plan, specific to site, that complies with requirements of authorities having jurisdiction or British Columbia Ministry of Transportation 2016 Standard Specifications for Highway Construction - Section 165 – Protection of the Environment, whichever is more stringent.
- .2 Inspect, repair, and maintain erosion and sedimentation control measures through construction.
- .3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal after completion of work.

3.2 PREPARATION

- .1 Inspect site and verify with Departmental Representative, items designated to remain.
- .2 Locate and protect utility lines: preserve in operating condition active utilities traversing site.
 - .1 Notify Departmental Representative immediately of damage to or when unknown existing utility lines are encountered.
 - .2 When utility lines which are to be removed are encountered within area of operations, notify Departmental Representative in ample time to minimize interruption of service.
- .3 Notify utility authorities before starting clearing grubbing.
- .4 Keep roads and walks free of dirt and debris.

3.3 APPLICATION

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

3.4 CLEARING

- .1 Clearing includes felling, trimming, cutting of trees into sections and satisfactory disposal of trees and other vegetation designated for removal, including downed timber, snags, brush, rubbish occurring within cleared areas.
- .2 Clear as indicated directed by Departmental Representative, by cutting at height of not more than 300 mm above ground. In areas to be subsequently grubbed, height of stumps left from clearing operations to be not more than 1000 mm above ground surface.
- .3 Cut off branches cut down trees overhanging area cleared as directed by Departmental Representative.
- .4 Cut off unsound branches on trees designated to remain as directed by Departmental Representative.
- .5 Apply herbicide in accordance with manufacturer's label at rate to top surface of stumps designated not to be removed.

3.5 CLOSE CUT CLEARING

- .1 Close cut clearing to ground level to within 100 mm of ground surface.
- .2 Perform close cut clearing by hand so that existing muskeg is not damaged.
- .3 Cut off branches down trees overhanging area cleared as directed by Departmental Representative.
- .4 Cut off unsound branches on trees designated to remain as directed by Departmental Representative.

3.6 ISOLATED TREES

- .1 Cut off isolated trees as directed by Departmental Representative at height of not more than 300 mm above ground surface.
- .2 Grub out isolated tree stumps.
- .3 Prune individual trees as indicated.
- .4 Trim trees designated to be left standing within cleared areas of dead branches 4 cm or more in diameter; and trim branches to heights as indicated.
- .5 Cut limbs and branches to be trimmed close to bole of tree or main branches.
- .6 Paint cuts more than 3 cm in diameter with approved tree wound paint.

3.7 UNDERBRUSH CLEARING

- .1 Clear underbrush from areas as indicated at ground level.

3.8 GRUBBING

- .1 Remove and dispose of roots larger than 7.5 cm in diameter, matted roots, and designated stumps from indicated grubbing areas.
- .2 Grub out stumps and roots to not less than 200 mm below ground surface.
- .3 Grub out visible rock fragments and boulders, greater than 300 mm in greatest dimension, but less than 0.25 m³.
- .4 Fill depressions made by grubbing with suitable material and to make new surface conform with existing adjacent surface of ground.

3.9 REMOVAL AND DISPOSAL

- .1 Remove cleared grubbed materials off site to disposal area as indicated designated by Departmental Representative.
- .2 Cut timber greater than 125 mm diameter to 600 mm lengths and stockpile as indicated. Stockpiled timber becomes property of Departmental Representative.
- .3 Dispose of cleared grubbed materials by burning burying.
- .4 Burn only in area designated by Departmental Representative. Burn under constant care of competent watchmen, at such times and so that surrounding vegetation, adjacent property or anything to remain will not be jeopardized.
- .5 Bury to approval of Departmental Representative by:
 - .1 Consolidating.
 - .2 Covering with minimum 500 mm of mineral soil.
 - .3 Finishing surface.
- .6 Chip mulch and stockpile spread cleared and grubbed vegetative material on site as directed by Departmental Representative.
- .7 Remove diseased trees identified by Departmental Representative and dispose of this material to approval of Departmental Representative.

3.10 FINISHED SURFACE

- .1 Leave ground surface in condition suitable for immediate grading operations to approval of Departmental Representative.

3.11 CLEANING

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

END OF SECTION

Part 1 General

1.1 SCOPE OF WORK

- .1 The Scope of Work shall include: All Soil Stripping and Stockpiling related to work required for the Sinclair Canyon Electrical Upgrade and Site Rehabilitation.

1.2 REFERENCES

- .1 B.C. Ministry of Transportation and Infrastructure
 - .1 Section 200 – Clearing and Grubbing, 2012 Standard Specifications for Highway Construction.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

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 Sinclair Creek; contractor to submit erosion and sediment control drawings and plan, specific to site, that complies with requirements of authorities having jurisdiction or British Columbia Ministry of Transportation 2016 Standard Specifications for Highway Construction - Section 165 – Protection of the Environment, whichever is more stringent.
- .2 Inspect, repair, and maintain erosion and sedimentation control measures through construction.
- .3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal after completion of work.

3.2 STRIPPING OF TOPSOIL

- .1 Ensure that procedures are conducted in accordance with applicable Provincial requirements.
- .2 Remove topsoil before construction procedures commence to avoid compaction of topsoil.
- .3 Handle topsoil only when it is dry and warm.
- .4 Remove vegetation from targeted areas by non-chemical means and dispose of stripped vegetation by alternative disposal.

- .5 Remove brush from targeted area by non-chemical means and dispose of through mulching.
- .6 Strip topsoil to depths as indicated on drawings.
 - .1 Avoid mixing topsoil with subsoil.
- .7 Pile topsoil by mechanical hoe in berms in locations as directed by Departmental Representative.
 - .1 Stockpile heights not to exceed 3m.
- .8 Dispose of unused topsoil in location as indicated by Departmental Representative.
- .9 Protect stockpiles from contamination and compaction.
- .10 Cover topsoil that has been piled for long term storage, with trefoil or grass to maintain agricultural potential of soil.

3.3 PREPARATION OF GRADE

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

3.4 PLACING OF TOPSOIL

- .1 Place topsoil only after Departmental Representative has accepted subgrade.
- .2 Spread topsoil during dry conditions by mechanical hoe in uniform layers not exceeding 250 mm, over unfrozen subgrade free of standing water.
- .3 Establish traffic patterns for equipment to prevent driving on topsoil after it has been spread to avoid compaction.
- .4 Cultivate soil following spreading procedures.

3.5 SUB-SOILING

- .1 Apply sub-soil, following spreading and cultivating procedures to designated areas to improve drainage and agricultural potential of soil.
- .2 Work sub-soil area following natural grade contour lines, with vibrating sub-soiler to depth of 40 cm.
- .3 Cross sub-soil the area following the first pass.
- .4 Cultivate the soil with a chain harrow to de-clod the soil.

3.6 CLEANING

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

END OF SECTION

Part 1 General

1.1 SCOPE OF WORK

- .1 The Scope of Work shall include: All Rough Grading related to work required for the Sinclair Canyon Electrical Upgrade and Site Rehabilitation.

1.2 REFERENCES

- .1 ASTM International
 - .1 ASTM D698, Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

1.4 EXISTING CONDITIONS

- .1 Examine subsurface investigation report.
- .2 Known underground and surface utility lines and buried objects are as indicated on site plan.
- .3 Refer to dewatering in Section 31 23 33.01 - Excavating, Trenching and Backfilling.

Part 2 Products

2.1 MATERIALS

- .1 Fill material in accordance with of Section 31 23 33.01 - Excavating, Trenching and Backfilling.
- .2 Excavated or graded material existing on site suitable to use as fill for grading work if approved by Departmental Representative.

Part 3 Execution

3.1 EXAMINATION

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

3.2 PREPERATION

- .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 Sinclair Creek; contractor to submit erosion and sediment control drawings and plan, specific to site, that complies with requirements of authorities having jurisdiction or British Columbia Ministry of Transportation 2016 Standard Specifications for Highway Construction - Section 165 – Protection of the Environment, whichever is more stringent.
 - .2 Inspect, repair, and maintain erosion and sedimentation control measures through construction.
 - .3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal after completion of work.

3.3 STRIPPING OF TOPSOIL

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

3.4 GRADING

- .1 Rough grade to levels, profiles, and contours allowing for surface treatment as indicated.
- .2 Slope rough grade away from building as directed.
- .3 Grade ditches to depth as directed.
- .4 Prior to placing fill over existing ground, scarify surface to depth of 150 mm minimum before placing fill over existing ground. Maintain fill and existing surface at approximately same moisture content to facilitate bonding.
- .5 Compact filled and disturbed areas to maximum dry density to ASTM D698, as follows:
 - a) 95% under landscaped areas.
 - b) 100% under paved and walk areas.
- .6 Do not disturb soil within branch spread of trees or shrubs to remain.

3.5 TESTING

- .1 Inspection and testing of soil compaction will be carried out by testing laboratory designated by ULC. Costs of tests will be paid by Owner in accordance with Sections 01 29 83 - Payment Procedures for Testing Laboratory Services and 01 45 00 - Quality Control.
- .2 Submit testing procedure, frequency of tests, testing laboratory as designated by certified testing personnel to Departmental Representative for review.

3.6 CLEANING

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

3.6 PROTECTION

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

END OF SECTION

Part 1 General

1.1 SCOPE OF WORK

- .1 The Scope of Work shall include: All Excavating, Trenching and Backfilling related to work required for the Sinclair Canyon Electrical Upgrade and Site Rehabilitation.

1.2 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM C117, Standard Test Method for Material Finer than 0.075 mm (No.200) Sieve in Mineral Aggregates by Washing.
 - .2 ASTM C136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .3 ASTM D422, Standard Test Method for Particle-Size Analysis of Soils.
 - .4 ASTM D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³) (600 kN-m/m³).
 - .5 ASTM D1557, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³) (2,700 kN-m/m³).
 - .6 ASTM D4318, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
- .2 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-A3000, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
 - .1 CSA-A3001, Cementitious Materials for Use in Concrete.
 - .2 CSA-A23.1/A23.2-14, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

1.3 DEFINITIONS

- .1 Excavation classes: two classes of excavation will be recognized; common excavation and rock excavation.
 - .1 Rock: solid material in excess of 1.00 m³ and which cannot be removed by means of heavy duty mechanical excavating equipment with 0.95 to 1.15m³ bucket. Frozen material not classified as rock.
 - .2 Common excavation: excavation of materials of whatever nature, which are not included under definitions of rock excavation.
- .2 Unclassified excavation: excavation of deposits of whatever character encountered in Work.
- .3 Topsoil:
 - .1 Material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping and seeding.

- .2 Material reasonably free from subsoil, clay lumps, brush, objectionable weeds, and other litter, and free from cobbles, stumps, roots, and other objectionable material larger than 25 millimeters in any dimension.
- .4 Waste material: excavated material unsuitable for use in Work or surplus to requirements.
- .5 Borrow material: material obtained from locations outside area to be graded, and required for construction of fill areas or for other portions of Work.
- .6 Recycled fill material: material, considered inert, obtained from alternate sources and engineered to meet requirements of fill areas.
- .7 Unsuitable materials:
 - .1 Weak, chemically unstable, and compressible materials.
 - .2 Frost susceptible materials:
 - .1 Fine grained soils with plasticity index less than 10 when tested to ASTM D4318, and gradation within limits specified when tested to ASTM D422 ASTM C136 : Sieve sizes to CAN/CGSB-8.1 CAN/CGSB-8.2.
 - .2 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.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Make submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Quality Control: in accordance with Section 01 45 00 - Quality Control:
 - .1 Submit condition survey of existing conditions as described in EXISTING CONDITIONS article of this Section.
 - .2 Submit for review by Departmental Representative proposed dewatering heave prevention methods as described in PART 3 of this Section.
 - .3 Submit to Departmental Representative written notice at least 7 days prior to excavation work, to ensure cross sections are taken.
 - .4 Submit to Departmental Representative written notice when bottom of excavation is reached.
 - .5 Submit to Departmental Representative testing inspection results report as described in PART 3 of this Section.
- .3 Preconstruction Submittals:
 - .1 Submit construction equipment list for major equipment to be used in this section prior to start of Work.
 - .2 Submit records of underground utility locates, indicating: location plan of existing utilities as found in field clearance record from utility authority location plan of relocated and abandoned services, as required.

- .4 Samples:
 - .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Inform Departmental Representative at least 4 weeks prior to beginning Work, of proposed source of fill unshrinkable fill materials and provide access for sampling.
 - .3 Submit 70 kg samples of type of fill unshrinkable fill specified including representative samples of excavated material.
 - .4 Ship samples prepaid to Departmental Representative, in tightly closed containers to prevent contamination and exposure to elements.
 - .5 At least 4 weeks prior to beginning Work, inform Departmental Representative source of fly ash and submit samples to Departmental Representative.
 - .1 Do not change source of Fly Ash without written approval of Departmental Representative.

1.6 QUALITY ASSURANCE

- .1 Qualification Statement: submit proof of insurance coverage for professional liability.
- .2 Where Departmental Representative is employee of Contractor, submit proof that Work by Departmental Representative is included in Contractor's insurance coverage.
- .3 Submit design and supporting data at least 2 weeks prior to beginning Work.
- .4 Design and supporting data submitted to bear stamp and signature of qualified professional engineer registered or licensed in Canada.
- .5 Keep design and supporting data on site.
- .6 Engage services of qualified professional Engineer who is registered or licensed in Canada in which Work is to be carried out to design and inspect cofferdams, shoring, bracing and underpinning required for Work.
- .7 Do not use soil material until written report of soil test results are reviewed by Departmental Representative.
- .8 Health and Safety Requirements:
 - .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.7 WASTE MANAGEMENT AND DISPOSAL

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

1.8 EXISTING CONDITIONS

- .1 Examine soil report.
- .2 Buried services:

- .1 Before commencing work verify location of buried services on and adjacent to site.
 - .2 Arrange with appropriate authority for relocation of buried services that interfere with execution of work: pay costs of relocating services.
 - .3 Remove obsolete buried services within 2 m of foundations: cap cut-offs.
 - .4 Size, depth and location of existing utilities and structures as indicated are for guidance only. Completeness and accuracy are not guaranteed.
 - .5 Prior to beginning excavation Work, notify applicable Departmental Representative authorities having jurisdiction establish location and state of use of buried utilities and structures. Departmental Representative authorities having jurisdiction to clearly mark such locations to prevent disturbance during Work.
 - .6 Confirm locations of buried utilities by careful soil hydrovac methods.
 - .7 Maintain and protect from damage, water, sewer, gas, electric, telephone and other utilities and structures encountered.
 - .8 Where utility lines or structures exist in area of excavation, obtain direction of Departmental Representative before removing.
 - .9 Record location of maintained, re-routed and abandoned underground lines.
 - .10 Confirm locations of recent excavations adjacent to area of excavation.
- .3 Existing buildings and surface features:
- .1 Conduct, with Departmental Representative, condition survey of existing buildings, trees and other plants, lawns, fencing, service poles, wires, rail tracks, pavement, survey bench marks and monuments which may be affected by Work.
 - .2 Protect existing buildings and surface features from damage while Work is in progress. In event of damage, immediately make repair as directed by Departmental Representative
 - .3 Where required for excavation, cut roots or branches as directed by Departmental Representative.

Part 2 Products

2.1 MATERIALS

- .1 Type 1 and Type 2 fill: properties to Section 31 05 16 - Aggregate Materials and the following requirements:
 - .1 Crushed, pit run or screened stone, gravel or sand.
 - .2 Gradations to be within limits specified when tested to ASTM C136 ASTM C117. Sieve sizes to CAN/CGSB-8.1 CAN/CGSB-8.2.
- .2 Type 3 fill: selected material from excavation or other sources, approved by Departmental Representative for use intended, unfrozen and free from rocks larger than 75 mm, cinders, ashes, sods, refuse or other deleterious materials.
- .3 Unshrinkable fill: proportioned and mixed to provide:
 - .1 Maximum compressive strength of 0.4 MPa at 28 days.
 - .2 Maximum cement content of 25 kg/m³ with 40 % by volume fly ash replacement: 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 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 in accordance with Section 02 41 13 - Selective Site Demolition.
- .3 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 Sinclair Creek; contractor to submit erosion and sediment control drawings and plan, specific to site, that complies with requirements of authorities having jurisdiction or British Columbia Ministry of Transportation 2016 Standard Specifications for Highway Construction - Section 165 – Protection of the Environment, whichever is more stringent.
 2. Inspect, repair, and maintain erosion and sedimentation control measures through construction.
 3. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal after completion of work.

3.2 PREPARATION/PROTECTION

- .1 Protect existing features in accordance with Section 01 56 00 - Temporary Barriers and Enclosures and applicable local regulations.
- .2 Keep excavations clean, free of standing water, and loose soil.
- .3 Where soil is subject to significant volume change due to change in moisture content, cover and protect to Departmental Representative approval.
- .4 Protect natural and man-made features required to remain undisturbed. Unless otherwise indicated or located in an area to be occupied by new construction, protect existing trees from damage.
- .5 Protect buried services that are required to remain undisturbed.

3.3 STRIPPING OF TOPSOIL

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

3.4 STOCKPILING

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

3.5 COFFERDAMS, SHORING, BRACING AND UNDERPINNING

- .1 Maintain sides and slopes of excavations in safe condition by appropriate methods and in accordance with Section 01 35 00 - Health and Safety Requirements.
 - .1 Where conditions are unstable, Departmental Representative to verify and advise methods.
- .2 Obtain permit from authority having jurisdiction for temporary diversion of water course.
- .3 Construct temporary Works to depths, heights and locations as indicated directed by Departmental Representative approved by Departmental Representative.

- .4 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.
- .5 When sheeting is required to remain in place, cut off tops at elevations as indicated.
- .6 Upon completion of substructure construction:
 - .1 Remove cofferdams, shoring and bracing.
 - .2 Remove excess materials from site and restore watercourses as indicated as directed by Departmental Representative.

3.6 DEWATERING AND HEAVE PREVENTION

- .1 Keep excavations free of water while Work is in progress.
- .2 Provide for Departmental Representative's review approval details of proposed dewatering or heave prevention methods, including dikes, well points, and sheet pile cut-offs.
- .3 Avoid excavation below groundwater table if quick condition or heave is likely to occur.
 - .1 Prevent piping or bottom heave of excavations by groundwater lowering, sheet pile cut-offs, or other means.
- .4 Protect open excavations against flooding and damage due to surface run-off.
- .5 Dispose of water in accordance with Section 01 35 43 - Environmental Procedures collection runoff areas 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.

3.7 EXCAVATION

- .1 Advise Departmental Representative at least 7 days in advance of excavation operations for initial cross sections to be taken.
- .2 Excavate to lines, grades, elevations and dimensions as indicated as directed by Departmental Representative.
- .3 Remove concrete masonry paving walks demolished foundations and rubble and other obstructions encountered during excavation in accordance with Section 02 41 13 - Selective Site Demolition.
- .4 Excavation must not interfere with bearing capacity of adjacent foundations.
- .5 Do not disturb soil within branch spread of trees or shrubs that are to remain.
 - .1 If excavating through roots, excavate by hand and cut roots with sharp axe or saw.
- .6 For trench excavation, unless otherwise authorized by Departmental Representative DCC Representative in writing, do not excavate more than 30 m of trench in advance of installation operations and do not leave open more than 15 m at end of day's operation.
- .7 Keep excavated and stockpiled materials safe distance away from edge of trench as directed by Departmental Representative.
- .8 Restrict vehicle operations directly adjacent to open trenches.
- .9 Dispose of surplus and unsuitable excavated material in approved location on site off site.
- .10 Do not obstruct flow of surface drainage or natural watercourses.
- .11 Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft or organic matter.
- .12 Notify Departmental Representative when bottom of excavation is reached.
- .13 Obtain Departmental Representative approval of completed excavation.
- .14 Remove unsuitable material from trench bottom including those that extend below required elevations to extent and depth as directed by Departmental Representative.
- .15 Correct unauthorized over-excavation as follows:
 - .1 Fill under bearing surfaces and footings with concrete specified for footings fill concrete Type 2 fill compacted to not less than 100% of corrected Standard Proctor maximum dry density.
 - .2 Fill under other areas with Type 2 fill compacted to not less than 95 % of corrected Standard Proctor maximum dry density.
- .16 Hand trim, make firm and remove loose material and debris from excavations.
 - .1 Where material at bottom of excavation is disturbed, compact foundation soil to density at least equal to undisturbed soil.
 - .2 Clean out rock seams and fill with concrete mortar or grout to approval of Departmental Representative.

3.8 FILL TYPES AND COMPACTION

- .1 Use types of fill as indicated or specified below. Compaction densities are percentages of maximum densities obtained from ASTM D698 ASTM D1557.
 - .1 Exterior side of perimeter walls: use Type 3 fill to subgrade level. Compact to 95% of corrected maximum dry density.
 - .2 Within building area: use Type 2 to underside of base course for floor slabs. Compact to 100 % of corrected maximum dry density.
 - .3 Under concrete slabs: provide 150 mm compacted thickness base course of Type 1 fill. Compact base course to 100 %.
 - .4 Retaining walls: use Type 2 fill to subgrade level on high side for minimum 500 mm from wall and compact to 95 %. For remaining portion, use Type 3 fill compacted to 95 %.
 - .5 Place unshrinkable fill in areas as indicated.

3.10 BEDDING AND SURROUND OF UNDERGROUND SERVICES

- .1 Place and compact granular material for bedding and surround of underground services as indicated in Section 33 41 00 - Storm Utility Drainage Piping
- .2 Place bedding and surround material in unfrozen condition.

3.11 BACKFILLING

- .1 Do not proceed with backfilling operations until completion of following:
 - .1 Departmental Representative has inspected and approved installations.
 - .2 Departmental Representative has inspected and approved of construction below finish grade.
 - .3 Inspection, testing, approval, and recording location of underground utilities.
 - .4 Removal of concrete formwork.
 - .5 Removal of shoring and bracing; backfilling of voids with satisfactory soil material.
- .2 Areas to be backfilled to be free from debris, snow, ice, water and frozen ground.
- .3 Do not use backfill material which is frozen or contains ice, snow or debris.
- .4 Place backfill material in uniform layers not exceeding 150 mm compacted thickness up to grades indicated. Compact each layer before placing succeeding layer.
- .5 Backfilling around installations:
 - .1 Place bedding and surround material as specified elsewhere.
 - .2 Do not backfill around or over cast-in-place concrete within 24 hours after placing of concrete.
 - .3 Place layers simultaneously on both sides of installed Work to equalize loading.
 - .4 Where temporary unbalanced earth pressures are liable to develop on walls or other structures:

- .1 Permit concrete to cure for minimum 14 days or until it has sufficient strength to withstand earth and compaction pressure and approval obtained from Departmental Representative:
- .2 If approved by Departmental Representative, erect bracing or shoring to counteract unbalance, and leave in place until removal is approved by Departmental Representative.
- .6 Place unshrinkable recycled fill in areas as indicated.
- .7 Consolidate and level unshrinkable fill with internal vibrators.

3.12 RESTORATION

- .1 Upon completion of Work, remove waste materials and debris in accordance to Section 01 74 21 - Construction/Demolition Waste Management and Disposal, trim slopes, and correct defects as directed by Departmental Representative.
- .2 Replace topsoil as directed by Departmental Representative.
- .3 Reinstall lawns to elevation which existed before excavation.
- .4 Reinstall pavements and sidewalks disturbed by excavation to thickness, structure and elevation which existed before excavation.
- .5 Clean and reinstall areas affected by Work as directed by Departmental Representative.
- .6 Use temporary plating to support traffic loads over unshrinkable fill for initial 24 hours.
- .7 Protect newly graded areas from traffic and erosion and maintain free of trash or debris.

END OF SECTION

Part 1 General

1.1 SCOPE OF WORK

- .1 Tangent concrete pile shoring system.
- .2 The intent of the Tangent pile shoring is to stabilise the slope along Highway 93.
- .3 The Piling Contractor is to supply all labour and material to install bored concrete piles as specified in tender documents for the Sinclair Canyon Electrical Upgrade and Site Rehabilitation.

1.2 WORK INCLUDED

- .1 Design, supply and install the Tangent pile shoring system to safely stabilise existing slope and prevent movement or loss of the integrity of the existing slope.
- .2 Drilling and placing of Tangent piles.
- .3 Supply and installation of reinforcing steel for vertical Tangent pile shoring supports.
- .4 Supply and installation of concrete for vertical Tangent pile shoring supports.
- .5 Supply and installation of all required horizontal bracing, soil anchors and connections.
- .6 Cut off tops of the Tangent pile shoring system at elevation required.
- .7 Trimming and finish of exposed surfaces of Tangent pile shoring system.
- .8 Removal of all temporary parts of the Tangent pile shoring system. Temporary parts include all parts projecting beyond the face of the Tangent pile wall, soil anchors.

1.3 RELATED REQUIREMENTS

- .1 Section 01 33 00 – Submittals Procedures
- .2 Section 01 45 00 – Quality Control
- .3 Section 03 20 00 – Concrete Reinforcing
- .4 Section 03 30 00 – Cast-in-Place Concrete
- .5 Section 31 10 00 – Earthwork

1.4 REFERENCES

- .1 BCBC 2012, “British Columbia Building Code”.
- .2 NBC 2010, “National Building Code”.
- .3 CAN/CSA-A3000, “Cementitious Materials Compendium”.
- .4 CSA-A23.1-14, “Concrete Materials and Methods of Concrete Construction”.
- .5 CSA-A23.2-14, “Methods of Test and Standard Practices for Concrete”.
- .6 CSA-A283-06(R2011), “Qualification Code for Concrete Testing Laboratories”.

- .7 CAN/CSA-G30.18-M92 (R2007), “Billet Steel Bars for Concrete Reinforcement”.
- .8 ASTM C109/C109M-08 “Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or 50-mm Cube Specimens).”
- .9 ASTM C295-08 “Standard Guide for Petrographic Examination of Aggregates for Concrete”
- .10 ASTM C618-08a “Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.”
- .11 ASTM C827-01a (2005) “Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens from Cementitious Mixtures.”
- .12 ASTM D3966/D3996M-07 (Reapproved 2013) “Standard Test Methods for Deep Foundations Under Lateral Load”

1.5 REGULATIONS

- .1 Abide by the current bylaws and regulations of the province and Regional District of East Kootenay and abide by the current laws and regulations with regard to public safety.
- .2 Safety requirements to comply with Construction Manager’s requirement, the regulations of the Minister of Labour, Occupational Health and Safety Act, the Workers’ Compensation Board and other applicable acts administered by the authority having jurisdiction of the province apply to the work of this section.

1.6 GEOTECHNICAL REPORTS

- .1 Refer to the geotechnical report Number 115302913 prepared by Stantec Consulting Ltd., titled “Geotechnical Investigation – Sinclair Canyon Site Rehabilitation”, and dated June 20th, 2016 and ensure it is available on-site.
- .2 Ensure the requirements of the geotechnical report and associated supplements are read and understood prior to commencing with work.

1.7 VISIT AND EXAMINE SITE

- .1 Check all dimensions, elevations and locations of existing structures, services and utilities at or adjacent to the site prior to commencing the tangent pile shoring work and report any discrepancies to the Engineer.
- .2 Obtain or examine air photos known to be available through public sources and additional information available for review in the office of the departmental representative to determine the possible extent of existing abandoned foundations, structures, services, and utilities.
- .3 No allowances will be made by the Departmental Representative for any conditions not anticipated or for any difficulties encountered due to any features or peculiarities of the site or existing conditions which exist at the time of examination prior to submission of bid.

1.8 CONDITIONS SURVEY OF EXISTING FEATURES

- .1 Conduct, with the appropriate property owners, authorities or agencies, a detailed investigation and survey of all existing features and conditions including adjacent existing structures, services and utilities to remain or be protected. Include photos, survey results and other necessary documentation.
- .2 Submit findings with a report for future reference in case of reported damage due to the execution of the work.

1.9 CHANGED CONDITIONS

- .1 If the conditions of the site sub-surface or of structures, services and utilities are significantly different when work is commenced, relative to the conditions at time of examination prior to bidding, immediately inform the departmental representative.

1.10 SPECIAL CONDITIONS

- .1 Ensure that all underground services are located and are not damaged by piling operations. Repair any damage done to existing services at no additional cost to the contract. Services indicated on the drawings are in accordance with available records. The Contractor is responsible for verifying all locations in the field.
- .2 The Contractor is to undertake a thorough inspection of existing structures and facilities and document any existing damage. The Contractor will be responsible for repairs of any damage caused by piling operations.
- .3 Confirm and establish the locations and extents of all underground structures, services and utilities in the work area prior to commencement of piling work by notifying the applicable owners, authorities or agencies. Clearly mark such locations to prevent disturbance or damage.
- .4 Arrange and pay for disconnecting, removing and capping, services and utilities within area of piling work. Disconnect and stub off as required by the authority having jurisdiction.
- .5 Place markers to indicate location of disconnected services and utilities. Identify utility and service lines and capping locations on as-built drawings.

1.11 PROTECTION

- .1 Protect benchmarks, existing structures, services and utilities, both above and below ground, including roads, sidewalks, paving and curbs which will or may be damaged by tangent pile shoring work.
- .2 Conform to good construction practice with regard to safety, and comply with the current requirements of the responsible regulatory agencies, such as the Workers' Compensation Board of British Columbia, and Occupation Health and Safety Act.
- .3 Make good and pay for any damage and be liable for any injury resulting from inadequate tangent pile shoring systems.

1.12 SAFETY

- .1 Carry out tangent pile shoring system work in accordance with the British Columbia Building Code and current Occupational Health and Safety Act construction safety regulations.
- .2 Carry out piling work in accordance with CSA S350 Code of Practice in Demolition of Structures, British Columbia Building Code and current Occupational Health and Safety Act construction safety regulations.

1.13 QUALIFICATIONS

- .1 The Contractor undertaking to design, supply and install the tangent pile shoring system and soil anchors, if required, is to be a recognized firm with at least five years experience in tangent pile shoring and soil anchor work in similar conditions and situations.
- .2 The organization undertaking to weld under this contract is to be currently approved by the Canadian Welding Bureau (CWB) under the requirements of CSA-W47.1, Division 1 or 2.1 only. Division 3 qualification is not sufficient.
- .3 Welders, welding operators and tackers are to be currently approved by the CWB in the particular category of weldment required.
- .4 Engage a professional engineer registered in the Province of British Columbia, fully qualified and experienced in the design of tangent pile shoring and soil anchors, to be responsible for the design of and supervision of installing the tangent pile shoring and soil anchor systems.

1.14 DESIGN

- .1 Design tangent pile shoring systems as necessary to protect existing structures, services and utilities to prevent movement or damage to these buildings and to prevent injury to personnel in accordance with the applicable standards, codes and regulations including CAN/CSA-S6.
- .2 Design to allow for surcharge loads as indicated on the drawings.
- .3 Design allowable tangent pile capacities:
 - .1 As recommended by the geotechnical engineering report .
- .4 Tangent piles to be based at least 0.2 m below the top surface.
- .5 Tangent pile reinforcement and shaft is to extend at least 7000 below final grade.
Tangent pile reinforcement to extend full length.
- .6 Base the design on the criteria recommended in the geotechnical report.
- .7 Submit details and calculations of the design prepared and sealed by the professional engineer responsible for the design to the Departmental Representative for review.
Indicate soil pressure diagrams, formulae and soil parameters used.

1.15 ALTERNATES

- .1 Alternates will be considered only after closing of tender and will only be discussed with the successful Contractor on the base bid.
- .2 Alternates will be subject to:
 - .1 A thorough review and unqualified acceptance by the geotechnical engineer retained by the Departmental Representative.
 - .2 Evidence that a significant saving will be realized by the departmental representative.
- .3 Contractors will be responsible for additional cost of design checking, re-design and re-drawing to accommodate the proposed alternate.

1.16 PILE LOAD TESTS

- .1 Allow in the contract price for a pile load test. Load test a pile selected by the departmental representative to confirm capacity of piles and/or design parameters.
- .2 Pile load tests may be required at the departmental representative's discretion. The cost of the tests will be borne by the departmental representative if piles are found to be in conformance with the specified requirements; otherwise, the cost is to be borne by the Contractor.
- .3 Pile load testing procedures will be monitored by an independent inspection and testing firm appointed by the Departmental Representative.
- .4 Testing is to be in accordance with ASTM D3966, Standard Loading Procedure. Contractors engineer to confirm loading requirements and send to the departmental representative prior to testing.
- .5 Make provisions for and perform tests, if requested, for any installed pile selected by the inspection and testing firm and at any time during the performance of piling work. Document all test procedures.
- .6 If tested piles do not conform to requirements, the departmental representative may request additional testing of other piles installed or request additional piles to be placed at no additional cost to the departmental representative.

1.17 SUBMITTALS

- .1 Submittals are to be in accordance with Section 01 33 00 and in a form sufficiently complete to satisfy any authority having jurisdiction.
- .2 Prior to commencement of work, submit the following:
 - .1 Submit evidence of qualifications, in the form of a list, of typical tangent pile shoring and soil anchor projects completed, together with dates.
 - .2 Submit qualifications and experience of the Contractor's professional engineer and proposed supervisor of the tangent pile shoring and soil anchor work. The Contractor's engineer is to further acknowledge, in writing, that he or she has

reviewed the specification and drawings and is aware that he or she is to inspect the fabrication and installation of the work and certify the work at completion.

- .3 Submit general outline of procedures and methods proposed to install tangent pile shoring for review by the Departmental Representative.
- .3 Welding:
 - .1 Submit evidence of qualifications for welding under CWB.
 - .2 Submit approved welding procedures for each type of weld to be used.
 - .3 Submit qualifications of welders, welding operators and tackers under CWB.
 - .4 Submit evidence of ability to weld reinforcing steel in accordance with CSA-W186.
- .4 Concrete and grout: Submit proposed concrete and grout mix designs.
- .5 Submit regular monitoring reports of the tangent pile shoring.
- .6 Submit methods of removal of temporary tangent pile shoring for review by the Departmental Representative.
- .7 Submit proof or certificate of source of reinforcement material. Clearly identify recycled content (post-consumer and post-industrial).

1.18 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with Section 01 33 00 of these specifications under the seal and signature of a professional engineer registered in the Province of British Columbia..
- .2 Clearly indicate the following information:
 - .1 Pile layout, schedule of installation and placing sequence.
 - .2 Type of pile, sizes and details.
 - .3 Grade and details of reinforcing steel.
 - .4 Type of cement, air content, slump and concrete strength.
 - .5 Elevation of pile bases.
 - .6 Elevation of top of pile.
 - .7 Calculated load capacity of each pile.
 - .8 Show all structures, utilities and services in the vicinity of all tangent pile shoring.
 - .9 Prepare shop drawings of piles this design.
 - .10 Review of the shop drawings by the Departmental Representative is intended to assist the Contractor and does not relieve the Contractor of responsibility for the completeness and accuracy of the work and its conformance with the contract drawings and specifications.

- .11 Fabrication that commences prior to shop drawing review by the Departmental Representative is at the risk of the Contractor.

1.19 QUALITY CONTROL

- .1 Perform concrete work in accordance with the requirements of CSA-A23.1 and Section 03 30 00 unless indicated otherwise herein.
- .2 The Piling Contractor must not assign the responsibility of coordination of placing reinforcing steel and placing concrete. To this end, a full time qualified superintendent representing the Contractor is to be in attendance during all phases of the work.
- .3 The Contractor's professional engineer responsible for this work is to inspect the fabrication and installation of the tangent pile shoring system on behalf of the Contractor in accordance with APEGBC "Guidelines for Professional Structural Engineering Services for Part 3 Building Projects" revised February, 2011.
- .4 Inspection of installation of the tangent pile shoring systems is to be done on a weekly basis by a competent person responsible to the Contractor's professional engineer. Frequency of reviews to be adequate to determine that work is constructed in accordance with shop drawings and design. Weekly review to be documented and submitted to the departmental representative within 24 hours of review. Procedures of the review to be approved by the departmental representative.

1.20 INSPECTION AND TESTING OF TANGENT PILE SHORING SYSTEM

- .1 Contractor to inspect installation of tangent pile shoring and monitor throughout the construction period.
- .2 Review of tangent pile shoring systems installation, will be done by a certified firm retained and paid for by the Contractor and approved by the Departmental Representative in accordance with Section 01 45 00 of these specifications.
- .3 Reviewing firm will check tangent pile shoring systems throughout the period of time in use. Reviews are to occur initially at weekly intervals, then reduce to every two weeks and monthly, based on performance.
- .4 Contractor to monitor and survey tangent piles and submit regular monitoring reports and survey results for review by the inspection firm.
- .5 Full time pile inspection of tangent pile shoring will be carried out by an independent geotechnical firm, retained and paid for by the Contractor and approved by the Departmental Representative in accordance with Section 01 45 00 of these specifications.
- .6 Inspection and testing firm to submit to the Departmental Representative a final report summarizing their inspection and testing and Contractor's degree of compliance with the contract documents and reviewed shop drawings, including any remedial requirements that may have been required during the course of work. This report is to be submitted under the seal and signature of a professional geotechnical engineer registered in the Province of British Columbia.
- .7 Notify Departmental Representative and inspection and testing firm five (5) working days in advance of starting tangent piling work on site.

1.21 INSPECTION AND TESTING OF CONCRETE

- .1 Testing of concrete will be carried out by an independent testing firm certified in accordance with CSA A283, retained and paid for by the Contractor and approved by the Departmental Representative in accordance with Section 01 45 00 of these specifications.
- .2 Test concrete in accordance with CSA-A23.2.
- .3 Conform to the requirements noted under Inspection and Testing of Concrete in Section 03300 of these specifications.
- .4 Provide casual labour to the testing firm's field personnel for the purpose of obtaining and handling sample materials. Provide free access to all portions of the work, and cooperate with the testing firm.
- .5 Advise testing firm 48 hours in advance of concrete placement.
- .6 The Contractor is to provide properly designed temperature-controlled storage boxes for test cylinders, as specified in Section 5.3.1.1 of CSA-A23.2-3C, for period of at least 24 hours and further protection from adverse weather and mishandling until removed from the site. The Contractor is to provide a max-min thermometer for each storage box. Storage in a portable building that will be used by the Contractor's personnel or the Engineer during the first 24 hour storage period will not be permitted. Storage facilities are to be provided, installed, checked and approved before any concrete may be placed.
- .7 Testing firm is to review all mix designs submitted and confirm in writing that all strength and durability requirements specified will be achieved.
- .8 Samples of concrete to be taken as close to the point of final deposit as possible at end of pipe when pumping is used.
- .9 Testing firm to take a minimum of three (3) test cylinders for a strength test from each 100 m³ of concrete, or fraction thereof, for each type of concrete placed in any one day.
- .10 Testing firm to moist cure and test one (1) cylinder in 7 days and to moist cure and test the remaining two cylinders in 28 days.
- .11 Testing firm is to take at least one slump test and one entrained air test for each set of test cylinders taken.
- .12 Testing firm is to report results of tests immediately to the Contractor. The Contractor is responsible for ensuring that the concrete meets requirements of the specifications. Report adverse test results to the Departmental Representative immediately.
- .13 Testing firm is to submit to the [Engineer] and Contractor certified copies of test results. Include the following information with the results:
 - .1 Name of the project.
 - .2 Date of sampling.
 - .3 Mix design, specified strength, slump and air content.
 - .4 Name of supplier, truck and ticket number.

- .5 Time batched and time placed.
- .6 Identification of sampling and testing technician.
- .7 Cement type and admixtures used.
- .8 Exact location in the structure of the concrete sampled.
- .9 Ambient air and concrete temperatures.
- .10 Nominal aggregate size.
- .11 Water added and personnel authorizing additional water.
- .12 Concrete density.
- .14 Testing firm is not authorized to revoke, relax, enlarge or release any requirements of the specification, nor to approve or disapprove any portion of the work.
- .15 Testing firm is to advise placing crews to halt placing of adverse concrete immediately, and thereafter notify Contractor to reject the concrete. The execution, or lack of execution, of this request is to be recorded.
- .16 Reject and do not place concrete with slumps greater than maximum specified, air content lower than minimum specified and concrete older than two hours from batch time.
- .17 Obtain approval of the departmental representative for reinforcing before placement of concrete commences. Contact the geotechnical engineer retained and paid for by the departmental representative for inspection of bases of execution prior to placing concrete.
- .18 Minimum 48 hours notice is required for all inspections.
- .19 Testing agency is to take at least one slump test and one entrained air test for each set of cylinder taken.
- .20 Testing agency to moist cure and test one cylinder in 7 days and the remainder two cylinders in 28 days.
- .21 Full time pile inspection of piling operations will be carried out by an independent geotechnical firm, retained and paid for by the Contractor and approved by the Departmental Representative. Inspection of the pile bases will be performed by the Inspection Agency for bearing capacity verification. Video camera may be employed where appropriate.
- .22 Testing agency shall direct the use of steel casing when site conditions warrant. Keep record of piles that require steel casing and the size and length of the casing used.
- .23 Testing agency shall keep record of the pile base elevation of each pile installed. The record is to be used as the basis for calculating the payment to the contractor.

1.22 INSPECTION AND TESTING OF GROUT

- .1 Test all grout by a testing firm certified in accordance with CSA-A283, retained and paid for by the Contractor and approved by the Departmental Representative in accordance with 01 45 00 of these specifications.
- .2 In accordance with ASTM C109, provide at least six separate cube tests of grout used. Tests to be equally spread over installation period.

1.23 DELIVERY, STORAGE AND HANDLING

- .1 Deliver all materials to the site in bundles easily identified and properly marked.
- .2 Store and handle all material on site in a manner to prevent damage and contamination.
- .3 Do not straighten or re-bend any reinforcement.
- .4 Do not use any reinforcement that has been kinked or bent on site.

1.24 FIELD RECORDS AND DRAWINGS

- .1 Maintain accurate records of all piles installed. Records are to include the following:
 - .1 Locations of piles.
 - .2 Sequence of placing.
 - .3 Final base and head elevations.
 - .4 Drilled shaft and bell diameters.
 - .5 Groundwater conditions.
 - .6 Condition of base material.
 - .7 Date and time of drilling.
 - .8 Length of casing.
 - .9 Reinforcing details.
 - .10 Date and time of placing concrete.
 - .11 Details of unusual occurrences.
 - .12 Inspector's name.
- .2 Submit three (3) copies of all field records and drawings to the Departmental Representative.

1.25 PROTECTION OF EXISTING STRUCTURES

- .1 Take all reasonable precautions to prevent damage to existing structures and utilities. These measures include but are not limited to subsidence control during drilling.

1.26 UNIT PRICE

- .1 In accordance with Bid Form, submit for each type of pile:
 - .1 A set up cost for each pile.
 - .2 A unit price for each metre length of pile installed.
 - .3 A unit price for each metre of casing installed when installed.

- .2 All unit prices to include costs of socket into bedrock (where applicable), drilling, concrete and reinforcing in place as required. Unit prices shall also include all overheads, profit mark-ups and supervision, etc.
- .3 Submit a unit price for standby time for each rig in case contaminants are encountered during pile drilling and have to be removed before drilling can resume.
- .4 Length of pile is measured from the final pile base elevation to the specified top of pile cut off elevation. Piling Contractor is responsible for all costs associated with installing top of pile to the specified elevation.
- .5 “Unit Price Schedule” along with “As-built drawings” and testing agency’s “Field Record” will be used to determine actual pile length of each pile type installed for progress billing and final contract value.
- .6 Additional costs due to additions or deletions of piles or pile lengths, or any other factors that may affect cost, are subject to approval by the Departmental Representative and Construction Manager.

1.27 PILE LOAD TESTS

- .1 Pile load testing procedures will be monitored by an independent inspection and testing firm appointed by the departmental representative.
- .2 Testing is to be in accordance with ASTM D3966, and requirement to load is to be in accordance with paragraph 8.1.2, Standard Loading Procedure.
- .3 Make provisions for and perform tests, if requested, for any installed pile selected by the inspection and testing firm and at any time during the performance of piling work. Document all test procedures.
- .4 If tested piles do not conform to requirements, the Departmental Representative may request additional testing of other piles installed or request additional piles to be placed at no additional cost to the Owner.
- .5 A minimum of 5% of the piles require testing. Contractor to allow for costs and schedule within overall submission.

1.28 INCLUDED IN SCOPE OF WORK

- .1 Removal of the tailings (spoils) from the work areas to designated stockpile locations on site is part of this contract. Piling Contractor is required to direct tailings to a separate stockpile in case contaminants are encountered.

1.29 ACCEPTABILITY

- .1 Conform to the requirements noted under Acceptability in Section 03 30 00 of these specifications.
- .2 Failure to comply with the requirements of these specifications will result in the structure being considered potentially deficient.

- .3 Additional testing, inspection and evaluation may be required where evidence points to a potentially deficient structure.
- .4 Pay all costs for additional testing, inspection and analysis required to demonstrate the adequacy of a structure that does not meet the requirements of the contract documents.
- .5 Reinforce by additional construction or replace as directed by the Departmental Representative at Contractor's expense all structure or material judged inadequate by structural analysis or by testing and inspection.
- .6 The Departmental Representative may order further testing, inspection and analysis at any time. In this instance, the Departmental Representative will pay for those tests, inspections or analysis that meet the specified requirements, and the Contractor will pay for those that do not.

Part 2 Products

2.1 CONCRETE AND GROUT MATERIALS

- .1 Conform to the requirements noted under Concrete Materials in Section 03 30 00 of these specifications and as noted herein.
- .2 All concrete and grout materials to conform to CSA-A23.1.
- .3 Portland cement: to CAN/CSA-A5 Normal - Type GU, Type MS or HS as indicated within the specifications section 03 30 00 Cast-in-Place Concrete.

2.2 CONCRETE MIXES

- .1 Conform to the requirements noted under Concrete Mixes in Section 03 30 00 of these specifications and as noted herein.
- .2 Provide concrete mix that is suitable for placement of concrete using tremie under submerged conditions.

2.3 REINFORCEMENT

- .1 Reinforcing steel: To CAN/CSA-G30.18, Grade 400R deformed billet steel bars.
- .2 Reinforcing steel: To CAN/CSA-G30.18, Grade 400W special low alloy deformed billet steel for welded bars with equivalent carbon content not exceeding 0.5.
- .3 Reinforcing steel material shall consist of minimum 40% post-consumer and 20% post-industrial recycled content.

2.4 CASING

- .1 Conform to ASTM A252, Grade 2, steel casing tube of required diameter for temporary use in wet or soft strata.
- .2 Provide steel casing for all piles where required to prevent sloughing and ingress of water.

Part 3 Execution

3.1 INSTALLATION

- .1 Conform to sequences of construction, tangent pile shoring shown on reviewed shop drawings.
- .2 Survey and set out construction lines, grades and foundation locations.
- .3 Establish the location of all underground service and utility lines in areas of tangent pile shoring. Notify Departmental Representative of finding.
- .4 Notify the Departmental Representative and inspection and testing firm 48 hours prior to any installations on site.
- .5 Ensure site conditions are adequate to support piling equipment and to allow proper performance of pile operations.
- .6 Ensure piling equipment is adequate for soil conditions. Piling Contractor is responsible for maintenance of the site grade and restoring any damages caused by the use of inappropriate equipment.
- .7 Use tangent pile shoring techniques that will prevent movement of soil and damage to structures, services and utilities required to be protected and retained.
- .8 Should conditions be encountered which are not consistent with the intent to which the design of tangent pile shoring is based, promptly notify the professional engineer responsible for the design and the Departmental Representative. Should deviations from the submitted information be required, obtain approval of such deviations from the Departmental Representative.
- .9 Repair all damage caused by work of this section. Where tangent pile shoring work may cause movement in soils below adjacent structures, services, utilities, roadway, sidewalk or lanes, pressure injection of grout may be required and will be at the Contractor's expense.
- .10 Install piles where indicated on drawings. Piling Contractor is responsible for their own survey and layout from designated control point or bench mark.
- .11 Ensure pile shafts are drilled vertically and that pile bases are founded minimum depths into bearing material as indicated on the drawings, specified herein, and as indicated in the geotechnical report.
- .12 To prevent breakthrough from one pile to another, drill and install piles alternately. Where pile spacing is less than three bell diameters, do not drill the adjacent pile before the previous pile concrete has set or for at least 24 hours.
- .13 Use steel casing for all piles to prevent sloughing and ingress of water where recommended in the geotechnical report or where required by site conditions. Requirements for casing will be determined and directed by the inspection agency and approved by the Departmental Representative.
- .14 Clean pile bases of loose material by a methods approved by the Departmental Representative, and place reinforcing steel and concrete after acceptance by the

- geotechnical engineer. Perform these operations as soon as possible, but not later than two hours after drilling for each pile. Do not leave any unfilled shafts overnight.
- .15 Arrange for and allow inspection of pile shafts and bases before concrete and reinforcing steel are placed.
 - .16 Place reinforcing steel in accordance with CSA-A23.1.. Use four 75 mm diameter by 450 mm long PVC pipes on the reinforcing steel cage at maximum 3000 mm on centre to ensure proper concrete cover for the reinforcing steel.
 - .17 Construct all piles to the top of pile cut off elevation and project vertical reinforcement as specified. Ensure concrete at the pile cut off elevation is sound and satisfactory to the Consultant that no additional preparation or repair work will be required for pile cap construction.
 - .18 Provide full length casing and protective cage with hoist and lowering equipment to facilitate downhole inspection and hand cleaning in accordance with the requirements of the Occupational Health and Safety Act if required by the inspection agency.
 - .19 Provide full length reinforcement for piles. Extend reinforcement into bells as shown on drawings for piles with uplift and for exterior isolated piles.
 - .20 Place concrete in vertical piles where the shaft and base are dry by means of a chute minimum 4000 mm in length held rigidly and centered in the pile shaft and the rebar cage. Concrete discharged from the chute is to be prevented from striking the sides of the shaft and the rebar cage.
 - .21 Vibrate concrete to full depth of reinforcing in the pile.
 - .22 Remove water from any source by pumping to allow placing concrete in dry conditions.
 - .23 Place concrete by means of a tremie should an inflow of water occur that can not be removed by pumping. Place to a height sufficient to effect a seal. Notify Departmental Representative prior to carrying out this work. Revise concrete mix design and placing methods as directed by the Departmental Representative.
 - .24 Protect concrete from freezing. Do not place concrete against frozen ground.
 - .25 Where casing is used, withdraw casing by vibratory methods to reduce the possibility of concrete arching in the casing. Ensure sufficient head of concrete above the bottom of the casing to resist lateral soil pressures. Ensure pile reinforcement is secure and does not settle due to vibratory methods.
 - .26 Clean casing thoroughly after each use.
 - .27 Discontinue piling operations and immediately notify the Departmental Representative in the event that unusual soil conditions are encountered such that pile load capacities can not be obtained.
 - .28 Fill abandoned piles with lean mix 2 MPa concrete. Contractor to replace at no additional cost to the contract all piles abandoned due to inadequate equipment or piling operation breakdown.
 - .29 Piles may be increased or decreased in length depending on soil conditions only as directed by the Inspection Agency and approved by the Departmental Representative and

in accordance with the stipulated unit price. Ensure that where pile lengths are increased or decreased, adjacent piles are not undermined or capacities are not reduced.

- .30 Notify the departmental representative of any sub-surface conditions that are not as shown on the drawings or in the specifications. Discontinue work in the area until the departmental representative provides notification to resume work.

3.2 BRACING AND UNDERPINNING

- .1 Design and install bracing and underpinning, both temporary and permanent, as necessary and required, where work is extended below existing construction, structures, services or utilities. Remove all temporary work and restore existing construction, structures, services and utilities to their original condition.

3.3 TOP OF PILE ELEVATION

- .1 Make allowance to place concrete to correct top of pile elevations specified on the drawings.

3.4 TOLERANCES

- .1 Do not deviate from true vertical alignment more than 2% of pile length.
- .2 Do not deviate from centre of true location more than 75 mm.
- .3 Do not deviate from specified head elevations more than 25 mm.

3.5 NON-CONFORMING PILES

- .1 Non-conforming piles are piles that are placed out of position or are damaged and/or piles not conforming to size, length and material specifications.
- .2 Provide additional piles or supplement piles with additional pile caps or grade beams to meet specified requirements as directed by the Departmental Representative at no additional cost to the contract.

3.6 MAINTENANCE AND CONTROL

- .1 Maintain all tangent pile shoring in safe and working condition until removal of temporary work is approved by the Departmental Representative.
- .2 Monitor movements of tangent pile shoring in all directions throughout the period of time in use on a weekly basis. Submit regular written reports of movement survey results.
- .3 If records indicate any tangent pile shoring has moved significantly in any direction as determined by the geotechnical engineer, stop work immediately. Submit for review by the Departmental Representative a proposal for bringing movement under control. Do not resume construction until directed by the Departmental Representative.

3.7 CERTIFICATION

- .1 Certify at completion of work all tangent pile shoring systems installed by the Contractor under the seal and signature of the Contractor's professional engineer responsible for this work.

- .2 Certify that all tangent pile shoring system are capable of developing the capacities specified in the contract specifications and on the drawings.
- .3 Certify that all piles are installed in accordance with the contract documents and the reviewed shop drawings.

3.8 SURVEY VERIFICATION

- .1 Submit a survey of all tangent pile shoring system locations with respect to grid lines. Survey to be carried out by an independent legal surveyor registered in the Province of British Columbia.
- .2 Survey drawings are to be submitted to the Departmental Representative for review prior to construction of formwork of foundation walls and/or grade beams.
- .3 Submit a survey of all material left in place showing locations with respect to grid lines. Survey to be carried out by an independent legal surveyor registered in the Province of British Columbia.
- .4 The cost of this survey is to be the responsibility of the Contractor.
- .5 Piling Contractor will survey all pile locations including non-conforming piles. Survey is to be carried out by an independent legal surveyor registered in the Province of British Columbia. Piling Contractor is to submit proposed remedial work for non-conforming piles to departmental representative for approval prior to proceeding with the work.

3.9 AS-BUILT DRAWINGS

- .1 Submit an as-built drawing prepared by an independent legal surveyor registered in the Province of British Columbia showing final pile locations, shaft diameter, top of pile elevation of each pile including all deviations and details of unusual occurrences from the original contract document within five (5) days after the completion of all piles.

END OF SECTION

Part 1 General

1.1 SCOPE OF WORK

- .1 The Scope of Work shall include: All Pavement Cleaning and Marking Removal related to work required for the Sinclair Canyon Electrical Upgrade and Site Rehabilitation.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for each type of abrasives and solvent used on project.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements with manufacturer's written instructions.
- .2 Develop Waste Reduction Workplan related to Work of this Section.

Part 2 Products

2.1 MATERIALS

- .1 Abrasives and solvents used for removal of paint, oil, grease, rubber deposits: proprietary products specially designed for pavement cleaning, subject to approval by Departmental Representative.

Part 3 Execution

3.1 REMOVING PAVEMENT MARKINGS

- .1 Remove rubber tire deposits and paint markings, in areas as directed by Departmental Representative, by water blasting, rotary grinding, heater planing or other method approved in writing by Departmental Representative.
- .2 Exercise care to avoid dislodging of coarse aggregate particles, excessive removal of fines, damage to bituminous binder.
- .3 Do not heat pavement surfaces above 120 degrees C, when using heater planing equipment.

3.2 PAVEMENT SURFACE CLEANING

- .1 Remove sealing compound which has protruded excessively, where directed by Departmental Representative.
 - .1 Dispose of removed material as directed by Departmental Representative.
- .2 Remove dust, contaminants, loose and foreign materials, oil and grease, in areas as directed by and by method approved in writing by Departmental Representative.
- .3 Use rotary power brooms supplemented by hand brooming.

3.3 CLEANING

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

END OF SECTION

Part 1 General

1.1 SCOPE OF WORK

- .1 The Scope of Work shall include: All Pavement Crack Cleaning and Filling related to work required for the Sinclair Canyon Electrical Upgrade and Site Rehabilitation.

1.2 REFERENCES

- .1 ASTM International
 - .1 ASTM C117, Standard Test Method for Material Finer Than 0.075 mm (No.200) Sieve in Mineral Aggregates by Washing.
 - .2 ASTM C136, Standard Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .3 ASTM D2419, Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for cleaning and filling materials and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Samples:
 - .1 Submit samples of materials proposed for use 2 weeks before beginning Work.
 - .1 One 4 L container of asphalt material. Submit emulsions in plastic container.
 - .2 One 20 kg sample of each aggregate gradation.
 - .2 Provide access for Departmental Representative to sample materials actually incorporated into Work as required.
- .4 Certificates:
 - .1 Submit manufacturer's test data and certification that materials meet requirements of this Section 2 weeks before beginning Work.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 1 61 00 - Common Product Requirements with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan related to Work of this Section

Part 2 Products

2.1 MATERIALS

- .1 Emulsified asphalt: to CAN/CGSB-16.2.
- .2 Cutback asphalt: to CAN/CGSB-16.1, grade.
- .3 Aggregate for crack filling: material to following requirements:
 - .1 Screened sand or screenings.
 - .2 Gradations to be within limits specified when tested to ASTM C136. Sieve sizes to CAN/CGSB-8.1, CAN/CGSB-8.2.
 - .3 Sand equivalent: to ASTM D2419, not less than 45%.
 - .4 Mixing water: free from foreign matter.

2.2 EQUIPMENT

- .1 Pressure applicator capable of applying slurry.
- .2 Manual pouring cones and Hand tools.
- .3 Small diameter diamond bladed pavement saws.

2.3 MIXES

- .1 Prepare sand asphalt slurry with following proportions:
 - .1 50 kg of aggregates.
 - .2 10 to 16 L of asphalt material as determined by Departmental Representative.
 - .3 Water to produce uniform mix of consistency to achieve full penetration into cracks.
- .2 Heat cutback asphalt to temperature suitable for mixing and pumping to CAN/CGSB-16.1.

Part 3 Execution

3.1 EXAMINATION

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

3.2 PREPARATION

- .1 Clean cracks designated by Departmental Representative.
- .2 Remove existing sealer and loose materials
 - .1 From spalled edges and pavement surface.
 - .2 To minimum depth of 50 mm.
 - .3 Open "V" type grooves not permitted.
- .3 Saw designated cracks to width of 10mm using pavement saws approved by Departmental Representative.
- .4 Saw designated cracks to depth between 25 mm and 30 mm.
 - .1 Clean cracks larger than 2 mm and less than 25 mm in concrete and asphalt pavement surfaces as directed by Departmental Representative.
 - .2 For asphalt pavements or overlays rout cracks less than 25 mm to width of 25 - 30 mm and depth of 25 mm below pavement surface.
- .5 Clean loose material from cracks with oil free compressed air.
- .6 Apply soil sterilant in crack prior to placing filler material.
- .7 Dispose of material removed from cracks as directed by Departmental Representative.

3.3 CRACK FILLING

- .1 Ensure cracks are clean and dry immediately before filling.
- .2 Fill cracks designated and approved by Departmental Representative.
- .3 Do not use frozen aggregate.
- .4 Fill cracks when air temperature is above 10 degrees C.
 - .1 When daily low temperature does not fall below 5 degrees C.
 - .2 When no rain is forecast.

- .5 Finishing:
 - .1 For cracks routed to width of 10 mm: place joint sealant 2 - 4 mm above pavement surface to provide an overband seal over crack.
 - .1 Ensure sealant overlaps both sides of crack by 40 mm minimum and 80 mm maximum.
 - .2 For cracks routed to width of 25 - 30 mm: place joint sealant to ensure that upon cooling, sealant is recessed 2 mm below pavement surface.
- .6 Fill and tamp cracks with sufficient applications to ensure cured fill material is level with pavement surface.
- .7 Fill cracks wider than 50 mm with hot mix asphalt concrete and tamped, immediately before placement of asphalt concrete overlay, where and when approved in writing by Departmental Representative.
- .8 Slightly overfill entire crack reservoir with filler material. Smooth with narrow V-shaped squeegee immediately after placement of filler material on each side of crack as directed by Departmental Representative.
- .9 Remove and dispose of excess filling material as directed by Departmental Representative.
- .10 Road lanes to be opened to traffic only after filler material has set sufficiently that it will not pick up under traffic. Blotting material may be applied to filler material after surface has set.

3.4 CLEANING

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

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 311100 – Clearing and Grubbing
- .2 Section 32934301- Tree Pruning.

1.2 REFERENCES

- .1 Definitions:
 - .1 Mycorrhiza: association between fungus and roots of plants. This symbiosis, enhances plant establishment in newly landscaped and imported soils.
- .2 Reference Standards:
 - .1 ASTM International
 - .1 ASTM A1064/A1064M, Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
 - .2 CSA Group
 - .1 CSA G30.18, Carbon Steel Bars for Concrete Reinforcement.
 - .3 Department of Justice Canada (Jus)
 - .1 Canadian Environmental Protection Act (CEPA), 1999, c. 33.
 - .2 Fertilizers Act (R.S. 1985, c. F-10).
 - .3 Fertilizers Regulations (C.R.C., c. 666).
 - .4 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.
 - .4 Health Canada - Pest Management Regulatory Agency (PMRA)
 - .1 National Standard for Pesticide Education, Training and Certification in Canada (1995).
 - .5 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).

1.3 ADMINISTRATIVE REQUIREMENTS

- .1 Scheduling:
 - .1 Obtain approval from Departmental Representative schedule indicating beginning of Work.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:

- .1 Submit manufacturer's instructions, printed product literature and data sheets for tree preservation materials and include product characteristics, performance criteria, physical size, finish and limitations prior to construction.
- .2 Submit monthly written reports on maintenance during warranty period, to Departmental Representative identifying:
 - .1 Maintenance work carried out.
 - .2 Development and condition of plant material.
 - .3 Preventative or corrective measures required which are outside Contractor's responsibility.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store and protect tree preservation materials from nicks, and scratches, and blemishes.
 - .2 Replace defective or damaged materials with new.

1.6 MAINTENANCE DURING WARRANTY PERIOD

- .1 From time of acceptance by Departmental Representative to end of warranty period, perform following maintenance operations.
 - .1 Water to maintain soil moisture conditions for optimum growth and health of plant material without causing erosion.
 - .2 Apply pesticides in accordance with National Standard for Pesticide Education, Training and Certification in Canada, Federal, Provincial and Municipal regulations as and when required to control insects, fungus and disease. Obtain product approval from Departmental Representative prior to application.
 - .3 Apply fertilizer in early spring, as soon as frost is out of the ground at manufacturer's suggested rate
 - .4 Spread 50% of fertilizer in one direction, then 50% at right angles.
 - .5 Water immediately after fertilizing according to manufacturer's recommendations and obtain moisture penetration of 50mm minimum.
 - .6 Remove dead, broken or hazardous branches from plant material. Dispose of debris through mulching or as directed by Departmental Representative.

Part 2 Products

2.1 MATERIALS

- .1 Fill:
 - .1 Type (A): clean, natural river sand and gravel material, free from silt, clay, loam, friable or soluble materials and organic matter.
 - .2 Type (B): excavated soil, free from roots, rocks larger than 75 mm, building debris, and toxic ingredients (salt, oil, etc). Excavated material shall be approved by Departmental Representative before use as fill.
- .2 Coarse washed stones: 35-75mm diameter clean round hard stone.
- .3 Peatmoss:
 - .1 Derived from partially decomposed species of Sphagnum Mosses.
 - .2 Elastic and homogeneous.
 - .3 Free of wood and deleterious material which could prohibit growth.
 - .4 Minimum 60% organic matter by weight and moisture content, not exceeding 15%
 - .5 Shredded maximum particle size: 6mm.
 - .6 Supply peatmoss in bags unless otherwise approved by Departmental Representative.
- .4 Fertilizer:
 - .1 To Canada Fertilizer Act and Fertilizers Regulations.
 - .2 Complete, commercial, slow release with 35% of nitrogen content in water-insoluble form.
- .5 Anti-desiccant: commercial, wax-like emulsion.
- .6 Filter Cloth:
 - .1 Type 1: 100 % non-woven needle punched polyester, 2.75 mm thick, 240 g/m² mass.
 - .2 Type 2: biodegradable burlap.
- .7 Wood posts: 38 x 89 x 2400 mm length, untreated wood.
- .8 Welded wire fabric (WWF): 100 x 100mm, to ASTM A1064/A1064M, CSA G30.18.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for tree preservation installation in accordance with manufacturer's written instructions.

- .1 Visually inspect substrate in presence of Departmental Representative.
- .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
- .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 IDENTIFICATION AND PROTECTION

- .1 Identify plants and limits of root systems to be preserved as approved by Departmental Representative.
- .2 Protect plant and root systems from damage, compaction and contamination resulting from construction as approved by Departmental Representative.
- .3 Ensure no pruning is done inside drip line. If pruning inside drip line is required consult an arborist or Canadian Certified Horticultural Technician (CCHT) as approved by Departmental Representative.

3.3 ROOT CURTAIN SYSTEM

- .1 Identify limits for required construction excavation as approved by Departmental Representative.
- .2 Prior to construction excavation, dig trench minimum 500 mm wide x 1500 mm deep, along perimeter of excavation limits. Where grade exceeds 3:1 trench to be hand dug.
- .3 Prune exposed roots cleanly at side of trench nearest plants to be preserved. Pruned ends to point obliquely downwards.
- .4 Install wooden posts and welded wire fabric against construction edge of trench.
- .5 Securely attach Type 2 filter fabric on plant side of wire mesh.
- .6 Prepare homogeneous mixture of fertilizer, parent material and organic matter.
 - .1 Add organic matter to mixture to achieve 7-9% organic matter content by weight.
 - .2 Incorporate with mixture grade 2:12:8 ratio fertilizer (dry) at rate of 1.5kg/m³.
- .7 Backfill with homogeneous mixture between curtain wall and plants to be preserved in layers not exceeding 150 mm in depth. Compact each layer to 85% Standard Proctor Density.
- .8 Protect root curtain from damage during construction operations.
- .9 Water plants and root curtain sufficiently during construction to maintain optimum soil moisture condition until backfill operations are complete.
- .10 Protect root curtain during backfill operations. Ensure root curtain is cut down to 300mm below finished grade and remove cut material.

3.4 AIR LAYERING SYSTEM

- .1 Using manual methods, carefully remove turf, plants, leaves and organic matter in area of root system, dispose of plant matter through compost site and slightly loosen topsoil surface. Avoid damage to root system.
- .2 Lay horizontal system of perforated drain pipe on surface of existing grade.
 - .1 Slope drain tile minimum 3% for drainage away from trunk of tree.
 - .2 Connect system with general site drainage system or drain to low point on site.
- .3 Install plastic vent pipes vertically over joints in horizontal pipe system or where indicated. Top of vent pipe to be 25 mm above finished grade of fill. Keep top of vent pipe covered during construction.
- .4 Cover joints with Type 1 filter fabric and place coarse washed stone around joints and vertical pipes to secure their position.
- .5 Construct drywell around trunk of tree.
 - .1 Ensure open ends of horizontal pipe system are left exposed for air circulation to root system.
 - .2 Protect openings from blockage during construction.
 - .3 Install protective caps on exposed horizontal openings.
- .6 Place 200 mm depth of coarse washed stone on surface of original ground and horizontal pipe system to limits.
- .7 Place Type 1 filter fabric over surface of granular layer.
- .8 Place Type A fill over filter fabric to required depth without disturbing or damaging drain pipe system. Avoid damage to filter fabric.
- .9 Complete topsoil and sodding and/or finished pavingover area of sub-surface system within one (1) week of placing fill.
- .10 Remove temporary protective covering from vent pipe openings. Install protective caps flush with finished grade.

3.5 TRENCHING AND TUNNELING FOR UNDERGROUND SERVICES

- .1 Centre line location and limits of trench/tunnel excavation to be approved by Departmental Representative prior to excavation. Tunnel excavation to extend 2000mm from edge of trunk on either side.
- .2 Excavate manually within zone of root system. Do not sever roots greater than 40 mm diameter except at greater than 500 mm below existing grade. Protect roots, and cut roots cleanly with sharp disinfected tools.
- .3 Excavate tunnel under centre of tree trunk using methods and equipment approved by Departmental Representative.
- .4 Minimum acceptable depth to top of tunnel: 1000mm.

- .5 Backfill for tunnel and trench to 85% Standard Proctor Density. Avoid damage to trunk and roots of tree.
- .6 Complete tunnelling and backfilling at tree within two (2) weeks of beginning Work.

3.6 LOWERING GRADE AROUND EXISTING TREE

- .1 Begin Work in accordance with schedule approved by Departmental Representative.
- .2 Cut slope not less than 500mm from tree trunk to new grade level or retaining wall.
- .3 Excavate to depths as indicated. Protect from damage root zone which is to remain.
- .4 When severing roots at excavation level, cut roots with sharp tools.
- .5 Cultivate excavated surface manually to 150 mm depth.
- .6 Prepare homogeneous soil mixture consisting by volume of:
 - .1 60% excavated soil cleaned of roots, plant matter, stones, debris.
 - .2 25% coarse, clean sterile sand.
 - .3 15% organic matter.
 - .4 Grade 2:12:8 fertilizer at rate of 1.5 kg/m³.
- .7 Place soil mixture over area of excavation to finished grade level. Compact to 85% Standard Proctor Density.
- .8 Water entire root zone to optimum soil moisture level. Obtain moisture penetration of 50mm minimum.
- .9 Install surface cover of seeding in accordance with Section 32 92 19.16 - Hydraulic Seeding.

3.7 PRUNING

- .1 Prune in accordance with Section 32 93 43.01 - Tree Pruning.
- .2 Prune crown to compensate for root loss while maintaining general form and character of plant. Dispose of debris through mulching or as directed by Departmental Representative.

3.8 ANTI-DESICCANT

- .1 Apply anti-desiccant to foliage where applicable and as directed by Departmental Representative.

3.9 VERIFICATION

- .1 Verification requirements in accordance with Section 01 47 17 - Sustainable Requirements: Contractor's Verification, include:
 - .1 Materials and resources.
 - .2 Storage and collection of recyclables.
 - .3 Construction waste management.
 - .4 Local/regional materials.

.5 Low-emitting materials.

3.10 CLEANING

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

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1
- .2 Section 017411 - Cleaning
- .3 Section 017421 - Construction/Demolition Waste Management and Disposal
- .4 Section 311413 – Soil Stripping and Stockpiling
- .5 Section 32019033 – Tree and Shrub Preservation
- .6 Section 32921916 - Hydraulic Seeding

1.2 MEASUREMENT PROCEDURES

- .1 Preparation of sub-grade for placing of topsoil will be measured in square metres of area prepared.
- .2 Topsoil stripping will be measured by Departmental Representative in cubic metres of stockpiled topsoil and volume will be determined by average end area method.
- .3 Measure placing of topsoil in cubic metres removed from stockpile.
 - .1 Stockpiles will be measured by Departmental Representative and volume of topsoil removed calculated by average end area method.
- .4 Measure supply and application of soil amendments, including fertilizer, in standard commercial units of weight/volume as determined by Departmental Representative
 - .1 Measuresoil amendments applied to site in square metres of area treated.
- .5 Measure supplying, placing and spreading topsoil in cubic metres as determined from actual surface area covered and depth of topsoil specified.
 - .1 Specified depth of topsoil: measured and approved by Departmental Representative after settlement and consolidation as specified.
- .6 Measure finish grading in square metres from actual surface measurements as determined by Departmental Representative.

1.3 PAYMENT

- .1 Testing of topsoil: Departmental Representative will pay for cost of tests as specified in Section 01 29 83 - Payment Procedures for Testing Laboratory Services.

1.4 REFERENCES

- .1 Agriculture and Agri-Food Canada

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

1.5 DEFINITIONS

- .1 Compost:
 - .1 Mixture of soil and decomposing organic matter used as fertilizer, mulch, or soil conditioner.
 - .2 Compost is processed organic matter containing 40% or more organic matter as determined by Walkley-Black or Loss On Ignition (LOI) test.
 - .3 Product must be sufficiently decomposed (i.e. stable) so that any further decomposition does not adversely affect plant growth (C:N ratio below (25) (50)), and contain no toxic or growth inhibiting contaminants.
 - .4 Composed bio-solids to: CCME Guidelines for Compost Quality, Category (A) (B).

1.6 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Quality control submittals:
 - .1 Soil testing: submit certified test reports showing compliance with specified performance characteristics and physical properties as described in PART 2 - SOURCE QUALITY CONTROL.
 - .2 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.7 QUALITY ASSURANCE

- .1 Pre-installation meetings: conduct pre-installation meeting to verify project requirements, installation instructions and warranty requirements in accordance with Section 014500 Quality Control
- .2 Salvaged topsoil shall be used for restoration operations.
- .3 Obtain the approval of imported topsoil sources (as required) from the Departmental Representative.
- .4 Soil testing is required for the purpose of creating an appropriate formulation to ensure the establishment of turf. Loam pile to be tested by the Contractor, and soil test results made available to the Departmental Representative.

- .5 Test topsoil for N.P.K., particle size analysis, soluble salt content and pH. Soils will be mixed thoroughly, containerize and labeled to include:
 - .1 Origin of material
 - .2 Intended Use
 - .3 Name and job number of the project.
- .6 Should the source of topsoil be exhausted, obtain the approval of the Departmental Representative for material from the new source before using.
- .7 The Departmental Representative shall approve both the rough grade and finished grade at appropriate times before the Contractor proceeds with the next phase of work.

1.8 WASTE MANAGEMENT AND DISPOSAL

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

1.9 JOB CONDITIONS

- .1 Report in writing to the Engineer prior to commencing work any conditions or defects encountered on site, upon which the work of this section depends, and which may adversely affect the performance of the work.
- .2 Do not commence work until such conditions or defects have been investigated and corrected.
- .3 Commencement of work implies acceptance of surface conditions and no claims for damages or extra work will be accepted, except where such conditions cannot be determined prior to construction.

1.10 PROTECTION

- .1 Protect all trees and planting areas to remain in accordance with Section 32019033 – Tree and Shrub Preservation.
- .2 Make good all damage at no extra cost.

1.11 WARRANTY

- .1 Guarantee all work for a period commencing on the date of issue of Substantial Performance to the date of issuance of the Final Acceptance.
- .2 Bring back to design grade all areas which have settled during the warranty period.

Part 2 Products

2.1 TOPSOIL

- .1 Topsoil for seeded areas : mixture of particulates, micro organisms and organic matter which provides suitable medium for supporting intended plant growth.
 - .1 Soil texture based on The Canadian System of Soil Classification, to consist of 20 to 70 % sand, minimum 7 % clay, and contain 4 to 10 % organic matter by weight.
 - .2 Contain no toxic elements or growth inhibiting materials.
 - .3 Topsoil containing non-native plant species or weed seeds will be rejected.
 - .4 Material subject to analysis by testing laboratory prior to use.
 - .5 Finished surface free from:
 - .1 Debris and stones over 50 mm diameter.
 - .2 Course vegetative material, 10 mm diameter and 100 mm length, occupying more than 2% of soil volume.
 - .6 Consistence: friable when moist.

2.2 ORIGINAL TOPSOIL

- .1 Original material stockpiled on site.
- .2 Material subject to analysis by testing laboratory before use.

2.3 SOIL AMENDMENTS

- .1 Fertilizer:
 - .1 Fertility: major soil nutrients present in following amounts:
 - .2 Nitrogen (N): 20 to 40 micrograms of available N per gram of topsoil.
 - .3 Phosphorus (P): 40 to 50 micrograms of phosphate per gram of topsoil.
 - .4 Potassium (K): 75 to 110 micrograms of potassium per gram of topsoil.
 - .5 Calcium, magnesium, sulfur and micro-nutrients present in balanced ratios to support germination and/or establishment of intended vegetation.
 - .6 Ph value: [6.5 to 8.0].
- .2 Peatmoss:
 - .1 Derived from partially decomposed species of Sphagnum Mosses.
 - .2 Elastic and homogeneous, brown in colour.
 - .3 Free of wood and deleterious material which could prohibit growth.

- .4 Minimum 60% organic matter by weight and moisture content, not exceeding 15%
- .5 Shredded maximum particle size: 6mm.
- .6 Supply peatmoss in bags unless otherwise approved by Departmental Representative.
- .7
- .3 Sand: washed coarse silica sand, medium to coarse textured.
- .4 Limestone:
 - .1 Ground agricultural limestone containing minimum 85% of total carbonates.
 - .2 Gradation requirements: percentage passing by weight, 90% passing 1.0 mm sieve, 50% passing 0.125 mm sieve.
- .5 Fertilizer: industry accepted standard medium containing nitrogen, phosphorous, potassium and other micro-nutrients suitable to specific plant species or application or defined by soil test.

2.4 SOURCE QUALITY CONTROL

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

Part 3 Execution

3.1 TEMPORARY EROSION AND SEDIMENTATION CONTROL

- .1 Work to be carried out in accordance to Section 31 14 13 Soil Stripping and Stockpiling

3.2 STRIPPING OF TOPSOIL

- .1 Work to be carried out in accordance to Section 31 14 13 Soil Stripping and Stockpiling

3.3 PREPARATION OF EXISTING GRADE

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

- .3 Remove debris, roots, branches, stones in excess of 50 mm diameter and other deleterious materials.
 - .1 Remove soil contaminated with calcium chloride, toxic materials and petroleum products.
 - .2 Remove debris which protrudes more than 75 mm above surface.
 - .3 Dispose of removed material off site.
- .4 Locate utility lines and appurtenances, including manholes, CB's, valves, hydrants and boxes before commencement of work and protect from damage.
- .5 Cultivate entire area which is to receive topsoil to minimum depth of 150mm.
 - .1 Cross cultivate those areas where equipment used for hauling and spreading has compacted soil.

3.4 PLACING AND SPREADING OF TOPSOIL/PLANTING SOIL

- .1 Place topsoil after Departmental Representative has accepted subgrade.
- .2 Spread topsoil with adequate moisture in uniform layers during dry weather over approved dry, unfrozen subgrade, where seeding or planting is indicated.
- .3 Spread topsoil in uniform layers not exceeding 150 mm.
- .4 Spread topsoil as indicated to following minimum depths after settlement.
 - .1 150 mm for seeded areas.
 - .2 600mm for relocated shrub beds
- .5 Manually spread topsoil/planting soil around trees, shrubs and obstacles.

3.5 FINISH GRADING

- .1 Grade to eliminate rough spots and low areas and ensure positive drainage.
 - .1 Prepare loose friable bed by means of cultivation and subsequent raking.
 - .2 Remove stones, roots, grass, weeds, construction materials, debris and foreign non-organic objects from the topsoil.
 - .3 Eliminate rough spots and low areas to ensure positive drainage
- .2 Consolidate topsoil to required bulk density using equipment approved by Departmental Representative..
 - .1 Leave surfaces smooth, uniform and firm against deep footprinting with a fine loose texture.
- .3 Apply soil amendments at rate determined from soil test report. Mix soil amendment well into full depth of topsoil by cultivating or rototilling prior to application of amendment.
- .4 Spread fertilizer with mechanical spreader, over entire area of topsoil. The rate is to be determined from the soil test report. Mix fertilizer thoroughly into upper 50 mm (2") topsoil.

- .5 Do not cover catch basins, valve covers or inspection pits.
- .6 Take appropriate measures to reduce dust and control erosion during spreading of topsoil.

3.6 ACCEPTANCE

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

3.7 SURPLUS MATERIAL

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

3.8 CLEANING

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.
- .2 Remove all temporary stockpile sites within or adjacent to contract limits to a “neat clean condition acceptable to the by Departmental Representative”.
- .3 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 32911913 - Topsoil Placement and Grading

1.2 MEASUREMENT AND PAYMENT

- .1 Measure hydraulic seeding square metres of actual surface area for:
 - .1 Grass mixture including fertilizer.
 - .2 Areas of blending into existing turf grass will not be measured for payment.
- .2 Measure maintenance during establishment period of areas seeded in square metres.
- .3 Payment for seeding made at unit price bid of actual area surface measurements taken and computed by Departmental Representative .

1.3 ADMINISTRATIVE REQUIREMENTS

- .1 Pre-Installation Meetings: conduct pre-installation meeting to verify project requirements, installation instructions and warranty requirements in accordance with Section 01 31 19 - Project Meetings.
- .2 Scheduling:
 - .1 Schedule hydraulic seeding to coincide with preparation of soil surface. Schedule hydraulic seeding using grass mixtures and mixtures containing Crownvetch or Trefoil between dates recommended by Regional Agricultural Department.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for seed, mulch, tackifier, fertilizer, liquid soil amendments and micronutrients.
 - .2 Submit [2] copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements
- .3 Submit in writing four (4) days prior to commencing work:
 - .1 Volume capacity of hydraulic seeder in litres.
 - .2 Amount of material to be used per tank based on volume.
 - .3 Number of tank loads required per hectare to apply specified slurry mixture per hectare.
- .4 Samples:
 - .1 Submit 0.5 kg container of each type of fertilizer used.

- .5 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .6 Test Reports: submit certified test reports showing compliance with specified performance characteristics and physical properties.

1.5 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Landscape Contractor: to be a Member in Good Standing of BC Landscape & Nursery Association (BCLNA) or Canadian Nursery Landscape Association (CNLA) The contractor must have experience at performing this type and scale of work and must be willing to provide proof of this experience.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements:
 - .1 Labelled bags of fertilizer identifying mass in kg, mix components and percentages, date of bagging, supplier's name and lot number.
 - .2 Inoculant containers to be tagged with expiry date.
 - .3 Deliver grass seed in original container identifying, analysis of seed mixture, percentage of pure seed, year of production, net mass, date when tagged and location, percentage of germination and name and address of distributor.
 - .4 Deliver wood fibre mulch in moisture proof containers indicating manufacturer content and net air-dry mass.
 - .5 Deliver erosion control agent in moisture proof containers, showing manufacturer, content and net mass.
- .3 Storage and Handling Requirements:
 - .1 Store fertilizer in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Replace defective or damaged materials with new.

1.7 WARRANTY

- .1 For seeding, 12 months warranty period is extended to 24 months.
- .2 Contractor hereby warrants that seeding will remain free of defects in accordance with General Conditions CCDC but for 24 months.
- .3 End-of-warranty inspection will be conducted by Departmental Representative.

Part 2 Products

2.1 MATERIALS

- .1 Seed: "Canada pedigreed grade" in accordance with Government of Canada Seeds Act and Regulations.
 - .1 Grass mixture: "Certified", "Canada No. 1 Lawn Grass Mixture" in accordance with Government of Canada "Seeds Act" and "Seeds Regulations".
 - .1 Native Seed Mixture composition:
 - .1 15% *Achnatherum hymenoides* - Indian rice grass
 - .2 10% *Bromus ciliatus* - Fringed brome
 - .3 10% *Calamagrostis rubescens* - Pine grass
 - .4 25% *Festuca brachyphylla* - Alpine fescue
 - .5 5% *Koeleria macrantha* - June grass
 - .6 15% *Poa alpine* spp. *Alpina* - Alpine blue grass
 - .7 15% *Trisetum spicatum* - Spike trisetum
 - .8 1% *Aquilegia flavescens* - Yellow columbine
 - .9 1% *Arctostaphylos Uva-Ursi* – Kinnickinnick
 - .10 1% *Campanula rotundifolia* – Bluebell
 - .11 1% *Erigeron peregrinnus* spp. *Callianthemus* - Subalpine daisy
 - .12 1% *Viola canadensis* - Canada violet
- .2 Mulch:
 - .1 Fibre wood or wood cellulose fibre free of germination or growth inhibiting ingredients and forming blotter like groundcover allowing absorption and percolation of water. The following specifications shall apply:
 - .1 moisture content 10%
 - .2 organic matter 99.2%
 - .3 ash content 8%
 - .4 water holding capacity 1000gms/100gms of fibre
 - .5 Minimum application rate is 16.0 kg of air dry fibre per 100 m²
 - .2 Fibre shall not be produced from recycled material.
- .3 Tackifier: Acceptable colloidal polysaccharide tackifier that adheres to mulch during manufacturing, non toxic, without growth or germination inhibiting factors. pH value to be between 7 and 8.
- .4 Water: Potable, free of impurities that would inhibit germination
 - .1 Application rate is 160 L/100 m².
- .5 Fertilizer and Chemical Control:
 - .1 Fertilizer:

- .1 To Canada "Fertilizers Act" and Regulations.
- .2 Complete synthetic, slow release with 35% of nitrogen content in water-insoluble form.
- .3 Commercial fertilizers of approved manufacture
- .4 Containing not less than 60% urea formaldehyde and the specified percentage of nutrients by weight.
- .5 Supply and deliver in bags clearly marked with name of manufacturer, contents, weights and analysis. Type and application rate to be determined by a soil test.
- .2 Use of "Weed and Feed" is not permitted.
- .3 In addition to the feeding specified, apply any nutrients and soil amendments required as indicated by deformed chlorite or stunted growth, or as determined by soils analysis.
- .6 Inoculants: inoculant containers to be tagged with expiry date.
- .7 Liquid Soil Amendment and Micronutrients: as determined by soil test.

Part 3 Execution

3.1 EXAMINATION

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

3.2 INSTALLERS

- .1 Use installers members in Good Standing of BC Landscape & Nursery Association (BCLNA) or Canadian Nursery Landscape Association (CNLA)

3.3 PROTECTION OF EXISTING CONDITIONS

- .1 Protect structures, signs, guide rails, fences, plant material, utilities and other surfaces not intended for spray.
- .2 Immediately remove any material sprayed where not intended as directed by Departmental Representative.

3.4 PREPARATION OF SURFACES

- .1 Do not perform work under adverse field conditions such as frozen ground or ground covered with snow, ice or standing water or when general site conditions are not approved by the Departmental Representative.
- .2 Fine grade areas to be seeded free of lumps and hollows.
 - .1 Ensure areas are free of deleterious and refuse materials.
- .3 Cultivated areas identified as requiring cultivation to depth of 50mm.
- .4 Ensure areas to be seeded are moist to depth of 150 mm before seeding.
- .5 Obtain Departmental Representative's approval of grade and topsoil depth before starting to seed.

3.5 INSTALLATION

- .1 Seeding time: May 1 until September 30, or otherwise approved by the Departmental Representative.
- .2 Maximum wind velocity 20km/h and when general site conditions are approved by the Departmental Representative.
- .3 Acceptable means applying seed is hydro-seeding
- .4 Hand broadcasting of seed is unacceptable under any conditions except for isolated repair work.
- .5 Tackifier:
 - .1 Apply as per labeled manufacturer's specifications for slopes 1:4 and greater or as specified by the Departmental Representative.
- .6 Blend applications into existing adjacent grass areas and previous applications to form uniform surfaces.
- .7 Rake in seed in all areas not accessible with hydro seeder.

3.6 FERTILIZING PROGRAM

- .1 Use only mechanical equipment and check calibration to achieve specified rate.
- .2 Spread 50% of fertilizer in one direction, then 50% at right angles.
- .3 Fertilize during establishment and warranty periods applying fertilizer equally distributed in accordance with the following program:

Application Range	Application Rate	Formulation (NPK Ratio) or soil analysis recommendations supersede ratios noted below
Early spring, as soon as frost is out of the ground	3-kg/100 m ²	11-51-0
During the first two weeks of July	3-kg/100 m ²	27-14-0
During the last two (2) weeks of August	3-kg/100 m ²	16-20-0

- .4 Water immediately after fertilizing according to manufacturer's recommendation, and obtain moisture penetration of 50 mm minimum.

3.7 PREPARATION OF SLURRY

- .1 Measure quantities of materials by weight or weight-calibrated volume measurement satisfactory to Departmental Representative. Supply equipment required for this work.
- .2 Charge required water into seeder. Add seed material and seed fertilizer into hydraulic seeder under agitation and mix thoroughly. Pulverize mulch and charge slowly into seeder.
- .3 After materials are in seeder and well mixed, charge tackifier into seeder and mix thoroughly to complete slurry.
- .4 Notify Departmental Representative 24 hours before loading seeder and allow for an inspection by same at location of loading operation.
- .5 Failure to notify the Departmental Representative before loading occurs can result in rejection of the seeding operation.

3.8 SLURRY APPLICATION

- .1 Ensure seed is placed under supervision of certified Landscape Planting Supervisor.
- .2 Hydraulic seeding equipment:
 - .1 Slurry tank.
 - .2 Agitation system for slurry to be capable of operating during charging of tank and during seeding, consisting of recirculation of slurry and/or mechanical agitation method.
 - .3 Capable of seeding by 50m hand operated hoses and appropriate nozzles.
 - .4 Tank volume to be certified by certifying authority and identified by authorities "Volume Certification Plate".
- .3 Slurry mixture applied per hectare.
 - .1 Seed: grass mixture 300kg/ha.
 - .2 Mulch: 16.0 kg of air dry fibre per 100 m2
 - .3 Tackifier: as per manufacturer's specifications
 - .4 Water: Minimum 30,000 L.
 - .5 Fertilizer: Type and application rate to be determined by a soil test.
 - .6 Liquid Soil Amendment/Micronutrients: Type and application rate to be determined by a soil test.
- .4 Apply slurry uniformly, at optimum angle of application for adherence to surfaces and germination of seed.
 - .1 Using correct nozzle for application.
 - .2 Using hoses for surfaces difficult to reach and to control application.

- .5 Blend application 300 mm into adjacent grass areas or sodded areas to form uniform surfaces.
- .6 Re-apply where application is not uniform.
- .7 Remove slurry from items and areas not designated to be sprayed.

3.9 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
 - .2 Keep pavement and area adjacent to site clean and free from mud, dirt, and debris at all times.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
 - .1 Clean and reinstate areas affected by Work.
- .3 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.
 - .2 Divert unused fertilizer from landfill to official hazardous material collections site approved by Departmental Representative.

3.10 PROTECTION

- .1 Protect seeded areas from trespass until plants are established.
- .2 Remove protection devices as directed by Departmental Representative.

3.11 MAINTENANCE DURING ESTABLISHMENT PERIOD

- .1 Ensure maintenance is carried out under supervision of certified Landscape Maintenance Supervisor.
- .2 Perform following operations from time of seed application until acceptance by Departmental Representative.
- .3 Grass Mixture:
 - .1 Repair and reseed dead or bare spots greater than 150mm to allow establishment of seed prior to acceptance.
 - .2 Seeded area to be cut evenly in a safe and efficient manner.
 - .3 Fire cuts seed areas to 100mm to 200mm or as directed by Departmental Representative.
 - .4 Remove clippings which will smother grass.
 - .5 No grass clippings to be present on sidewalks, pathways or any hard surfaces.

- .6 Control weeds by mechanical means utilizing acceptable integrated pest management practices.
- .7 Water seeded area to maintain optimum soil moisture level for germination and continued growth of grass. Control watering to prevent washouts.

3.12 ACCEPTANCE AND WARRANTY

- .1 Seeded areas will be accepted by Departmental Representative provided that:
 - .1 Plants are uniformly established.
 - .2 Seeded areas are free of rutted, eroded, bare or dead spots.
 - .3 Areas have been mown at least twice.
 - .4 Areas have been fertilized.
- .2 Contractor hereby warrants that seeded areas will remain free of defects until the Final Warranty Inspection.
- .3 Areas seeded will have a final acceptance inspection on the date of the Final Warranty Inspection.
- .4 End-of-warranty inspection will be conducted by Departmental Representative.
- .5 Departmental Representative reserves the right to extend Contractor's warranty responsibilities for an additional one year if, at end of initial warranty period, area seeded do not meet the above acceptance requirements.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 32019033 Tree and Shrub Preservation.

1.2 MEASUREMENT PROCEDURES

- .1 Measure tree pruning for payment per tree.

1.3 REFERENCES

- .1 American National Standard Institute (ANSI)
 - .1 ANSI A300 (Part 1)-[2001], Tree Care Operations - Tree, Shrub and Other Woody Plant Maintenance - Standard Practices (revision and re-designation of ANSI A300-1995) (includes supplements).
 - .2 ANSI A300 (Part 2)-[1998], Tree Care Operations - Tree, Shrub, and Other Woody Plant Maintenance - Standard Practices - Part 2 - Fertilization.
 - .3 ANSI A300 (Part 3)-[2000], Tree Care Operations - Tree, Shrub and Other Woody Plant Maintenance: Standard Practices - Part 3 - Tree Support Systems (a. Cabling, Bracing, and Guying) (supplement to ANSI A300-1995).
- .2 Canadian Nursery Landscape Association (CNLA)
- .3 International Society of Arboriculture (ISA)
- .4 Ontario Ministry of Agriculture, Food and Rural Affairs
 - .1 Publication 483-[2004], Pruning Ornamentals.

1.4 DEFINITIONS

- .1 Crown Cleaning: consists of selective removal of one or more of following items: dead, dying or diseased branches, weak branches and water sprouts.
- .2 Crown Thinning: consists of selective removal of branches to increase light penetration, air movement and reduce weight.
- .3 Crown Raising: consists of removal of lower tree branches to provide clearance.
- .4 Crown Reduction or Crown Shaping: decreases tree height and/or spread.
- .5 Vista Pruning: is selective thinning of framework limbs or specific crown areas to improve views.
- .6 Crown Restoration: improves structure, form and appearance of trees that have been severely headed or vandalized.

1.5 QUALITY ASSURANCE

- .1 Certification: provide International Society of Arboriculture certification.
- .2 Regulatory requirements: provide safety certificate as approved by local hydro utility.
- .3 Field Samples: do sample pruning in manner to enable Departmental Representative to identify:
 - .1 Knowledge of target areas including branch bark ridge and branch collars.
 - .2 Technique for selection process and pruning used to establish desired form and shape for each species.
- .4 Acceptance of Work will be determined by Departmental Representative from field sample.
- .5 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.6 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .2 Place materials defined as hazardous or toxic in designated containers.
- .3 Dispose of unused disinfectant at official hazardous material collections site approved by Departmental Representative .
- .4 Ensure emptied containers are sealed and stored safely.
- .5 Divert wood materials from landfill to location as directed by Departmental Representative.

1.7 TOOL MAINTENANCE

- .1 Ensure that tools are clean and sharp throughout pruning operation: do not use tools that crush or tear bark.
- .2 Disinfect tools before each tree is pruned.
- .3 On diseased plant material disinfect tools before each cut.

Part 2 Products

2.1 DISINFECTANT

- .1 20% solution of sodium hypochlorite or 70% solution of ethyl alcohol.

Part 3 Execution

3.1 APPLICATION

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

3.2 GENERAL

- .1 Prune in accordance with Pruning Ornamentals, and as directed by Departmental Representative. Where discrepancies occur between standard and specifications, specifications govern.
- .2 Notify immediately Departmental Representative conditions detrimental to health of plant material or operations.
- .3 Prune during plant dormant period or after leaves have matured. Avoid pruning during leaf formation, at time of leaf fall, or when seasonal temperature drops below minus 10 degrees C.
- .4 Prune when in full leaf.
- .5 Retain natural form and shape of plant species.
- .6 Do not:
 - .1 Flush cut branches.
 - .2 Crush or tear bark.
 - .3 Cut behind branch bark ridge.
 - .4 Damage branch collars.
 - .5 Damage branches to remain.

3.3 PRUNING

- .1 Remove dead, dying, diseased and weak growth from plant material to promote healthy growth or as directed by Departmental Representative.
- .2 Remove live branches that:
 - .1 Interfere with healthy development and structural strength including branches crossed or rubbing more important branches.
 - .2 Are of weak structure including narrow crotches.
 - .3 Obstruct development of more important branches.
 - .4 Are broken.
- .3 Remove live branches to re-establish natural species form including:
 - .1 One or more developing leaders.
 - .2 Multiple growth due to previous topping.
 - .3 Branches extending outward from natural form.

- .4 Undesirable sucker growth.
- .4 Remove loose branches, twigs and other debris lodged in tree.
- .5 Remove vines.
- .6 For branches under 50 mm in diameter:
 - .1 Locate branch bark ridge and make cuts smooth and flush with outer edge of branch collar to ensure retention of branch collar. Cut target area to bottom of branch collar at angle equal to that formed by line opposite to branch bark ridge.
 - .2 Make cuts on dead branches smooth and flush with swollen callus collar. Do not injure or remove callus collar.
- .7 Do not cut lead branches unless directed by Departmental Representative .For branches greater than 50 mm in diameter:
 - .1 Make first cut on lower side of branch 300 mm from trunk, one third diameter of branch.
 - .2 Make second cut on upper side of branch 500 mm from trunk until branch falls off.
 - .3 Make final cut adjacent to and outside branch collar.
- .8 Ensure that trunk bark and branch collar are not damaged or torn during limb removal.
 - .1 Repair areas which are damaged, or remove damaged area back to next branch collar.
- .9 Remove additional growth designated by [Departmental Representative] [DCC Representative] [Consultant].

3.4 ROOT GIRDLING

- .1 For girdling roots one-quarter size of trunk diameter or larger, V-cut girdling root one-half way through at point where root is crossing.
- .2 Remove exposed portion of girdling root as directed by Departmental Representative after cleanly cutting root flush with grade on each side of parent root. Do not injure bark or parent root.

3.5 CARE OF WOUNDS

- .1 Shape bark around wound to oblong configuration ensuring minimal increase in wound size. Retain peninsulas of existing live bark.

3.6 CLEAN-UP

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.
- .2 Collect, dispose of and remove from sitepruned material as directed by Departmental Representative.
- .3 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

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END OF SECTION

Part 1 General

1.1 SCOPE OF WORK

- .1 The Scope of Work shall include: All Aggregate Base Courses related to work required for the Sinclair Canyon Electrical Upgrade and Site Rehabilitation.

1.2 REFERENCES

- .1 ASTM International
 - .1 ASTM C117, Standard Test Methods for Material Finer Than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.
 - .2 ASTM C131, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
 - .3 ASTM C136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .4 ASTM D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft-lbf/ft³) (600kN-m/m³).
 - .5 ASTM D1557, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000ft-lbf/ft³) (2,700kN-m/m³).
 - .6 ASTM D1883, Standard Test Method for CBR (California Bearing Ratio) of Laboratory Compacted Soils.
 - .7 ASTM D4318, Standard Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Storage and Handling Requirements:
 - .1 Stockpile minimum 50% of total aggregate required prior to beginning operation.
 - .2 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .3 Replace defective or damaged materials with new.
- .3 Develop Construction Waste Management Plan related to Work of this Section.

Part 2 Products

2.1 MATERIALS

- .1 Granular base: material in accordance with the following requirements:
 - .1 Crushed stone or gravel.
 - .2 Gradations to be within limits specified when tested to ASTM C136. Sieve sizes to CAN/CGSB-8.1.
 - .1 Gradation shall fall within BC Ministry of Transportation limits, for the specified classification, shown in Table 202-C to:

TABLE 202-C: AGGREGATE GRADATIONS

Sieve Size (mm)	Percent Passing (%) Sieve Size														
	Surfacing Aggregate	Base Course									Subbase Aggregates			Bridge End Fill	
		HFSA	WGB			IGB			OGB			SGSB	IGSB	OGSB	BEF
			25mm	50mm	75mm	25mm	50mm	75mm	25mm	50mm	75mm				
75	---	---	---	100	---	---	100	---	---	100	100	100	100	100	
50	---	---	100	---	---	100	55 - 100	---	100	70 - 100	---	55 - 100	70 - 100	30 - 100	
37.5	---	---	80 - 100	60 - 100	---	60 - 100	40 - 80	---	75 - 100	50 - 85	---	40 - 80	50 - 85	---	
25	100	100	---	---	100	40 - 75	---	100	---	---	---	---	---	---	
19	85 - 100	80 - 100	50 - 100	35 - 80	65 - 100	---	17 - 40	75 - 100	35 - 65	15 - 55	15 - 100	17 - 40	15 - 55	20 - 100	
12.5	---	---	---	---	---	15 - 40	---	---	---	---	---	---	---	---	
9.5	60 - 85	50 - 85	35 - 75	25 - 60	30 - 70	---	---	30 - 65	5 - 35	---	0 - 100	---	---	---	
6.3	---	---	---	---	---	---	---	---	---	0 - 20	---	---	0 - 20	---	
4.75	40 - 70	35 - 70	25 - 55	20 - 40	15 - 40	---	---	5 - 30	0 - 15	---	---	---	---	10 - 60	
2.36	---	25 - 50	20 - 40	15 - 30	10 - 30	10 - 25	10 - 25	0 - 10	0 - 10	0 - 10	---	10 - 25	0 - 10	---	
1.18	20 - 50	15 - 35	15 - 30	10 - 20	---	---	---	---	---	---	---	---	---	6 - 32	
0.60	---	---	---	---	---	---	---	---	---	---	0 - 100	---	---	---	
0.30	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
0	10 - 30	5 - 20	5 - 15	3 - 10	5 - 15	5 - 15	4 - 15	0 - 8	0 - 8	0 - 8	0 - 15	4 - 15	0 - 8	4 - 15	
0.075	5 - 15	0 - 5	0 - 5	0 - 5	0 - 5	0 - 5	0 - 5	0 - 5	0 - 5	0 - 5	0 - 5	0 - 5	0 - 5	0 - 5	

- .2 Liquid limit: to ASTM D4318, maximum 25
- .3 Plasticity index: to ASTM D4318, maximum 6.
- .4 Los Angeles degradation: to ASTM C131. Max. % loss by weight: 45
- .5 Crushed particles: at least 60% of particles by mass within each of following sieve designation ranges to have at least 1 freshly fractured face. Material to be divided into ranges using methods of ASTM C136.

Passing	Retained on	
[50] mm	to	[25] mm
[25] mm	to	[19.0] mm
[19.0] mm	to	[4.75] mm

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 Sinclair Creek; contractor to submit erosion and sediment control drawings and plan, specific to site, that complies with requirements of authorities having jurisdiction or British Columbia Ministry of Transportation 2016 Standard Specifications for Highway Construction - Section 165 – Protection of the Environment, whichever is more stringent.
 - .2 Inspect, repair, and maintain erosion and sedimentation control measures through construction.
 - .3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal after completion of work.

3.2 PLACEMENT AND INSTALLATION

- .1 Place granular base after 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 For spreading and shaping material, use spreader boxes having adjustable templates or screeds which will place material in uniform layers of required thickness.
 - .7 Place material to full width in uniform layers not exceeding 150 mm compacted thickness.
 - .8 Shape each layer to smooth contour and compact to specified density before succeeding layer is placed.
 - .9 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:

- .1 Compact to density not less than 98% corrected maximum dry density to ASTM D698, 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.
- .5 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.
- .5 Proof Rolling:
 - .1 Obtain written approval from Departmental Representative to use nonstandard proof rolling equipment.
 - .2 Make sufficient passes with proof roller to subject every point on surface to three separate passes of loaded tire.
 - .3 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 granular material as specified by Departmental Representative.
 - .3 Replace base material and compact in accordance with this Section.
 - .4 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 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

END OF SECTION

Part 1 General

1.1 SCOPE OF WORK

- .1 The Scope of work shall include: All Asphalt Paving related to work required for the Sinclair Canyon Electrical Upgrade and Site Rehabilitation.

1.2 REFERENCES

- .1 ASTM International
 - .1 ASTM C88, Standard Test Method for Soundness of Aggregates by Use of Sodium Sulphate or Magnesium Sulphate.
 - .2 ASTM C117, Standard Test Method for Material Finer Than 0.075mm (No.200) Sieve in Mineral Aggregates by Washing.
 - .3 ASTM C123, Standard Test Method for Lightweight Particles in Aggregate.
 - .4 ASTM C127, Standard Test Method for Specific Gravity and Absorption of Coarse Aggregate.
 - .5 ASTM C128, Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Fine Aggregate.
 - .6 ASTM C131, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
 - .7 ASTM C136, Standard Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .8 ASTM D995, Standard Specification for Mixing Plants for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures.
 - .9 ASTM D2419, Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate.
 - .10 ASTM D3203, Standard Test Method for Percent Air Voids in Compacted Dense and Open Bituminous Paving Mixtures.
 - .11 ASTM D4791, Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate.
- .2 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .3 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for asphalt mixes and aggregate and include product characteristics, performance criteria, physical size, finish and limitations.
- .4 Samples:
 - .1 Inform Departmental Representative of proposed source of aggregates and provide access for sampling 2 weeks prior to beginning Work.

- .2 Submit samples of following materials proposed for use 2 weeks prior to beginning Work.
 - .1 One 5 L container of asphalt cement.
- .5 Certificates:
 - .1 Certification to be marked on pipe.
- .6 Test and Evaluation Reports:
 - .1 Submit manufacturer's test data and certification that asphalt cement meets specification requirements.
 - .2 Submit manufacturer's test data and certification that hydrated lime meets specified requirements.
 - .3 Submit asphalt concrete mix design and trial mix test results to Departmental Representative for review.
 - .4 Submit printed record of mix temperatures at end of each day.

1.3 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Develop Construction Waste Management Plan related to Work of this SectionProducts

1.4 MATERIALS

- .1 Asphalt to be supplied by Plant and to match Asphalt Pavement design provided by Departmental Representative.
- .2 Job Mix Formula is not accepted for use.

1.5 EQUIPMENT

- .1 Pavers: mechanical self-powered pavers capable of spreading mix within specified tolerances, true to line, grade and crown indicated.
- .2 Rollers: sufficient number of type and weight to obtain specified density of compacted mix.
- .3 Vibratory rollers:
 - .1 Drum diameter: 1200 mm minimum.
 - .2 Amplitude of vibration (machine setting): 0.5 mm maximum for lifts less than 40 mm thick.
- .4 Haul trucks: sufficient number and of adequate size, speed and condition to ensure orderly and continuous operation and as follows:
 - .1 Boxes with tight metal bottoms.
 - .2 Covers of sufficient size and weight to completely cover and protect asphalt mix when truck fully loaded.

- .3 In cool weather or for long hauls, insulate entire contact area of each truck box.
- .4 Use only trucks which can be weighed in single operation on scales supplied.
- .5 Hand tools:
 - .1 Lutes or rakes with covered teeth for spreading and finishing operations.
 - .2 Tamping irons having mass 12 kg minimum and bearing area not exceeding 310 cm² for compacting material along curbs, gutters and other structures inaccessible to roller. Mechanical compaction equipment, when approved by, may be used instead of tamping irons.
 - .3 Straight edges, 4.5 m in length, to test finished surface.

1.6 MIX DESIGN

- .1 Mix design to be provided in writing by Departmental Representative.
- .2 Mix design to be developed by testing laboratory approved in writing by Departmental Representative.

Part 2 Execution

2.1 EXAMINATION

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

2.2 PREPARATION

- .1 Temporary Erosion and Sedimentation Control:
 - .1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and Sinclair Creek; contractor to submit erosion and sediment control drawings and plan, specific to site, that complies with requirements of authorities having jurisdiction or British Columbia Ministry of Transportation 2016 Standard Specifications for Highway Construction - Section 165 – Protection of the Environment, whichever is more stringent.
 - .2 Inspect, repair, and maintain erosion and sedimentation control measures through construction.

- .3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal after completion of work.
- .1 When paving over existing asphalt surface, clean pavement surface in accordance with Section 32 01 11.01 - Pavement Cleaning and Marking Removal.
 - .1 When levelling course is not required, patch and correct depressions and other irregularities to approval of Departmental Representative before beginning paving operations.
- .2 Apply prime coat.
- .3 Prior to laying mix, clean surfaces of loose and foreign material.

2.3 TRANSPORTATION OF MIX

- .1 Transport mix to job site in vehicles cleaned of foreign material.
- .2 Paint or spray truck beds with limewater, soap or detergent solution, or non-petroleum based commercial product, at least daily or as required.
 - .1 Raise truck bed and thoroughly drain, and ensure no excess solution remains in truck bed.
- .3 Schedule delivery of material for placing in daylight, unless Departmental Representative approves artificial light for night placing.
- .4 Deposit mix from surge or storage silo to trucks in multiple drops to reduce segregation.
 - .1 Do not dribble mix into trucks.
- .5 Deliver material to paver at uniform rate and in an amount within capacity of paving and compacting equipment.
- .6 Deliver loads continuously in covered vehicles and immediately spread and compact.
 - .1 Deliver and place mixes at temperature within range as directed by Departmental Representative, but not less than 135 degrees C.

2.4 PLACING

- .1 Obtain Departmental Representative's approval of base, existing surface, and prime coat prior to placing asphalt.
- .2 Place asphalt concrete to thicknesses, grades and lines as indicated.
- .3 Placing conditions:
 - .1 Place asphalt mixtures only when air temperature is 5 degrees C minimum.
 - .2 When temperature of surface on which material is to be placed falls below 10 degrees C, provide extra rollers as necessary to obtain required compaction before cooling.
 - .3 Do not place hot-mix asphalt when pools of standing water exist on surface to be paved, during rain, or when surface is damp.
- .4 Place asphalt concrete in compacted lifts of thickness.

- .5 Where possible do tapering and levelling where required in lower lifts. Overlap joints by not less than 300 mm.
- .6 Spread and strike off mixture with self-propelled mechanical finisher.
 - .1 Construct longitudinal joints and edges true to line markings.
 - .1 Departmental Representative to establish lines for paver to follow parallel to centerline of proposed pavement. Position and operate paver to follow established line closely.
 - .2 Maintain constant head of mix in auger chamber of paver during placing.
 - .3 If segregation occurs, immediately suspend spreading operation until cause is determined and corrected.
 - .4 Correct irregularities in alignment left by paver by trimming directly behind machine.
 - .5 Correct irregularities in surface of pavement course directly behind paver.
 - .1 Remove excess material forming high spots using shovel or lute.
 - .1 Fill and smooth indented areas with hot mix.
 - .2 Do not broadcast material over such areas.
 - .6 Do not throw surplus material on freshly screeded surfaces.
- .7 When hand spreading is used:
 - .1 Use approved wood or steel forms, rigidly supported to assure correct grade and cross section.
 - .1 Use measuring blocks and intermediate strips to aid in obtaining required cross-section.
 - .2 Distribute material uniformly without broad casting material.
 - .3 During spreading operation, thoroughly loosen and uniformly distribute material by lutes or covered rakes.
 - .1 Reject material that has formed into lumps and does not break down readily.
 - .4 After placing and before rolling, check surface with templates and straightedges and correct irregularities.
 - .5 Provide heating equipment to keep hand tools free from asphalt.
 - .1 Control temperature to avoid burning material.
 - .2 Do not use tools at higher temperature than temperature of mix being placed.

2.5 COMPACTING

- .1 Roll asphalt continuously using established rolling pattern for test strip and to density of not less than 100 % of maximum density determined.
- .2 Do not change rolling pattern unless mix changes or lift thickness changes.
- .3 General:

- .1 Provide at least 2 rollers and as many additional rollers as necessary to achieve specified pavement density. When more than 2 rollers are required, 1 roller must be pneumatic tired type.
- .2 Start rolling operations as soon as placed mix can bear weight of roller without excess displacement of material or cracking of surface.
- .3 Operate roller slowly initially to avoid displacement of material. Do not exceed 5 km/h for breakdown and intermediate rolling for static steel-wheeled and pneumatic tired rollers. Do not exceed 9 km/h for finish rolling.
- .4 Use static compaction for levelling course less than 25 mm thick.
- .5 For lifts 50 mm thick and greater, adjust speed and vibration frequency of vibratory rollers to produce minimum of 25 impacts per metre of travel. For lifts less than 50 mm thick, impact spacing not to exceed compacted lift thickness.
- .6 Overlap successive passes of roller by minimum of 200 mm and vary pass lengths.
- .7 Keep wheels of roller slightly moistened with water to prevent pick-up of material but do not over-water.
- .8 Do not stop vibratory rollers on pavement that is being compacted with vibratory mechanism operating.
- .9 Do not permit heavy equipment or rollers to stand on finished surface before it has been compacted and has thoroughly cooled.
- .10 After traverse and longitudinal joints and outside edge have been compacted, start rolling longitudinally at low side and progress to high side.
 - .1 Ensure that all points across width of pavement receive essentially equal numbers of passes of compactors.
- .11 Where rolling causes displacement of material, loosen affected areas at once with lutes or shovels and restore to original grade of loose material before re-rolling.
- .4 Breakdown rolling:
 - .1 Begin breakdown rolling with static steel wheeled roller immediately following rolling of transverse and longitudinal joint and edges.
 - .2 Operate rollers as close to paver as necessary to obtain adequate density without causing undue displacement.
 - .3 Operate breakdown roller with drive roll or wheel nearest finishing machine. When working on steep slopes or super-elevated sections use operation approved by Departmental Representative.
 - .4 Use only experienced roller operators.
- .5 Intermediate rolling:
 - .1 Use pneumatic-tired, steel wheel or vibratory rollers and follow breakdown rolling as closely as possible and while paving mix temperature allows maximum density from this operation.
 - .2 Rolling to be continuous after initial rolling until mix placed has been thoroughly compacted.

- .6 Finish rolling:
 - .1 Accomplish finish rolling with two-axle or three-axle tandem steel wheeled rollers while material is still warm enough for removal of roller marks.
 - .1 If necessary to obtain desired surface finish, use pneumatic-tired rollers as directed by Departmental Representative.
 - .2 Conduct rolling operations in close sequence.
- .7 Dust entire area of sheet asphalt pavements immediately after rolling to eliminate tendency to pick-up under traffic.

2.6 JOINTS

- .1 General:
 - .1 Remove surplus material from surface of previously laid strip.
 - .1 Do not deposit on surface of freshly laid strip.
 - .2 Construct joints between asphalt concrete pavement and Portland cement concrete pavement as indicated.
 - .3 Paint contact surfaces of existing structures such as manholes, curbs or gutters with bituminous material prior to placing adjacent pavement.
- .2 Transverse joints:
 - .1 Offset transverse joint in succeeding lifts by at least 600 mm.
 - .2 Cut back to full depth vertical face and tack face with thin coat of hot asphalt prior to continuing paving.
 - .3 Compact transverse joints to provide smooth riding surface. Use methods to prevent rounding of compacted surface at joints.
- .3 Longitudinal joints:
 - .1 Offset longitudinal joints in succeeding lifts by at least 150 mm.
 - .2 Cold joint is defined as joint where asphalt mix is placed, compacted and left to cool below 100 degrees C prior to paving of adjacent lane.
 - .3 Overlap previously laid strip with spreader by 25 to 50 mm.
 - .4 Before rolling, carefully remove and discard coarse aggregate in material overlapping joint with lute or rake.
 - .5 Roll longitudinal joints directly behind paving operation.
 - .6 When rolling with static or vibratory rollers, have most of drum width ride on newly placed lane with remaining 150 mm extending onto previously placed and compacted lane.
- .4 Construct feather joints so that thinner portion of joint contains fine graded material obtained by changed mix design or by raking out coarse aggregate in mix.
 - .1 Place and compact joint to ensure joint is smooth and without visible breaks in grade.

- .2 Locate feather joints as indicated.
- .5 Construct butt joints as indicated.

2.7 SLURRY CEMENT BACKFILL

- .1 Materials
 - .1 Slurry cement backfill shall consist of a fluid, workable mixture of aggregate, cementitious material, and water.
- .2 Preparation
 - .1 Ensure trench is clean and free of deleterious materials.
 - .2 Ensure trench is compacted and subgrade has been prepped for pouring of slurry.
 - .3 Edges of asphalt are to be sawcut and squared off.
- .3 Placing
 - .1 Fill the trench with concrete slurry from the bottom of excavation to a maximum of 40mm below the lip of gutter.
 - .2 Slurry cement backfill shall be placed in a uniform manner that will prevent voids in, or segregation of, the backfill.
 - .3 Surface of slurry to be roughened (raked).

2.8 FINISH TOLERANCES

- .1 Finished asphalt surface to be within 5 mm of design elevation but not uniformly high or low.
- .2 Finished asphalt surface not to have irregularities exceeding 5 mm when checked with 4.5 m straight edge placed in any direction.

2.9 DEFECTIVE WORK

- .1 Correct irregularities which develop before completion of rolling by loosening surface mix and removing or adding material as required.
 - .1 If irregularities or defects remain after final compaction, remove surface course promptly and lay new material to form true and even surface and compact immediately to specified density.
- .2 Repair areas showing checking, rippling, or segregation.
- .3 Adjust roller operation and screed settings on paver to prevent further defects such as rippling and checking of pavement.

2.10 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

END OF SECTION

Part 1 General

1.1 SCOPE OF WORK

- .1 The Scope of work shall include: Slurry Cement Backfill for asphalt rehabilitation related to work required for the Sinclair Canyon Electrical Upgrade and Site Rehabilitation.

1.2 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Develop Construction Waste Management Plan related to Work of this Section.

1.3 MATERIALS

- .1 Slurry cement backfill shall consist of a fluid, workable mixture of aggregate, cementitious material, and water.

1.4 EQUIPMENT

- .1 Hand tools:
 - .1 Lutes or rakes with covered teeth for spreading and finishing operations.

Part 2 Execution

2.1 EXAMINATION

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

2.2 PREPARATION

- .1 Ensure trench is clean and free of deleterious materials.
- .2 Ensure trench is compacted and subgrade has been prepped for pouring of slurry.
- .3 Edges of asphalt are to be sawcut and squared off.

2.3 PLACING

- .1 Fill the trench with concrete slurry from the bottom of excavation to a maximum of 40mm below the lip of gutter.
- .2 Slurry cement backfill shall be placed in a uniform manner that will prevent voids in, or segregation of, the backfill.
- .3 Surface of slurry to be roughened (raked).

2.4 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

END OF SECTION

Part 1 General

1.1 SCOPE OF WORK

- .1 The Scope of Work shall include: All Storm Utility Drainage Piping related to work required for the Sinclair Canyon Electrical Upgrade and Site Rehabilitation.

1.2 REFERENCES

- .1 ASTM International
 - .1 ASTM C14M, Standard Specification for Concrete Sewer, Storm Drain and Culvert Pipe (Metric).
 - .2 ASTM C76M, Standard Specification for Reinforced Concrete Culvert, Storm Drain and Sewer Pipe (Metric).
 - .3 ASTM C117, Standard Test Method for Material Finer Than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.
 - .4 ASTM C136, Standard Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .5 ASTM D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³(600 kN-m/m³)).
- .2 CSA International
 - CSA G401-07, Corrugated Steel Pipe Products

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 instructions, printed product literature and data sheets for pipes, and backfill and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Shop drawings to indicate proposed method for installing carrier pipe for undercrossings.
 - .2 Submit drawings stamped and signed by professional engineer registered or licensed in Province

- .4 Samples
 - .1 Inform Departmental Representative at least 4 weeks prior to beginning Work, of proposed source of bedding materials and provide access for sampling.
- .5 Certification to be marked on pipe.
- .6 Test and Evaluation Reports: submit manufacturer's test data and certification at least 2 weeks prior to beginning Work.
- .7 Manufacturer's Instructions: submit to Departmental Representative 1 copy of manufacturer's installation instructions.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements with manufacturer's written instructions.
- .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:
 - a. Store materials in accordance with manufacturer's recommendations.
 - b. Store and protect pipes from damage.
 - c. Replace defective or damaged materials with new.
 - d. Develop Waste Reduction Workplan related to Work of this Section.

Part 2 Products

2.1 CORRUGATED STEEL PIPE

- .1 Corrugated steel pipe and couplers: to CSA G401.
 - .1 Gaskets: to ASTM D1056.

2.2 PIPE BEDDING AND SURROUND MATERIAL

- .1 As indicated on the engineering drawings.

2.3 BACKFILL MATERIAL

- .1 As indicated on the engineering drawings.
- .2 Type 3 in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.
- .3 Unshrinkable fill: in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

2.4 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 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 Sinclair Creek; contractor to submit erosion and sediment control drawings and plan, specific to site, that complies with requirements of authorities having jurisdiction or British Columbia Ministry of Transportation 2016 Standard Specifications for Highway Construction - Section 165 – Protection of the Environment, whichever is more stringent.
 - .2 Inspect, repair, and maintain erosion and sedimentation control measures through construction.
 - .3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal after completion of work.
- .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.
- .4 Water jetting of backfill under haunches of corrugated steel pipe may be permitted if recommended by manufacturer and approved by Departmental Representative.

3.3 GRANULAR BEDDING

- .1 Place bedding in unfrozen condition.
- .2 Place granular bedding material in uniform layers not exceeding 150 mm compacted thickness to depth as indicated to depth of mm.
- .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 % corrected maximum dry density maximum density to ASTM D698.
- .6 Fill excavation below bottom of specified bedding adjacent to manholes or catch basins with lean mix concrete compacted bedding material compacted common backfill.

3.4 INSTALLATION

- .1 Lay and join pipes to: ASTM C12.
- .2 Lay and join pipe in accordance with manufacturer's recommendations and to approval of Departmental Representative.
- .3 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.
- .4 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.
- .5 Begin laying at outlet and proceed in upstream direction with socket ends of pipe facing upgrade.
- .6 Lay corrugated steel pipe:
 - .1 With outside circumferential laps facing upgrade and longitudinal laps or seams at side or quarter points.
 - .2 With longitudinal centre line of paved invert coinciding with flow line.
- .7 Joint deflection permitted within limits recommended by pipe manufacturer.
- .8 Water to flow through pipes during construction only as permitted by Departmental Representative.
- .9 Whenever Work is suspended, install removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.
- .10 Joints:
 - .1 Match corrugations or indentations of coupler band with pipe sections before tightening.
 - .2 Tap coupler firmly while tightening, to take up slack and ensure snug fit.
 - .3 Ensure bolts are inserted and tightened.
 - .4 Support pipes with hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.

- .5 Align pipes before joining.
- .6 Maintain pipe joints free from mud, silt, gravel and other foreign material.
- .7 Avoid displacing gasket or contaminating with dirt or other foreign material. Remove disturbed or dirty gaskets; clean, lubricate and replace before joining is attempted.
- .8 Complete each joint before laying next length of pipe.
- .9 Minimize joint deflection after joint has been made to avoid joint damage.
- .10 Apply sufficient pressure in making joints to ensure that joint is complete as outlined in manufacturer's recommendations.
- .11 Mortared joints:
 - .1 Pipe interior: circular pipes 700 mm diameter and larger, and arch or elliptical pipe equivalent to 900 mm diameter or larger shall have interior gap between ends of adjacent pipes filled with mortar.
 - .1 Apply mortar minimum 7 days after backfilling has been completed to allow pipe settlement to occur.
 - .2 Finish interior surface of joints smooth.
 - .2 Pipe exterior: for bell and spigot pipe, use mortar to seal outside of joints. Press and bed mortar into place.
 - .1 Allow mortar to set minimum of 1 hour before backfilling.
- .12 When any stoppage of Work occurs, restrain pipes as directed by Departmental Representative, to prevent "creep" during down time.

- .13 Plug lifting holes with Departmental Representative approved prefabricated plugs, set in shrinkage compensating grout.
- .14 Cut pipes as required for special inserts, fittings or closure pieces, as recommended by pipe manufacturer, without damaging pipe or its coating and to leave smooth end at right angles to axis of pipe.
- .15 Make watertight connections to manholes and catch basins.
 - .1 Use shrinkage compensating grout when suitable gaskets are not available.
- .16 Use prefabricated saddles or approved field connections for connecting pipes to existing sewer pipes.
 - .1 Joint to be structurally sound and watertight.
- .17 Temporarily plug open upstream ends of pipes with removable watertight concrete, steel or plastic bulkheads.

3.5 PIPE SURROUND

- .1 Place surround material in unfrozen condition.
- .2 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.
- .3 Hand place surround material in uniform layers not exceeding 150 mm compacted thickness as indicated.
 - .1 Do not dump material within 5 m of pipe.
- .4 Place layers uniformly and simultaneously on each side of pipe.
- .5 Compact each layer from pipe invert to mid height of pipe to at least 95 % corrected maximum dry density maximum density to ASTM D698.
- .6 Compact each layer from mid height of pipe to underside of backfill to at least 90 % corrected maximum dry density maximum density to ASTM D698.
- .7 When field test results are acceptable to Departmental Representative, place surround material at pipe joints.

3.6 BACKFILL

- .1 Place backfill material in unfrozen condition.
- .2 Place backfill material, above pipe surround, in uniform layers not exceeding 150 mm compacted thickness up to grades as indicated.
- .3 Under paving and walks, compact backfill to at least 95 % corrected maximum dry density maximum density to ASTM D698. In other areas, compact backfill to at least 90 % corrected maximum dry density maximum density to ASTM D698.
- .4 Place unshrinkable backfill in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

3.8 UNDERCROSSING

- .1 Excavate working pit to dimensions indicated, outside right-of-way to be crossed.
- .2 Excavate working pit to minimum of 0.5 m below lowest invert of encasing pipe.
- .3 Dewater excavation.
- .4 Dewater area of undercrossing.
- .5 Install heavy timber steel frame backstop.
- .6 Install encasing pipe by jacking boring tunnelling.
- .7 Ensure encasing pipe is not in tension.
- .8 Use mechanical welded type joints for encasing pipe.
- .9 Place concrete grout levelling pad in encasing pipe. Carefully control level of grout during placing.
- .10 Provide shop drawings showing proposed method of installation for storm sewer pipe.
- .11 Insert storm sewer pipe into encasement pipe, in end with largest opening after placement of levelling pad.
- .12 Use approved blocking method to guide storm sewer pipe in true alignment.
- .13 Clearance between blocks and encasement pipe: maximum 12 mm when storm sewer pipe is in position.
- .14 Join storm sewer pipe one length at time outside encasement pipe. Push Pull storm sewer pipe into position.
- .15 Couplings of storm sewer pipe: not to rest on levelling pad when carrier pipe is in position.
- .16 Place 20 MPa concrete cradle around storm sewer pipe after it is positioned.
 - .1 Cradle to be minimum of 225 mm and maximum of 300 mm above levelling pad.
- .17 Pressure grout remaining void with grout consisting of one part Portland cement and two parts clean washed sand with only sufficient amount of water added to allow placement.
 - .1 Install pressure grout after storm sewer pipe is secure against flotation.
 - .2 Do not use additives.
- .18 Do field testing before placing concrete cradle and grouting.

3.9 FIELD TESTS AND INSPECTIONS

- .1 Repair or replace pipe, pipe joint or bedding found defective.
- .2 Draw tapered wooden plug with diameter of 50 mm less than nominal pipe diameter through sewer to ensure that pipe is free of obstruction directed by Departmental Representative.
- .3 Remove foreign material from sewers and related appurtenances by flushing with water.

3.10 CLEANING

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

END OF SECTION

Part 1 General

1.1 SCOPE OF WORK

- .1 The Scope of Work shall include: All Pipe Culverts related to work required for the Sinclair Canyon Electrical Upgrade and Site Rehabilitation.

1.2 REFERENCES

- .1 ASTM International
 - .1 ASTM C14M, Standard Specification for Nonreinforced Concrete Sewer, Storm Drain and Culvert Pipe (Metric).
 - .2 ASTM C76M, Standard Specification for Reinforced Concrete Culvert, Storm Drain and Sewer Pipe (Metric).
 - .3 ASTM C117, Standard Test Method for Material Finer Than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.
 - .4 ASTM C136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .5 ASTM C144, Standard Specification for Aggregate for Masonry Mortar.
 - .6 ASTM D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
- .1 CSA International
 - .1 CAN/CSA G401-07, Corrugated Steel Pipe Products.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for pipes and backfill and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Samples:
 - .1 Inform Departmental Representative at least 4 weeks before beginning Work, of proposed source of bedding materials and provide access for sampling.
 - .2 Submit to Departmental Representative for testing, at least 4 weeks before beginning Work.
- .4 Certification: to be marked on pipe.
- .5 Test and Evaluation Reports:
 - .1 Submit manufacturer's test data and certification at least 4 weeks prior to beginning Work.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 – Common Product Requirements.
- .2 Product Requirements with manufacturer's written instructions.
 - .1 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 Waste Reduction Workplan related to Work of this Section.

Part 2 Products

2.1 CORRUGATED STEEL PIPE

- .1 Corrugated steel pipe: to CAN/CSA-G401.
- .2 Water-tight cut-off collars: as indicated.
- .3 Prefabricated end sections
- .4 Corrugated fluming: to CAN/CSA-G401.

2.2 CORRUGATED POLYETHYLENE PIPE AND FITTINGS

- .1 To ASTM F667.
 - .1 Polyethylene resin: to ASTM D1248, grade W8 W9.
 - .2 Weathering resistance: to ASTM D1248, Class C

2.3 GRANULAR BEDDING AND BACKFILL

- .1 Granular bedding and backfill material to the following requirements:
 - .1 Crushed pit run or screened stone, gravel or sand.
 - .2 Gradations to be within limits specified when tested to ASTM C136 and ASTM C117. Sieve sizes to CAN/CGSB-8.1 CAN/CGSB-8.2.
- .2 Concrete mixes and materials for bedding, cradles, encasement, supports: to Section 03 30 00- Cast-in-Place Concrete.

Part 3 Execution

3.1 EXAMINATION

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

3.2 PREPARATION

- .1 Temporary Erosion and Sedimentation Control:
 - .1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and Sinclair Creek; contractor to submit erosion and sediment control drawings and plan, specific to site, that complies with requirements of authorities having jurisdiction or British Columbia Ministry of Transportation 2016 Standard Specifications for Highway Construction - Section 165 – Protection of the Environment, whichever is more stringent.
 - .2 Inspect, repair, and maintain erosion and sedimentation control measures through construction.
 - .3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal after completion of work.

3.3 TRENCHING

- .1 Do trenching Work in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.
- .2 Obtain Departmental Representative's approval of trench line and depth prior to placing bedding material or pipe.

3.4 BEDDING

- .1 Dewater excavation, as necessary, to allow placement of culvert bedding in dry condition.
- .2 Place 200 mm minimum thickness of approved granular material on bottom of excavation and compact to 95% minimum of maximum density to ASTM D698.

- .3 Shape bedding to fit lower segment of pipe exterior so that width of at least 50% of pipe diameter is in close contact with bedding and to camber as indicated or as directed by Departmental Representative, free from sags or high points.
- .4 Place bedding in unfrozen condition.

3.5 LAYING CORRUGATED STEEL PIPE CULVERTS

- .1 Begin pipe placing at downstream end.
- .2 Ensure bottom of pipe is in contact with shaped bed or compacted fill throughout its length.
- .3 Lay pipe with outside circumferential laps facing upstream and longitudinal laps or seams at side or quarter points.
- .4 Lay paved invert or partially lined pipe with longitudinal centre line of paved segment coinciding with flow line.
- .5 Do not allow water to flow through pipes during construction except as permitted by Departmental Representative.

3.6 JOINTS: CORRUGATED STEEL CULVERTS

- .1 Corrugated steel pipe:
 - .1 Match corrugations or indentations of coupler with pipe sections before tightening.
 - .2 Tap couplers firmly as they are being tightened, to take up slack and ensure snug fit.
 - .3 Insert and tighten bolts.

3.7 LAYING CONCRETE PIPE CULVERTS

- .1 Begin at downstream end of culvert with flanged end of first pipe section facing upstream.
- .2 Ensure barrel of each pipe is in contact with shaped bed throughout its length.
- .3 Allow water to flow through pipes during construction only as permitted by Departmental Representative.

3.8 JOINTS: CONCRETE PIPE CULVERTS

- .1 Joints may be made with rubber gaskets, bituminous jointing compound or Portland cement mortar.
 - .1 Mortar joints:
 - .1 Prepare mortar as specified herein.
 - .2 Clean pipe ends and wet with water before joint is made.
 - .3 Place mortar in lower half of flanged end of pipe section in place.
 - .4 Apply mortar to upper half of tapered end of pipe section being installed.
 - .5 Join pipe ends and force joint up tight, taking care to ensure inner surfaces of abutting pipe sections are flush and even.

- .6 Clean inside of pipe and annular space between ends of pipes after each joint is made.
- .7 Fill joint with mortar and finish smooth and even.
- .8 For pipes 800 mm or less diameter, fill joints before mortar in joints has set.
- .9 For pipes over 800 mm diameter, postpone filling joint until backfilling has been completed. Re-clean joints before applying mortar.

3.9 LAYING CORRUGATED POLYETHYLENE PIPE CULVERTS

- .1 Begin laying at downstream end of culvert.
- .2 Install pipe in trench by lowering.
- .3 Ensure bottom of pipe is in contact with shaped bedding throughout pipe length.
- .4 Allow water to flow through pipes during construction only as permitted by Departmental Representative.

3.10 JOINTS FOR POLYETHYLENE CULVERTS

- .1 Install couplings in accordance with manufacturer's instructions.

3.11 BACKFILLING

- .1 Backfill around and over culverts as indicated or as directed by Departmental Representative.
- .2 Place granular backfill material in 150 mm layers to full width, alternately on each side of culvert, so as not to displace it laterally or vertically.
- .3 Compact each layer to 95% corrected maximum dry density maximum density to ASTM D698 taking special care to obtain required density under haunches.
- .4 Protect installed culvert with minimum 900 mm cover of compacted fill before heavy equipment is permitted to cross.
 - .1 During construction, width of fill, at its top, to be at least twice diameter or span of pipe and with slopes not steeper than 1:2.
- .5 Place backfill in unfrozen condition.

3.12 CLEANING

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

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section- 31 23 33.01 - Excavation Trenching & Backfilling
- .2 Section – 26 05 34 - Conduits, Conduit Fastening & Conduit fittings
- .3 Section – 26 05 43.01- Installation of Cables in Trenches and Ducts

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

1.3 QUALITY ASSURANCE

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

1.4 DELIVERY, STORAGE AND HANDLING

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

Part 2 Products

2.1 CABLE PULLING EQUIPMENT

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

2.2 MARKERS

- .1 Concrete type cable markers: as indicated, with words: "Cable", "Joint" or "Conduit" impressed in top surface, with arrows to indicate change in direction of duct runs.

2.3 WARNING TAPE

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

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

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

3.3 CLEANING

- .1 Clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.
- .2 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

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DCU – SINCLAIR CANYON ELECTRICAL UPGRADE
AND SITE REHABILITATION
KOOTENAY NATIONAL PARK, BC
DIRECT BURIED UNDERGROUND CABLE DUCTS

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END OF SECTION