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[DRAWING PACKAGE]:

Len's Snowshed Lighting

Drawing Reference No.	Drawing No.	Rev.	Description
G2002R1	1	-	COVER SHEET, INDEX & GENERAL ARRANGEMENT
G2002R1	2	-	PLAN – LUMINAIRE LAYOUT (SHEET 1 OF 2)
G2002R1	3	-	PLAN – LUMINAIRE LAYOUT (SHEET 2 OF 2)
G2002R1	4	-	DETAILS – TUNNEL LUMINAIRE RISER DIAGRAM
G2002R1	5	-	DETAILS – LUMINAIRE MOUNTING
G2002R1	6	-	SECTIONS – CONDUIT CROSSING (WEST ENTRANCE)
G2002R1	7	-	SECTIONS – CONDUIT CROSSING (EAST & WEST ENTRANCE)
G2002R1	8	-	SECTIONS – LUMINAIRE MOUNTING LOCATIONS
G2002R1	9	-	DETAILS – LUMINAIRE MOUNTING
G2002R1	10	-	DETAILS – SPLICE BOX WIRING
G2002R1	11	-	BLOCK DIAGRAM – LIGHTING CONTROL

High and Low Voltage Distribution Systems

Drawing Reference No.	Drawing No.	Rev.	Description
G2002R1	1	-	COVER SHEET, INDEX & SITE PLAN
G2002R1	2	-	SYMBOL, LEGEND & ABBREVIATIONS
G2002R1	3	-	GENERAL NOTES
G2002R1	12	-	PLAN – STA. 23+024 TO STA. 21+600
G2002R1	18	-	BLOCK & FIBRE RISER DIAGRAM – LIGHTING & POWER CONTROL SYSTEM
G2002R1	40	-	SWITCHGEAR LAYOUT – LEN'S
G2002R1	42	-	UNDERGROUND LAYOUT – LEN'S
G2002R1	43	-	ABOVE GROUND LAYOUT – LEN'S
G2002R1	46	-	SINGLE LINE DIAGRAM – LOW VOLTAGE – LEN'S

For reference for removals the following drawings will also be provided:

Drawing Reference No.	Drawing No.	Rev.	Description
G2002R1	1	-	GENERAL ARRANGMENT – SITE PLANS
G2002R1	13	-	LUMINAIRE LAYOUT AND CIRCUIT CONNECTION
G2002R1	14	-	HYDRO SERVICE/LIGHTING CONTROL – KIOSKS LAYOUT
G2002R1	15	-	HYDRO SERVICE/LIGHTING CONTROL – KIOSKS DETAILS
G2002R1	16	-	PLC LAYOUT AND LUMINAIRE CONTROL – WIRING DIAGRAM
G2002R1	17	-	SINGLE LINE DIAGRAM/LOAD SCHEDULE
G2002R1	18	-	WIREWAY AND LUMINAIRE – MOUNTING DETAILS
G2002R1	19	-	LUMINAIRE MOUNTING BRACKET DETAILS
G2002R1	20	-	LUMINAIRE MOUNTING LOCATIONS – SNOWSHED ELEVATION
G2002R1	21	-	POWER DISTRIBUTION/CONTROL LAYOUT

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Snowsheds Lighting
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[REFERENCE DOCUMENTS]:

BEIA GNP Snowshed Lighting Jun 2014
BIA GNP Snowshed Lighting Addendum #1 Oct 2015
BIA GNP Snowshed Lighting Addendum #2 Feb 2016

LENs Snowshed structure record drawings for reference only

Part 1 General

1.1 PROJECT LOCATION

- .1 The project is located in Glacier National Park, British Columbia. Construction work is on the Trans-Canada Highway (TCH). The project is located along an existing section of 2 lane undivided highway. The following are key locations relevant to the project:
- TCH km 0.0 – East Glacier Park Gate
 - TCH km 2.9 – Mountain Creek Rd.
 - TCH km 9.5 – Beaver River Bridge
 - TCH km 12.0 – Beaver Pit
 - TCH km 17.3 to 17.9 – Tupper No. 2 Snowshed, Tupper 2 West Substation, Tupper 2 East Substation
 - TCH km 18.1 to 18.3 – Tupper 1 Snowshed
 - TCH km 18.75 to 18.95 – Approximate Location of Works (Len's Substation)
 - TCH km 19.65 – Single Bench Substation
 - TCH km 22.5 – 25kV Maintenance Yard Substation
 - TCH km 22.75 – Roger's Pass summit intersection
 - TCH km 43.7 – West Glacier Park Gate

1.2 WORK COVERED BY CONTRACT DOCUMENTS

- .1 The Works are located on Roger's Pass, Glacier National Park, as listed in 1.2 Project Location. Major scope items include: Removal of existing lighting ingratitudes, supply and install of LEDs within the snowshed, LED approach lighting to the snowshed, installation, testing and commissioning of Lens lighting control system, electrical testing and commissioning, and traffic management.
- .2 Without limiting the scope of work, the Work of this Contract generally comprises the following:
- .1 Supply and installation of tunnel LED luminaire mounting struts, and brackets;
 - .2 Supply and installation of tunnel LED luminaires within the snowshed;
 - .3 Supply and installation of Approach Systems Street Lighting;
 - .4 Supply and installation of Approach Systems Flashers;
 - .5 Supply and installation of custom tunnel LED luminaire mounting brackets, conduit, junction boxes, and wiring;
 - .6 Supply and installation of fibre optic cabling inside the substation;
 - .7 Supply and installation of lighting control system;
 - .8 Trenching, and underground conduit supply and installation;
 - .9 Testing and commissioning;
 - .10 Traffic signage and traffic control;
 - .11 Removal of existing snowshed lighting and power distribution equipment after new lighting is operational;
 - .12 Miscellaneous Additional Work as directed by the Departmental Representative

- .3 In preparation for and during construction of this project, an "Environmental Protection Plan" (EPP) is to be prepared by the Contractor to meet the requirements of Section 01 35 43 – Environmental Procedures to ensure the desired minimal adverse effects are achieved. The Contractor's EPP must be approved by Parks Canada Agency (PCA) prior to the commencement of construction. The Departmental Representative and Parks Canada's environmental surveillance officer (ESO) will refer to the approved EPP in determining compliance with the plan and contract specifications.

1.3 **CONTRACT METHOD**

- .1 Construct Work under combined price contract.

1.4 **WORK BY OTHERS**

- .1 The Contractor is advised that the following Work in the vicinity has been or will be contracted by Parks Canada:
- .1 A Contractor, as yet unknown, is likely to be undertaking concrete repairs in Single Bench, Tupper 1, and Tupper 2 Snowsheds.
 - .2 A Contractor, as yet unknown, is likely to be undertaking drainage repairs to various snowsheds in the area.
 - .3 A Contractor, Martech Electric, is likely to be completing the installation of LED luminaires in the Tupper Timber Snowshed.
 - .4 A Contractor, Bergevin Electrical Contracting Ltd, is likely to be completing the installation of LED luminaires in the Tupper 2 Snowshed.
 - .5 It is anticipated that a Contractor will be undertaking pavement rehabilitation from approximately TCH km 0 to 4 from Spring 2017 to Fall 2017.
 - .6 It is anticipated that a contractor will be construction and installing Remote Avalanche Control Systems throughout the Roger's Pass area from Spring 2017 to late Fall 2017.
 - .7 It is anticipated that a contractor will be performing safety improvements and roadworks on the TCH from approximately km 20 – 24 in Glacier National Park from Fall 2016 to Fall 2017.
 - .8 It is anticipated that a contractor will be performing safety improvements and roadworks on the TCH from approximately km 24 – 28 in Glacier National Park from Fall 2016 to Fall 2017.
 - .9 Other projects and maintenance work may occur along nearby areas of the TCH in 2016.
- .2 Where it is necessary that work is to proceed in areas of this project common to both the Contractor and forces of others, the Contractor shall cooperate with the other Contractors and the Owner in reviewing their construction schedules and sharing their work space,

and shall coordinate their operations with the other Contractors, including traffic management, construction staging, and the operation of existing snowshed lighting.

- .3 The Contractors shall coordinate all work on this project with other Contractors including Site Safety, Traffic Control, and power shutdowns.
- .4 No separate payment shall be made in co-ordinating work with other contractors.

1.5 PRECEDENCE

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

1.6 DEFINITIONS

- .1 Parks Canada Agency will be referred to as "PCA".
- .2 British Columbia Ministry of Transportation and Infrastructure is referred to as "BC MoTI".

1.7 WORK SEQUENCE

- .1 Schedule work progress to allow Owner / Departmental Representative unrestricted access to inspect all phases of the Work.
- .2 Maintain fire and emergency access on the Trans-Canada Highway at all times.
- .3 Co-ordinate Work with other Contractors / Departmental Representatives doing maintenance, survey / testing work.
- .4 Refer to section 01 14 00 with regard to Work Restrictions that may impact the Work sequence.
- .5 Work is to be sequenced so as to maintain existing lighting during installation of new tunnel luminaires as follows:
 - .1 A single lane of travel is to be closed, existing lighting decommissioned and new lighting installed and commissioned in that order.
 - .2 Opposite side of tunnel to be closed for decommissioning existing luminaires and installation and commissioning of new luminaires following commissioning of first side of tunnel.
- .6 The Contractor shall:
 - .1 **Supply and store luminaires and associated equipment in Western Canada by March 31, 2017.**
 - .2 **Obtain Substantial Performance by September 29, 2017.**

.3 Complete all Works by October 13, 2017 (Contract Completion Date).

.4 Demobilize from site if at any time, the relevant area is declared to be at immanent risk of being impacted by an avalanche.

.1 Although no guarantee is provided as to when this may occur, in the past it has been after mid-October.

1.8 CONTRACTOR USE OF PREMISES

.1 The Contractor is not permitted to extract and process native material for the production of granular aggregate anywhere inside the Park.

.2 Contractor has unrestricted use of site subject to 1.9.1 above, Section 01 14 00 and Section 01 29 01, until Contract Completion date.

.3 Contractor shall limit use of premises for Work, for storage, and for access, to allow:

.1 Owner occupancy;

.2 Work by other Contractors;

.3 Safety of the public.

.4 Coordinate use of premises under direction of the Departmental Representative.

.5 Obtain and pay for use of additional storage or work areas needed for operations under this Contract.

.6 The Contractor and any Sub-Contractors shall contact Terry Imm (PCA) to obtain a business license, prior to commencement of the Contract.

.1 Phone: 250-837-7537, Email: terry.imm@pc.gc.ca

.7 All Contractor's business and private vehicles are required to display a vehicle work pass from Parks Canada. These permits may be obtained free of charge from PCA Environmental Surveillance Officer or as directed by the Departmental Representative.

1.9 OWNER OCCUPANCY

.1 Owner will occupy premises during entire construction period for execution of normal operations.

.2 Cooperate with Owner in scheduling operations to minimize conflict and to facilitate Owner usage.

1.10 OWNER SUPPLIED ITEMS

.1 Not Used.

1.11 CONSTRUCTION SIGNAGE

- .1 No signs or advertisements, other than warning signs, are permitted on site.
- .2 Signs and notices for safety and instruction shall be in both official languages. Signs shall be diamond grade and shall conform to CAN3-Z321.
- .3 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 the Departmental Representative.
- .4 All temporary traffic control signs that are used for longer than one day shall be mounted on wood posts other than Variable Message Boards that shall be secured at all times.
- .5 Signage shall be coordinated with other Contractors.

1.12 SETTING OUT OF WORK

- .1 Departmental Representative will establish control points and provide:
 - .1 Complete set of electronic construction Drawings.
 - .2 List of control monuments including coordinates and elevations.
- .2 Contractor to:
 - .1 Set additional control points as necessary.
 - .2 Set all work stakes necessary to complete work.
 - .3 Allow sufficient time for Departmental Representative to take measurements for payment.
 - .4 Not damage geodetic benchmarks or control monuments unless authorized by Departmental Representative.
- .3 No separate payment for setting out work, unless Departmental Representative adjusts alignment in field and additional survey costs are incurred. Payment for additional survey required due to changes by Departmental Representative to be paid for as part of "Lump Sum Item 3 – Prime Cost Sum".

Part 2 Products

- .1 Not used.

Part 3 Execution

- .1 Not used.

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SUMMARY OF WORK

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END OF SECTION

Part 1 General

1.1 PRECEDENCE

- .1 For Federal Government projects, Division 1 Sections take precedence over technical sections on other Divisions of this Specification.

1.2 ACCESS AND EGRESS

- .1 Provide for pedestrian, bicycle, railway and vehicular traffic for the duration of the construction.

1.3 USE OF THE SITE AND FACILITIES

- .1 The Work Site (limits shown on Drawings) will be specified by Parks Canada and shall only be used for the purposes of the Work. The Work Site will be made available by Parks Canada to the Contractor for its non-exclusive use for the duration of the Work, unless otherwise provided in the Contract Documents.
- .2 The Contractor is not permitted to set up a camp in the National Parks. Parks Canada regulations prohibit anyone working within the Park from using public campground facilities.
- .3 Office-tool trailer may be set up at the Work Site as approved by the Departmental Representative and ESO. See Section 01 35 43 – Environmental Procedures.
- .4 Contractor shall maintain adequate drainage at the Work Site.
- .5 The Contractor shall keep the Work Site clean and free from accumulation of waste materials and rubbish regardless of source. Snow shall be removed by the Contractor as necessary and at their cost for the performance and inspection of the Work.
- .6 The Contractor shall provide sanitary facilities for work force in accordance with governing regulations and the Environmental Procedures for this project. The Contractor shall post notices and take such precautions as required by local health authorities and keep area and premises in sanitary condition.
- .7 Any damage to the Work Site caused by the Contractor shall be repaired by the Contractor at its expense.

1.4 STAGING AND LIGHTING REQUIREMENTS

- .1 The Contractor shall stage their works to ensure that at least one of the Len's portals remains lit from either existing High Pressure Sodium (HPS) lighting or newly installed LED lighting at all times.
- .2 This will necessarily require the Contractor to maintain the existing lighting in one portal while decommissioning the existing lighting in the adjacent portal and then installing and fully commissioning that portal prior to decommissioning the remaining existing lighting.

- .3 The Contractor may not under any circumstances decommission, remove, or otherwise prevent the existing Len's lighting from operating without approval to do so from the Departmental Representative. No less than 2 weeks' notice is required for all planned changes in lighting conditions or operations.
- .4 If for any reason whatsoever the Contractor has not fully commissioned the LED lights by the required Contract Completion Date, they shall provide temporary lighting and if required, additional power for that lighting, to no less than the pre-existing lighting condition prior to removal of the existing HPS lighting, at their cost.
- .5 This temporary lighting shall be provided until such a time as the Contractor has fully commissioned the LED lights even if the Contractor is prevented from completing that work by weather and or avalanche conditions.

1.5 WORKING TIMES

- .1 Work in GNP is permitted during daylight hours from 07:00 AM to 07:00 PM, Monday to Saturday inclusive.
- .2 No Work shall occur on Sundays unless prior written approval is granted by the Departmental Representative.
- .3 The Contractor will not be permitted to work on Civic Holidays or long weekends unless prior written approval is granted by the Departmental Representative.
Statutory and Civic Holidays:
 - BC Family Day weekend: From 19:00 Thursday, February 9, 2017 to 7:00, Tuesday February 14, 2017.
 - Good Friday weekend: From 19:00 Thursday, April 13, 2017 to 7:00 Tuesday, April 18, 2017.
 - Victoria Day weekend: From 19:00 Thursday, May 18, 2017 to 7:00 Tuesday, May 23, 2017.
 - Canada Day weekend: From 19:00 Thursday, June 29, 2017 to 7:00 Tuesday, July 4, 2017.
 - Civic Holiday weekend: From 19:00 Thursday, August 3, 2017 to 7:00 Tuesday, August 8, 2017.
 - Labour Day weekend: From 19:00 Thursday August 31, 2017 to 7:00 Tuesday, September 5, 2017.

1.6 WORK CONDUCTED OVER OR ADJACENT TO WATERWAYS

- .1 All components of the Work shall be conducted in accordance with Section 01 35 43 – Environmental Procedures and the Environmental Protection Plan prepared for the project.
- .2 All components of the Work shall be conducted without equipment entering into wetlands, water bodies, or streams.
- .3 Refer to Section 01 35 43 – Environmental Procedures for details.

- .4 All waste materials from the Work shall be contained and collected in a manner to prevent any contact with the river valleys and waterways. All collected waste materials shall be disposed of in accordance with Section 01 35 43 – Environmental Procedures and the Environmental Protection Plan prepared for the project. One “Bear Proof” garbage container will be provided by PCA.
- .5 The Contractor is responsible for the development and supply of construction access to the Work as approved by the Departmental Representative.

1.7 **ACCESS TO ADJACENT PROPERTIES AND PARK FACILITIES**

- .1 Construction operations shall be conducted so as to cause minimal inconvenience to the public and to owners of adjoining property. Existing access to all affected property and National Park attractions, facilities, and points of interest shall be maintained continuously by the Contractor by means of constructing a temporary access to the same standard as the existing access prior to removing or otherwise preventing the use of the existing access as approved by the Departmental Representative.

1.8 **UTILITIES**

- .1 The Contractor shall become familiar with all utilities and services adjacent to the Work and shall be responsible for cost of repair of any damage resulting from their operations.
- .2 The Contractor shall establish and maintain direct and continuous contact with the owners or operators of any Utilities which may interfere with the Work. The Contractor shall co-operate with them at all times and in all places of Work. The Contractor shall keep the Departmental Representative informed of all communications with the Utility companies and authorities.
- .3 The Contractor shall notify the Departmental Representative and the Utility companies at least seven days in advance of any activities which may interfere with the operation of such Utilities.
- .4 Whenever working in the vicinity of Utilities, the Contractor shall locate such Utilities and expose those that may be affected by the Work, using hand labour as required.
- .5 The Contractor shall assess the possible impact of its operations on all Utilities that may be affected by its operations, and shall, in consultation with Utility owner(s), protect, divert, temporarily support or relocate, or otherwise appropriately treat such Utilities to ensure that they are preserved.

- .6 The Contractor shall immediately report any damage to Utilities to the Departmental Representative and to the Utility company or authority affected, and shall promptly undertake such remedial measures as are necessary at no additional cost to the Owner.

1.9 SURVEY OF EXISTING PROPERTY CONDITIONS

- .1 Submission of tender is deemed to be confirmation that the Contractor has inspected the site and is conversant with all conditions affecting execution and completion of work.
- .2 The Contractor shall regularly monitor the condition of the Work Site and of property on and adjoining the Work Site throughout the construction period, and shall immediately notify the Owner if any deterioration in condition is detected. Such monitoring shall cover all pertinent features and property including, but not limited to, buildings, structures, roads, walls, fences, slopes, sewers, culverts and landscaped areas.
- .3 The Departmental Representative may, but shall not be obligated to, survey and record the condition of the Work Site and of property on or adjoining the Work Site prior to the commencement of construction by the Contractor. If requested, the Departmental Representative will provide a copy of the survey records to the Contractor for reference.
- .4 Whenever supplied with survey records, the Contractor shall satisfy itself as to the accuracy and completeness of the survey records provided by the Departmental Representative for any area before commencing construction in that area.
- .5 Commencement of construction in any area shall be interpreted to signify that the Contractor has accepted such survey records as being a true record of the existing conditions prior to construction.
- .6 The provision of the records of a survey of existing conditions by the Departmental Representative shall in no way limit or restrict the Contractor's responsibility to exercise proper care to prevent damage to all property within or adjacent to the Work Site, whether all such property is covered by the survey or not.

1.10 PROTECTION OF PERSONS AND PROPERTY

- .1 The Contractor shall comply with all applicable safety regulations of WorkSafeBC and the Workers Compensation Act of British Columbia including, but not limited to, Occupational Health and Safety Regulations and General Safety Regulations. Within the Site, the Contractor has all the responsibilities of an "employer" under the *Workers Compensation Act* and the *Occupational Health and Safety Regulation* and is designated as the "Prime Contractor".
- .2 The Contractor shall take all necessary precautions and measures to prevent injury or damage to persons and property on or near the Work Site.
- .3 The Contractor shall promptly take such measures as are required to repair, replace or compensate for any loss or damage caused by the Contractor to any property or, if Parks Canada so directs, shall promptly reimburse to Parks Canada the costs resulting from such loss or damage.

1.11 USE OF PUBLIC AREAS

- .1 Off-road construction equipment will not be allowed on the existing Trans-Canada highway except at designated crossing points and loading areas. Steel tracked equipment with cleats will not be allowed on pavement designated for future use. Asphalt, granular, embankment and excavation materials may be hauled on existing highway but this shall be by standard highway trucks not exceeding legal highway load limits.
- .2 Flag persons shall be provided when vehicles are entering or exiting Work Site access points. Flag persons used shall be competent, properly equipped, certified and registered as a Traffic Control Person (TCP) with the Construction Safety Network.
- .3 The Contractor shall ensure that its vehicles and equipment do not cause nuisance in public areas. All vehicles and equipment leaving the Work Site and entering public roadways shall be cleaned of mud and dirt clinging to the body and wheels of the vehicle. All vehicles arriving at or leaving the Work Site and transporting materials shall be loaded in a manner that will prevent dropping of materials or debris on the roadways and, where contents may otherwise be blown off during transit, such loads shall be covered by tarpaulins or other suitable covers. Spills of materials in public areas shall be removed or cleaned immediately by the Contractor at no cost to the Owner. All activities shall be in accordance with Section 01 35 43 – Environmental Procedures and the Environmental Protection Plan prepared for the project.
- .4 Construction areas and construction crossings shall be flood-lit for night operations.

1.12 SUPERVISORY PERSONNEL

- .1 Within five days after award notification, the Contractor shall submit to the Departmental Representative confirmation of the names of the supervisory personnel and other key staff designated for assignment on the Contract.
- .2 The following personnel shall be included in the list:
 - .1 Project Superintendent
 - .2 Safety Representative
- .3 The above personnel shall perform the following duties:
 - .1 The Project Superintendent shall be employed full time and shall be present on the Work Site each and every workday that Work is being performed, from the commencement of Work to Total Performance of the Work.
 - .2 The Project Superintendent shall nominate a Deputy Project Superintendent who shall have the authority of the Project Superintendent during the latter's absence.
 - .3 The Safety Representative shall possess safety experience in general construction. Duties shall encompass all matters of safety activities from commencement of Work until the Total Performance of the Work.

1.13 MEETINGS

- .1 The Work includes attending meetings between the Contractor and the Departmental Representative. The meetings will be called and chaired by the Departmental Representative as required. The Contractor shall be represented at such meetings to the satisfaction of the Departmental Representative.
- .2 The Departmental Representative will schedule an initial meeting to be held on site after award notification. Senior representatives of the Owner, Departmental Representative, Contractor, major Subcontractors, field inspectors and supervisors are to be in attendance.
- .3 The Contractor will be requested to assemble their site staff and sub-contractors for an environmental briefing to be conducted by Parks Canada. The briefing shall be of approximately 2 hours in duration and held at initial project start-up. The Contractor shall ensure that all their current project staff is in attendance. The Departmental Representative and the Contractor will co-operate in setting the most appropriate time and place for the briefing. Subsequent to the initial environmental briefing, briefings will be arranged for new staff and sub-contractors showing up on the project.
- .4 Cost of attending the above meetings shall be considered incidental to the Unit Price items and no additional payment will be made.

1.14 WASTE DISPOSAL

- .1 All surplus, unsuitable and waste materials shall be removed from the job site to approved sites outside Glacier National Park at the Contractor's expense. Refer to Section 01 35 43 – Environmental Procedures and the Environmental Protection Plan.
- .2 Deposit of any construction debris into any waterway is strictly forbidden.
- .3 Cost for Waste Disposal described above shall be considered incidental to the Unit Price items and no additional payment will be made.
- .4 Waste Disposal shall be completed in accordance with Section 01 35 43 – Environmental Procedures.

1.15 WORK STOPPAGE

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

Part 2 Products

2.1 **NOT USED.**

Part 3 Execution

3.1 **IMPACT OF NEARBY WORKS**

- .1 The Contractor is advised that nearby works by other Contractors will likely require the disconnection of the existing power to the Snowsheds and in turn items within the Scope of this Contract. This may restrict the Contractor's ability to commission their Works until such a time that other Contractors have commissioned their scope.
- .2 The Contractor is obliged to coordinate their works with other nearby Contractors and no claim for delay costs will be entertained for delay due to other Contractors incomplete works.

END OF SECTION

Part 1 **General**

1.1 **REFERENCES**

- .1 General Conditions.

1.2 **PRIME COST SUM**

- .1 Included in Contract Price a total Prime Cost Sum of \$230,000
- .2 Do not include in the Contract Amount, additional contingency allowances for products, installation, overhead or profit.
- .3 Prime Cost Sum provided for in the lump sum table is not a sum due the Contractor. Rather, payment will be made against it for miscellaneous Work not included in the unit price table under the General Conditions of the Contract.
- .4 No interpretation of the work as noted below shall indicate that work will be included under the Prime Cost Sum. Items, tasks, and activities included in the Works elsewhere in the Contract shall be paid as indicated in those sections.
- .5 Any and all additional work must be approved in writing by the Departmental Representative prior to commencement.
- .6 All expenditures must be substantiated with verified invoices and/or approved daily extra work reports as noted in Clause 1.3 below.
- .7 Such work may include, but not be limited to:
 - .1 Additional work prescribed in LED luminaire supply and install
 - .2 Additional work related to communication and system integration
 - .3 Additional silt fence as requested by the Departmental Representative or ESO
 - .4 Supply and installation of traffic signage (permanent) signs (not construction signs)
 - .5 Additional survey resulting from changes made by the Departmental Representative
 - .6 Additional stripping, excavation and disposal of waste materials as directed by the Departmental Representative
 - .7 Remediation or removal and replacement of unsuitable or contaminated soils not described in the contract documents
 - .8 Excavation or removal of rock
 - .9 Relocation or removal and disposal of existing signs, guardrail, guide posts and other miscellaneous items

- .10 Provision of additional traffic control measures
- .11 Payment of BC Hydro costs
- .12 Seeding as requested by the Departmental Representative
- .13 Miscellaneous work as directed by the Departmental Representative
- .8 The Contract Price, and not Prime Cost Sum, includes Contractor's overhead and profit in connection with the Work.

1.3 MEASUREMENT PROCEDURES

- .1 Payment for Work under the "Lump Sum Price Item 3 – Prime Cost Sum" will be made using negotiated rates or by material, labour and equipment rates as per the following:
- .2 For Work in GNP:
 - .1 Equipment rates will be in accordance with current British Columbia Roadbuilders and Heavy Construction Association Equipment Rental Rate Guide, and will be all inclusive and fully operated.
 - .2 Hourly rental of equipment will be measured in actual working time and necessary travel time within project limits. Transportation time to and from site to be reimbursed only if equipment is used exclusively for additional work.
 - .3 Equipment paid on standby will be paid on 50% of the relevant Less Operator rates to a maximum of 10hrs per day.
 - .4 When based upon actual costs for additional works under Prime Cost Sum, payment will be based upon supplied invoices and other work records.
 - .5 The Prime Contractor may apply a 10% mark-up to subcontractor or supplier invoices only, as approved by the Departmental Representative. No mark-up will be allowed on relevant equipment and labour rates.
 - .6 A claim for additional payment will not be considered submitted until all required documentation has been received by the Departmental Representative.

Part 2 Products

- .1 Products shall be in accordance with BC MoTI – Standard Specifications for Highway Construction (Latest Edition), and/or as directed by the Departmental Representative.

Part 3 Execution

- .1 Work shall be in accordance with BC MoTI – Standard Specifications for Highway Construction (Latest Edition), and/or as directed by the Departmental Representative.

Project No. 201619
August 2016
Parks Canada Agency

Snowsheds Lighting
Len's LED Lighting
Trans Canada Highway
Glacier National Park

Section 01 21 00
ALLOWANCES

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END OF SECTION

Part 1 General

1.1 DESCRIPTION

- .1 Mobilization and Demobilization consists of preparatory work and operations including but not limited to, those necessary for the movement of personnel, equipment, camp, buildings, shops, offices, supplies and incidentals to and from the project sites.
- .2 Any protective measures or movement of Contractor trailers necessitated by animal interactions and required by Parks Canada will be paid by owner and will be paid for in the prime cost sum, and are not to be anticipated in the Lump Sum Contract Price for Mobilization and Demobilization.

1.2 MEASUREMENT PROCEDURES

- .1 Mobilization and Demobilization:
 - .1 Payment will be made under **“Lump Sum Price Item 1 – Mobilization / Demobilization”**.
 - .2 50% of Lump Sum Contract Price for Mobilization and Demobilization to be paid when mobilization to site is complete.
 - .3 The remainder of the Lump Sum Price for Mobilization and Demobilization to be paid when work is complete and all materials, equipment, camp, buildings, shops, offices, and other facilities have been removed from site and site cleaned and left in condition to the satisfaction of the Departmental Representative and all other Agencies having Jurisdiction.
 - .4 Payment of only 5% of the total price tendered will be scheduled as outlined above. If the amount bid for mobilization and demobilization is greater than 5% of the total price tendered, payment of the remainder of the amount will be authorized when the contract has been completed. If the amount is lower than 5% of the total price tendered, payment of only 50% of that tendered amount will be paid when mobilization to site is complete.

Part 2 Products

- .1 Not used.

Part 3 Execution

- .1 Not used.

END OF SECTION

Part 1 General

1.1 PRECEDENCE

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

1.2 RELATED SECTIONS

- .1 SACC R2850D – GC 5.10.
- .2 Section 01 11 00 – Summary of Work Clause 1.8 - Work Sequence.

1.3 DEFINITION OF OCCUPANCY

- .1 The Contractor shall be permitted to lease and occupy sites when working in Glacier National Park, free of charge from the date of award of the contract up to and including the Contract Completion Date.
- .2 The Contractor's occupancy of the sites identified in Contract will be deemed to have ended, when both of the following conditions are met to the satisfaction of Parks Canada:
 - .1 All the work identified under this Contract, has been completed.
 - .2 All sites' clean up and any outstanding deficiencies for the work identified under this Contract have been addressed to the satisfaction of the Departmental Representative.
 - .3 Contractor has removed from the park all trailers and equipment and sites have been cleaned-up to the satisfaction of the Departmental Representative.

Part 2 Products

2.1 NOT USED.

Part 3 Execution

3.1 NOT USED.

END OF SECTION

Part 1 **General**

1.1 **MEASUREMENT PROCEDURES**

- .1 This Work shall be incidental to the contract and will not be measured for payment.

1.2 **COORDINATION**

- .1 Perform coordination of progress schedules, submittals, use of site, temporary utilities, construction facilities, and construction Work, with progress of Work of other Contractors, and Work by Owner, under instructions of the Departmental Representative.

1.3 **PROJECT MEETINGS**

- .1 Attend weekly project meetings throughout progress of Work and provide information as determined by the Departmental Representative. Meetings shall be chaired by the Departmental Representative who will prepare the minutes of the meetings.
- .2 Attend pre-installation meetings, when specified in specifications and when required to coordinate related or affected Work and provide information, as determined by the Departmental Representative.
- .3 Provide physical space and make arrangements for meetings.

1.4 **CONSTRUCTION ORGANIZATION AND START-UP**

- .1 Within seven (7) days after award of Contract, request a meeting of Contract Representatives to discuss and resolve administrative procedures and responsibilities. Meeting shall be chaired by the Departmental Representative who will prepare the minutes of the meeting.
- .2 Senior representatives of the Owner, Departmental Representative, Contractor, major Subcontractors, field inspectors and supervisors are to be in attendance.
- .3 Agenda to include following:
 - .1 Appointment of official representative of participants in Work.
 - .2 Schedule of Work, progress scheduling in accordance with Section 01 32 16.07.
 - .3 Schedule of submittals in accordance with Section 01 33 00.
 - .4 Requirements for temporary facilities, offices, storage sheds, utilities, fences in accordance with Section 01 52 00.
 - .5 Site safety and security in accordance with Sections 01 14 00, 01 52 00 and 01 35 43.
 - .6 Quality Control in accordance with Section 01 45 00.

- .7 Proposed changes, change orders, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, and administrative requirements.
- .8 Monthly progress claims, administrative procedures, photographs, and holdbacks.
- .9 Close out procedures and submittals in accordance with Sections 01 77 00 and 01 78 00.
- .10 Insurances and transcript of policies.
- .11 Other business.
- .4 Comply with Departmental Representative's allocation of mobilization areas of site, for field offices and sheds, and for access, traffic, and parking facilities.
- .5 During construction, coordinate use of site and facilities through Departmental Representative's procedures for intra-project communications: submittals, reports and records, schedules, coordination of Drawings, recommendations, and resolution of ambiguities and conflicts.
- .6 Comply with instructions of the Departmental Representative for use of temporary utilities and construction facilities.
- .7 Coordinate field engineering and layout work with the Departmental Representative.

1.5 **ON-SITE DOCUMENTS**

- .1 Maintain at job site and allow access by the Departmental Representative, one copy each of the following:
 - .1 Contract Drawings.
 - .2 Specifications.
 - .3 Addenda.
 - .4 Reviewed Shop Drawings and mix designs.
 - .5 Change Orders.
 - .6 Other modifications to Contract.
 - .7 Traffic Management Plan.
 - .8 Safety Plan.
 - .9 WHMIS.
 - .10 Environmental Protection Plan.

- .11 Field test reports.
- .12 Copy of approved Work schedule and most recent updated schedule.
- .13 Labour conditions and wage schedules.
- .14 Applicable current editions of municipal regulations and by-laws.

1.6 **SUBMITTAL SCHEDULE**

- .1 Prepare a schedule of the required submissions and the date the submissions will be made. Include columns for Actual Date of Submission, Review Comments Received, Final Submission and Final Acceptance Received.
- .2 Nothing in the Contractor's Submittal Schedule will oblige the Owner or Departmental Representative to adhere to those deadlines, due dates, or similar although they shall act reasonably in the progress of their reviews and provision of comment to the Contractor.

1.7 **PROJECT SCHEDULES**

- .1 Submit preliminary construction progress schedule in accordance with Section 01 3216.07 to Departmental Representative coordinated with Owner's project schedule.
- .2 After review, revise and resubmit schedule to comply with revised project schedule.
- .3 During progress of Work revise and resubmit as directed by the Departmental Representative.
- .4 In addition to the project schedule, submit weekly schedules to the Departmental Representative showing Work planned for the following week on a day by day basis.
- .5 Nothing in the Contractor's Project Schedules shall oblige the Owner or Departmental Representative to meet any deadlines, due dates, or similar.

1.8 **CONSTRUCTION PROGRESS MEETINGS**

- .1 During course of Work prior to project completion, schedule progress meetings weekly.
- .2 Contractor, major Subcontractors involved in Work and Departmental Representative are to be in attendance. Meetings shall be chaired by the Departmental Representative who will prepare the minutes of the meetings.
- .3 Agenda to include following:
 - .1 Review, approval of minutes of previous meeting.
 - .2 Review environmental issues.
 - .3 Review Traffic Control and Emergency response Protocol issues.
 - .4 Review site safety and security issues.

- .5 Review issues with Prime Contractor and co-ordination with other contractors.
- .6 Review of Work progress since previous meeting.
- .7 Discuss field observations, problems, and conflicts.
- .8 Review off-site fabrication delivery schedules.
- .9 Review submittal schedules: expedite as required.
- .10 Corrective measures and procedures to regain projected schedule.
- .11 Revisions to construction schedule.
- .12 Review Weekly Progress schedule, during succeeding work period.
- .13 Review of quality reports since previous meeting.
- .14 Review construction budget: Progress payments, variances from contract.
- .15 Other business.

1.9 **SUBMITTALS**

- .1 Submit product data to Section 01 33 00 for review for compliance with Contract Documents.
- .2 Submit requests for payment for review, and for transmittal to Departmental Representative. Payment request on last day of the month.
- .3 Submit requests for interpretation of Contract Documents, and obtain instructions through Departmental Representative.
- .4 Process substitutions through Departmental Representative.
- .5 Process change orders through Departmental Representative.
- .6 Deliver closeout submittals for review and preliminary inspections, for transmittal to Departmental Representative.

1.10 **CLOSEOUT PROCEDURES**

- .1 Notify Departmental Representative when Work is considered to be nearing Completion.
- .2 Accompany Departmental Representative on preliminary inspection to determine items listed for completion or correction.
- .3 Comply with Departmental Representative's instructions for correction of items of Work listed in executed certificate of Completion.
- .4 Notify Departmental Representative of instructions for completion of items of Work determined in Departmental Representative's final inspection.

Project No. 201619
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PROJECT MANAGEMENT
AND COORDINATION
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Part 2 Products

2.1 **NOT USED.**

Part 3 Execution

3.1 **NOT USED.**

END OF SECTION

Part 1 **General**

1.1 **MEASUREMENT PROCEDURES**

- .1 This Work shall be incidental to contract and will not be measured for payment.

1.2 **PRECEDENCE**

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

1.3 **DEFINITIONS**

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

1.4 **REQUIREMENTS**

- .1 Ensure the Project Schedule is practical and remains within specified Contract duration.
- .2 Ensure all the Work required for the Contract is identified in the Project Schedule. Refer to Section 01 11 00 – Summary of Work for a potential list of activities.
- .3 Include an allowance in the schedule for Work performed and paid for as Prime Cost Sum. Refer to Section 01 21 00 – Allowances for a list of activities.
- .4 Plan to complete Work in accordance with prescribed Project Schedule.
- .5 Limit activity durations to maximum of approximately 14 working days, to allow for progress reporting.
- .6 Ensure that it is understood that Award of Contract or time of beginning, rate of progress, and Final Certificate as defined times of completion are of essence of this contract.
- .7 Include the requirements of Section 01 14 00 – Work Restrictions and Section 01 35 43 – Environmental Procedures.

1.5 **SUBMITTALS**

- .1 Submit to Departmental Representative within 10 working days of Award of Contract Bar (GANTT) Chart as Master Plan for planning, monitoring and reporting of project progress.
- .2 Submit Project Schedule to Departmental Representative within 10 working days of receipt of acceptance of Master Plan.

1.6 **PROJECT MILESTONES**

- .1 Project milestones form interim targets for Project Schedule. Completion of each Stage of Construction. In addition to all other requirements, include the following milestones:
 - .1 Commencement of work on site
 - .2 Commissioning of new LED lighting in Len's Tunnel
 - .3 Planned Substantial Performance
 - .4 Planned Contract Completion Date

1.7 **MASTER PLAN**

- .1 Structure schedule to allow orderly planning, organizing and execution of Work as Bar Chart (GANTT).
- .2 Departmental Representative will review and return revised schedules within 5 working days.

- .3 Revise impractical schedule and resubmit within 5 working days.
- .4 Accepted revised schedule will become Master Plan and be used as baseline for updates.

1.8 **PROJECT SCHEDULE**

- .1 Develop detailed Project Schedule derived from Master Plan.
- .2 Ensure detailed Project Schedule includes as minimum milestone and activity types as follows:
 - .1 Contract Award
 - .2 Submittals, specifically in regard to shop drawings
 - .3 Luminaire Purchase Order issued
 - .4 Luminaire Delivery to storage
 - .5 Mobilization
 - .6 Kiosk works
 - .7 Approach lighting
 - .8 Westbound existing infrastructure removal
 - .9 Westbound mounting hardware installation
 - .10 Westbound luminaire mounting
 - .11 Westbound luminaire commissioning
 - .12 Eastbound existing infrastructure removal
 - .13 Eastbound mounting hardware installation
 - .14 Eastbound luminaire mounting
 - .15 Eastbound luminaire commissioning
 - .16 Interim Inspection
 - .17 Site Clean-up / De-mobilization

1.9 **PROJECT SCHEDULE REPORTING**

- .1 Update Project Schedule on monthly basis reflecting activity changes and completions, as well as activities in progress. Provide weekly Progress Reports.

- .2 Include, as part of Project Schedule, narrative report identifying Work status to date, comparing current progress to baseline, presenting current forecasts, defining problem areas, anticipated delays and impact with possible mitigation.

1.10 **PROJECT MEETINGS**

- .1 Discuss Project Schedule at regular site meetings, identify activities that are behind schedule and provide measures to regain slippage. Activities considered behind schedule are those with projected start or completion dates later than current approved dates shown on baseline schedule.

Part 2 Products

2.1 **NOT USED.**

Part 3 Execution

3.1 **NOT USED.**

END OF SECTION

Part 1 **General**

1.1 **MEASUREMENT PROCEDURES**

- .1 This work shall be incidental to contract and will not be measured for payment.

1.2 **REFERENCES**

- .1 Not used.

1.3 **ADMINISTRATIVE**

- .1 Submit to Departmental Representative submittals listed for review. Submit with reasonable promptness and in orderly sequence so as to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for an extension of Contract Time and no claim for extension by reason of such default will be allowed.
- .2 Do not proceed with Work affected by submittal until review is complete.
- .3 Present shop drawings, product data, samples and mock-ups in SI Metric units.
- .4 Where items or information is not produced in SI Metric units converted values are acceptable.
- .5 Review submittals prior to submission to 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 shall be considered rejected.
- .6 Notify Departmental Representative in writing at time of submission, identifying any deviations from requirements of Contract Documents stating reasons for deviations.
- .7 Verify field measurements and affected adjacent Work is consistent.
- .8 Contractor's responsibility for errors and omissions in submission is not relieved by Departmental Representative's review of submittals.
- .9 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Departmental Representative review.
- .10 Keep one reviewed copy of each submission on site.

1.4 **SAMPLES**

- .1 Not used.

1.5 **MOCK-UPS**

- .1 Not used.

1.6 CERTIFICATES AND TRANSCRIPTS

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

1.7 REQUIRED CONTRACTOR SUBMITTALS

.1 Pre-Mobilization Submittals

The Contractor shall not begin any site Work until the Departmental Representative has authorized acceptance of submittals in writing. Submit the following plans and programs to the Departmental Representative for review a minimum of twenty (20) days prior to mobilization to the project site:

- .1 Project schedule, detailing the schedule of the workdays required from Contractor, subcontractors, suppliers and consultants to complete each activity of the project by road segment or location in order to meet stages specified in Section 01 11 00. In addition, for each activity critical elements that could impact on the schedule are to be identified. Submission shall include both a paper copy of the schedule and an electronic copy in Microsoft Projects format
- .2 List of subcontractors, suppliers and consultants, their role and their key personnel, including names and positions, addresses, telephone, cellular telephone and/or pager numbers.
- .3 Plan describing methods the Contractor will have to meet his responsibilities as the Prime Contractor for Traffic Control along the in areas affected by their Works, and to co-ordinate Work, traffic control, site access, safety, with other Contractors working in this Work zone.
- .4 Contractor Chain of Command, listing key Contractor personnel, including for each name, position, qualification, experience, telephone, cellular telephone and/or pager numbers. The list shall include the names and telephone/cellular telephone/pager numbers for contact persons who are available on a 24-hour basis in the event of emergencies.
- .5 Work Plan, describing in detail for each activity by road segment and location, the Contractor's intended methods of construction, and materials, equipment and manpower he will use to meet stages specified in Section 01 11 00. The Work Plan has to be linked to the Project Schedule.
- .6 Quality Control Plan in accordance with Section 01 45 00 – Quality Control.
- .7 Traffic Management Plan, in accordance with the requirements of Section 01 35 00.06 – Special Procedures for Traffic Control.
- .8 Environmental Protection Plans (EPP) and Environmental Construction Operations Plans (ECO Plans) that shall meet the requirements of Section 01 35 43 – Environmental Procedures.
- .9 Contractor shall develop an “Emergency Procedures Protocol” in consultation with Parks Canada. Parks Canada will supply the Contractor with a template with contact names and numbers to be used for this purpose.
- .10 Health and Safety Plan - The Contractor shall have a Certificate of Recognition (COR) or Registered Safety Plan (RSP) including a site specific Health and Safety Plan acceptable to the Departmental Representative. The Contractor shall implement and maintain the Health and Safety Plan during the Work.
- .11 Health and Safety Plan must include:
 - .1 Contractor's safety policy.
 - .2 Identification of applicable compliance obligations.
 - .3 Definition of responsibilities for project safety/organization chart for project.

- .4 Site specific hazard assessment.
 - .5 General safety rules for project.
 - .6 Job specific safe work procedures.
 - .7 Inspection policy and procedures.
 - .8 Incident reporting and investigation policy and procedures.
 - .9 Occupational Health and Safety meetings.
 - .10 Occupational Health and Safety communications and record keeping procedures.
 - .11 Results of safety and health risk or hazard analysis for site tasks and operation.
 - .12 Submit copies of Material Safety Data Sheets (MSDS).
 - .13 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.
 - .14 On-site Contingency and Emergency Response Plan: address standard operating procedures to be implemented during emergency situations.
 - .15 The Contractor shall not begin any site Work until the Departmental Representative has authorized acceptance of the submittals in writing.
 - .16 Copy of the filed notice of project with provincial authorities prior to beginning of work.
- .2 Construction Phase Submittals
- .1 Monthly Progress Reports in accordance with Section 01 32 16.07.
 - .2 Weekly Progress Reports that outline the detailed Work (Contractor, subcontractors, suppliers, consultants) completed to date as well as the anticipated Work to be performed for the following week on a day-by-day basis. Work to be linked to activities identified in project schedule and to provide information on materials, equipment and manpower. Also, alternate Work to be identified if Work or a portion of, proposed cannot be done due to weather, equipment breakdown, delays in delivery, etc.
 - .3 Quality Control Inspection Reports - The Contractor shall maintain a daily inspection report that itemizes the results of all Quality Control inspections conducted by the Contractor. The reports shall be made available for review by the Departmental Representative upon request. A summary of all Quality Control inspections conducted to date shall be submitted by the Contractor with each request for payment.
 - .4 Progress Photographs:
 - .1 Format: Electronic .jpg files, minimum three (3) mega pixels.
 - .2 Submission requirements: one (1) set of electronic files, monthly.
 - .3 Identification: Name and number of project, description of photograph and date.

- .4 Viewpoints: viewpoints determined by Construction Manager or Departmental Representative.
- .5 Submission Frequency: prior to commencement of Work and weekly thereafter with progress statement, or as directed by Construction Manager or Departmental Representative.
- .6 Submit CD with all electronic pictures as part of closeout package.
- .5 Submit an electronic copy of Contractor's authorized representative's work site health and safety inspection reports to Departmental Representative and authority having jurisdiction, weekly.
- .6 Submit copies of reports or directions issued by Federal and Provincial health and safety inspectors.
- .7 Submit copies of incident and accident reports.
- .3 Project Completion Submittals
 - .1 Record Drawings -The Contractor shall submit copies of all Contractor's Drawings revised as necessary to record all as-built changes to the Work and the Contractor shall submit a set of Contract Drawings clearly marked to record as-built changes to the Work.
 - .2 Quality Control Records – The Contractor shall submit a bound and itemized set of project quality control documentation.
 - .3 Additional finalisation and completion documents identified elsewhere within the Contract.
- .4 The Contractor shall not construe the Departmental Representative's authorization of the submittals to imply approval of any particular method or sequence for conducting the Work, or for addressing health and safety concerns. Authorization of the programs shall not relieve the Contractor from the responsibility to conduct the Work in strict accordance with the requirements of Federal or Provincial regulations and this specification and Contract, or to adequately protect the health and safety of all workers involved in the project and any members of the public who may be affected by the project. The Contractor shall remain solely responsible for the adequacy and completeness of the programs and work practices, and adherence to them.

Part 2 Products

- .1 Not Used.

Part 3 Execution

- .1 Not Used.

END OF SECTION

Part 1 **General**

1.1 **PRECEDENCE**

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

1.2 **MEASUREMENT PROCEDURES**

- .1 Cost of Traffic Control, including temporary pavement marking, described in this Section 01 35 00.06, shall be considered incidental to "**Lump Sum Price Item 2 – Traffic Accommodation**", and no additional payment will be made for the duration of the Contract. The Contractor shall receive payment for traffic management on a monthly basis prorated by the number of months working on site divided by the number of months on site identified on Contractor schedule, not to exceed the total lump sum bid price for Traffic Management.
- .2 Cost of keeping existing roadway clean and pothole free, if used by the Contractor while on site, shall be considered incidental to "**Lump Sum Price Item 2 – Traffic Accommodation**", and no additional payment will be made for the duration of the Contract.
- .3 Cost of snow removal of existing roadway, if used by the Contractor while on site, shall be considered incidental to "**Lump Sum Price Item 2 – Traffic Accommodation**", and no additional payment will be made for the duration of the Contract. This excludes snow removal on Public roads.

1.3 **REFERENCES**

- .1 The Contractor shall provide traffic control in accordance with current edition of:
- BC MoTI – Traffic Control Manual for Work on Roadways (Current Edition)
 - BC MoTI –Standard Specifications for Highway Construction, Section 194 – Traffic Management for Work Zones (Current edition).
 - Manual of Uniform Traffic Control Devices for Canada, (MUTCD) distributed by Transportation Association of Canada.

1.4 **QUALITY CONTROL**

- .1 All Quality Control by the Contractor.

1.5 **GENERAL**

- .1 The Contractor shall develop and implement a Traffic Management Plan (TMP) in accordance BC MoTI Standard Specifications for Highway Construction, Section 194 – Traffic Management for Work Zones (current edition), except where specified otherwise in these specifications. The Traffic Management Plan will include plans specific to each roadway affected by the project and for each Work activity.
- .2 Traffic Control Plans included in the TMP shall be to the same presentation standard as those in the BC MoTI Standard Specifications for Highway Construction, Section 194 – Traffic Management for Work Zones (current edition) and shall not be hand drafted.
- .3 The Contractor shall design, supply, erect, move and maintain all traffic control devices, signs, temporary pavement marking, other safety measures, and provide staff to ensure safe passage of all traffic from commencement of site work to date of acceptance by the Departmental Representative.
- .4 All temporary signs that are used for longer than one day shall be mounted on wood posts or equivalent as approved by the Departmental Representative other than portable electronic Changeable Message Signs that shall be secured at all times.
 - .1 As an alternative, signs may be wind resistant in the form of Windmaster sign stand 5018 or equivalent.
- .5 All traffic and warning signs shall be either bilingual or of a symbolic or pictorial type. If bilingual signs are used, the English and French message shall be of equal letter size and at the same elevation, with English on left and French on right. Assistance in translation of construction and warning signs to French may be obtained from Parks Canada.
- .6 All speed limits, traffic control and warning signs shall have an “NPC” adhesive sticker added to bottom right-hand corner. These stickers will be supplied by Parks Canada following the acceptance by the Departmental Representative of the Contractor's traffic management plan.
- .7 Temporary pavement marking used shall be acceptable to the Departmental Representative. These temporary pavement markings shall be in accordance with the current “BC MoTI - Traffic Control Manual for Work on Roadways”. Temporary markings that conflict with the Final permanent paint lines and other associated markings will be removed at the contractor's expense.
- .8 Contractor shall have appropriate traffic control measures in place so that two travelling lanes of highway traffic are maintained through the work zone at all times throughout the construction.

- .9 The Contractor shall coordinate traffic management procedures with other Contractors working in the area. Refer to Section 01 11 00, Summary of Work for details of other Work in the area.
- .10 The Contractor shall continually inspect and maintain traffic control devices in use by:
 - .1 Checking signs daily for legibility, damage, suitability and location.
 - .2 Cleaning, repairing or replacing signs as required ensuring clarity and reflectance.
 - .3 Removing or covering signs that do not apply to conditions existing from day to day or time to time.
 - .4 Recording all traffic control inspection and maintenance activities in Weekly Reports.

1.6 **PROTECTION OF PUBLIC TRAFFIC**

- .1 Comply with requirements of Acts, Regulations and By-Laws in force for regulation of traffic or use of roadways upon or over which it is necessary to carry out Work or haul materials or equipment.
- .2 Carry out traffic regulation in accordance with BC MoTI –Standard Specifications for Highway Construction, Section 194 – Traffic Management for Work Zones (current edition), except where specified otherwise.
- .3 The Contractor shall develop a Traffic Control Plan taking into account all hazards associated with working on or adjacent to a busy highway and minimize risks to motorists.
- .4 A minimum of two travelling lanes 4 m wide shall be maintained by the Contractor at all times to provide for safe movement of traveling public through work area. The Contractor shall submit a Traffic Management Plan prior to commencement of work. Short closures may be allowed by the Departmental Representative for some activities as long as the delay to motorists does not exceed 20 minutes.
- .5 Regardless of type of traffic control being used, maximum period of delay to public traffic shall be 20 minutes. Emergency vehicles (i.e., ambulance, RCMP, Park Warden) must be granted immediate passage at all times. The Departmental Representative reserves the right to reduce delay time for public traffic at times when specified delay results in excessive backup of public traffic.
- .6 The Contractor shall provide competent flag persons, properly equipped, and certified and registered as a Traffic Control Person (TCP) with the Construction Safety Network or the Construction Safety Association of British Columbia.
- .7 The Contractor shall 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.

- .8 The Departmental Representative will monitor the traffic control measures, and may require modifications of these measures from time to time to achieve satisfactory traffic flow, safety of traveling public and coordination with adjacent contracts. The cost of implementing these modifications to ensure traffic control is undertaking in accordance with the Contract shall be considered incidental to the Contract.
- .9 The Contractor shall maintain a dust free construction zone by means of cleaning and watering when required.
- .10 Traffic control measures will be monitored by the Departmental Representative, who may require modifications of these measures from time to time to achieve satisfactory traffic flow, safety of traveling public and coordination with adjacent contracts

1.7 **INFORMATIONAL AND WARNING DEVICES**

- .1 Provide and maintain signs, flashing warning lights and other devices required to indicate construction activities or other temporary and unusual conditions resulting from Project Work that requires road user response.
- .2 Supply and erect signs, delineators, barricades and miscellaneous warning devices as specified in the Traffic Management Plan submitted by the Contractor and approved by the Departmental Representative.
- .3 At each end of the Work site, supply, install and maintain a portable electronic changeable message sign with a minimum of three (3) lines with 8 characters for the duration of the project.
- .4 During times when the Contractor is working within Len's, supply, install and maintain an additional 2 portable electronic changeable message signs with 1 at each portal entrance of the snowshed with a message as detailed by the Departmental Representative.
- .5 Place signs and other devices to standards and in locations recommended in British Columbia Traffic Control Manual for Work on Roadways. Provide intermittent signage if work zones exceed 2.0 km in length.
- .6 Signs shall be wind resistant in the form of windmaster sign stand 5018 or equivalent.
- .7 As situation on site changes, Contractor to update his Traffic Management Plan outlining signs and other devices required for the project and submit for the approval of the Departmental Representative.

1.8 **CONTROL OF PUBLIC TRAFFIC**

- .1 Contractor shall provide competent flag persons, properly equipped, and certified and registered as a Traffic Control Person (TCP) with the Construction Safety Network or the Construction Safety Association of British Columbia.
 - .1 When public traffic is required to pass working vehicles or equipment, that block all or part of travelled roadway.

- .2 When vehicles are entering or exiting Work Site access points.
 - .3 When vehicles are entering or exiting gravel pits in the park.
 - .4 When it is necessary to institute one-way traffic system through construction area or other blockage where traffic volumes are heavy, approach speeds are high and traffic signal system is not in use.
 - .5 When workmen or equipment are employed on travelled way over brow of hills, around sharp curves or at other locations where oncoming traffic would not otherwise have adequate warning.
 - .6 Where temporary protection is required while other traffic control devices are being erected or taken down.
 - .7 For emergency protection when other traffic control devices are not readily available.
 - .8 In situations where complete protection for workers, working equipment and public traffic is not provided by other traffic control devices.
 - .9 At each end of restricted sections where pilot cars are required.
- .2 No stoppage of traffic will be allowed for the periods specified in Section 01 14 00, Work Restrictions pertaining to Statutory Holiday or long weekend.
 - .3 During hours of darkness, Contractor shall determine requirements but as a minimum, flagpersons shall be additionally equipped with a red signal hand-light of sufficient brightness to be clearly visible to approaching traffic and flagging stations shall be illuminated by overhead lighting. Signs indicating hazardous conditions and signs requiring increased attention shall be marked with flashers.

Part 2 Products

- .1 Not used.

Part 3 Execution

- .1 Not used.

END OF SECTION

Part 1 **General**

1.1 **PRECEDENCE**

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

1.2 **MEASUREMENT PROCEDURES**

- .1 The cost of environmental and aesthetic protection in accordance with this Section 01 35 43 – Environmental Procedures will not be measured separately for payment and will be considered incidental to the Work.

1.3 **REFERENCES**

- .1 Canada Labour Code, Part 2, Canada Occupational Safety and Health Regulations.
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
- .3 Material Safety Data Sheets (MSDS).
- .4 Province of British Columbia
 - .1 Occupational Health and Safety Regulations.

1.4 **SUBMITTALS**

- .1 Make submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit site-specific Health and Safety Plan: Within seven (7) days after date of Notice to Proceed and prior to commencement of Work. Health and Safety Plan must include:
 - .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 meetings.
 - .9 Occupational Health and Safety communications and record keeping procedures.

- .10 Results of site specific safety hazard assessment.
- .11 Results of safety and health risk or hazard analysis for site tasks and operation.
- .12 Submit copies of Contractor's authorized representative's work site health and safety inspection reports to Departmental Representative and authority having jurisdiction, weekly.
- .13 Submit copies of reports or directions issued by Federal and Provincial health and safety inspectors.
- .14 Submit copies of incident and accident reports.
- .15 Submit copies of Material Safety Data Sheets (MSDS) to Departmental Representative.
- .16 Departmental Representative will review Contractor's site-specific Health and Safety Plan and provide comments to Contractor within ten (10) days after receipt of plan. Revise plan as appropriate and resubmit plan to Departmental Representative within five (5) days after receipt of comments from Departmental Representative.
- .17 Departmental Representative's review of Contractor's final Health and Safety plan should not be construed as approval and does not reduce the Contractor's overall responsibility for construction Health and Safety.
- .18 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.
- .19 On-site Contingency and Emergency Response Plan: address standard operating procedures to be implemented during emergency situations.

1.5 **FILING OF NOTICE**

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

1.6 **SAFETY ASSESSMENT**

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

1.7 **NATIONAL PARK REGULATIONS**

- .1 The Contractor shall ensure that all work is performed in accordance with the ordinances, laws, rules and regulations set out in the Canada National Parks Act and Regulations.

1.8 **CANADIAN ENVIRONMENTAL ASSESSMENT ACT (CEAA)**

- .1 Execution of the work is subject to the provisions within the *Canadian Environmental Assessment Act* (CEAA) Guidelines Order of 2003 and subsequent amendments.
- .2 Failure to comply with or observe environmental protection measures as identified in these specifications may result in the work being suspended pending rectification of the problems.
- .3 Refer to the Basic Environmental Impact Analysis (BEIA), April 2015 R.1, EBA for this Work. The Contractor's EPP is to include these BIA's recommendations as a minimum.

1.9 **START-UP AND ENVIRONMENTAL BRIEFING**

- .1 All staff employed at the construction site will be subject to a briefing in accordance with Section 01 35 43.

1.10 **MEETINGS**

- .1 Schedule and administer Health and Safety meeting with Departmental Representative prior to commencement of Work. This may be covered in the pre-mobilization meeting.
- .2 Parks Canada recognizes that federal Occupational Health and Safety legislation places specific responsibilities upon Parks Canada as owner of the work place. In order to meet those requirements, Parks Canada has implemented a contractor safety regime to ensure roles and responsibilities assigned under Part II of the Canada Labour Code and the Canada Occupational Health and Safety Regulations are implemented and observed when involving contractor(s) to undertake work in Parks Canada work places, including on Parks Canada property.
- .3 After contract award and prior to commencement of any work under the contract, the Contractor will hold a health and safety meeting with the Departmental Representative. At this meeting, the Contractor is required to complete and sign an Attestation to certify the Contractor will comply with the requirements set out in the Attestation and the terms and conditions of the contract.
 - .1 A copy of the "Attestation and Proof of Compliance with Occupational Health and Safety (OHS)" form is attached as Appendix A.

1.11 **REGULATORY REQUIREMENTS**

- .1 Do Work in accordance with National Parks Act.

1.12 **PROJECT / SITE CONDITIONS**

- .1 Work at site will involve contact with British Columbia Occupational Health and Safety Act.

1.13 **GENERAL REQUIREMENTS**

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

1.14 **RESPONSIBILITY**

- .1 Be responsible for health and safety of persons on site, safety of property on site and for protection of persons adjacent to site and environment to extent that they may be affected by conduct of Work.
- .2 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.

1.15 **COMPLIANCE REQUIREMENTS**

- .1 Comply with Occupational Health and Safety Regulations, British Columbia.
- .2 Comply with Canada Labour Code, Canada Occupational Safety and Health Regulations.

1.16 **UNFORESEEN HAZARDS**

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

1.17 **HEALTH AND SAFETY COORDINATOR**

- .1 Employ and assign to Work, competent and authorized representative as Health and Safety Coordinator. Health and Safety Co-ordinator must:
 - .1 Have minimum 2 years site-related working experience specific to activities associated with roadway construction.
 - .2 Have working knowledge of occupational safety and health regulations.
 - .3 Be responsible for completing Contractor's Health and Safety Training Sessions and ensuring that personnel not successfully completing required training are not permitted to enter site to perform Work.
 - .4 Be responsible for implementing, enforcing daily and monitoring site-specific Contractor's Health and Safety Plan.
 - .5 Be on site during execution of Work and report directly to and be under direction of site supervisor.

1.18 POSTING OF DOCUMENTS

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

1.19 CORRECTION OF NON-COMPLIANCE

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

1.20 WORK STOPPAGE

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

Part 2 Products

- .1 **Not used.**

Part 3 Execution

- .1 **Not used.**

END OF SECTION

Part 1 **General**

1.1 **MEASUREMENT PROCEDURES**

- .1 Preparation and implementation of an Environmental Protection Plan (EPP) in accordance with this Section 01 35 43 – Environmental Procedures will not be measured separately for payment and will be considered incidental to the Work.

1.2 **SUBMITTALS**

- .1 The Contractor is required to prepare an Environmental Protection Plan (EPP) in accordance with this Section 01 35 43 – Environmental Procedures.

1.3 **NATIONAL PARK REGULATIONS**

- .1 The Contractor shall ensure that all work is performed in accordance with the ordinances, laws, rules and regulations set out in the Canada National Parks Act and Regulations.
- .2 The Contractor and any Subcontractors shall contact Terry Imm (PCA) to obtain a business license prior to commencement of the contract.

Phone: 250-837-7537

Email: terry.imm@pc.gc.ca

- .3 All Contractor's vehicles are required to display a vehicle work pass from Parks Canada. These permits may be obtained free of charge from the Departmental Representative, PCA Environmental Officer or at the Park Gate.

1.4 **CANADIAN ENVIRONMENTAL ASSESSMENT ACT (CEAA)**

- .1 Execution of the work is subject to the provisions within the *Canadian Environmental Assessment Act* (CEAA) Guidelines Order of 2003 and subsequent amendments. This project, and its components, has been subject to an environmental assessment – *Basic Impact Analysis*, EBA 2014. Environmental Protection Plans are the next step to achieve the desired end results of minimal adverse environmental effect, as the project is constructed.
- .2 Failure to comply with or observe environmental protection measures as identified in these specifications may result in the work being suspended pending rectification of the problems.

1.5 **START-UP AND ENVIRONMENTAL BRIEFING**

- .1 All staff employed at the construction site will be subject to a briefing regarding their individual and collective responsibilities to ensure avoidable adverse environmental impact do not arise from their activities and personal choices. All employees must attend this briefing before beginning their work at the site. Each employee, having received the briefing, will be issued a certification sticker to be displayed on their helmet. It is recognized that new employees may join the Contractors' work force after the initial round of "environmental briefing". In that case and as required, subsequent

“environmental briefings” can be presented as numbers warrant, by arrangement with the ESO through the Departmental Representative. Also, some sub-trades may be present at the site for a short time, to perform once-only duties. In these cases, the “environmental briefing” will be replaced by the Contractor explaining the environmental sensitivity of the work location to the sub-trade worker(s), and reviewing highlights of personal conduct expected, with reference to a one-page briefing summary to be provided to the Contractor by the ESO. A copy of this summary will be provided to each sub-trade worker joining the work force at the site.

- .2 Parks Canada will have an ESO attending the site to monitor the construction activity for conformance with the EPP. The ESO or alternate designated Parks Canada staff member will present the “environmental briefing”. The ESO’s main duties are to monitor the progress of the construction on an on-going basis to ensure compliance with environmental protection measures, and to provide guidance through the Departmental Representative, in the event of unanticipated environmental problems. Although the ESO has authority to enforce National Parks Act violations, direction to the Contractor will be the duty of the Departmental Representative.

1.6 CONSTRUCTION SITE ACCESS AND PARKING

- .1 Points of access from the existing TCH to the various construction sites will be required. The Contractor shall review both short and long term construction access requirements with the Departmental Representative, both at start-up and on an ongoing basis. In consultation with the Departmental Representative, the Contractor shall formulate an agreement for worker transportation to and from the work sites and where workers shall park their private vehicles. Generally, personal vehicles shall be parked at least 10 metres distance from any watercourse.
- .2 The Contractor shall ensure that the environment beyond the work limits is not negatively impacted or damaged by workers’ vehicles or construction machinery and shall instruct workers so that the “footprint” of the project is kept within defined boundaries.

1.7 PROTECTION OF WORK LIMITS

- .1 The Contractor is to prepare an EPP that details how the work limits shall be marked and what procedures will be employed to ensure trespass outside these limits does not occur, to the satisfaction of the Departmental Representative and the ESO.

1.8 EROSION CONTROL

- .1 Erosion control measures that prevent sediment from entering any waterway, water body or wetland in the vicinity of the construction site are a critical element of the project and shall be implemented by the Contractor.
- .2 The Contractor shall include an Erosion Control Plan in his EPP to the satisfaction of the Departmental Representative and the ESO.
- .3 The regular monitoring and maintenance of all erosion control measures shall be the responsibility of the Contractor. If the design of the control measures is not functioning effectively they are to be repaired. The Departmental Representative and ESO also will monitor erosion control performance.

- .4 The site will be secured against erosion during any periods of construction inactivity or shutdown.

1.9 POLLUTION CONTROL

- .1 The Contractor shall prevent any deleterious and objectionable materials from entering streams, rivers, wetlands, water bodies or watercourses that would result in damage to aquatic and riparian habitat. Hazardous or toxic products shall be stored no closer than 100 metres from watercourses.
- .2 A Spill Response Plan will be prepared as part of the EPP and shall detail the containment and storage, security, handling, use and disposal of empty containers, surplus product or waste generated in the application of these products, to the satisfaction of the Departmental Representative and the ESO and in accordance with all applicable federal and provincial legislation. The EPP shall include a list of products and materials to be used or brought to the construction site that are considered or defined as hazardous or toxic to the environment. Such products include, but are not limited to, waterproofing agents, grout, cement, concrete finishing agents, hot poured rubber membrane materials, asphalt cement agents.
- .3 The containment, storage, security, handling, use, unique spill response requirements and disposal of empty containers, surplus product or waste generated in the use of any hazardous or toxic products shall be in accordance with all applicable federal and provincial legislation. Hazardous products shall be stored no closer than 100 metres from watercourses.
- .4 An impervious berm shall be constructed around fuel tanks and any other potential spill area. The berms shall be capable of holding 110% of tank storage volumes and shall be to the satisfaction of the Departmental Representative and the ESO before start-up. Measures such as collection / drip trays and berms lined with occlusive material such as plastic and a layer of sand, and double-lined fuel tanks can prevent spills into the environment.
- .5 The Contractor shall prevent blowing dust and debris by covering and/or providing dust control for temporary roads and on-site work by methods that are approved by the Departmental Representative or ESO.
- .6 The Contractor shall provide spill kits at re-fuelling, lubrication, and repair locations that will be capable of dealing with 110% of the largest potential spill and shall be maintained in good working order on the construction site. The ESO and Departmental Representative prior to project start-up must approve these spill kits. The Contractor and site staff shall be informed of the location of the spill response kit(s) and be trained in its use.
- .7 Timely and effective action shall be taken to stop, contain and clean-up all spills as long as the site is safe to enter. The Departmental Representative and the ESO shall be notified immediately of any spill. If not available, Jasper Dispatch will be contacted at 1-887-852-3100. Spill response cards will be distributed during the initial Environmental Briefing with basic instructions and phone numbers.

- .8 In the event of a major spill, all other work shall be stopped and all personnel devoted to spill containment and clean-up.
- .9 The costs involved in a spill incident (the control, clean up, disposal of contaminants and site remediation to pre-spill conditions), shall be the responsibility of the Contractor. The site will be inspected to ensure completion to the expected standard and to the satisfaction of the Departmental Representative and ESO.

1.10 **EQUIPMENT MAINTENANCE, FUELLING AND OPERATION**

- .1 The Contractor shall ensure that all soil, seeds and any debris attached to construction equipment to be used on the project site shall be removed (e.g. power washing) outside the Glacier National Park before delivery to the work site.
- .2 Equipment fuelling sites will be identified by the Contractor and approved by the Departmental Representative and the ESO. Except for chain saws, any fuelling closer than 100 metres any streams, wetlands, water bodies or waterways shall require the authorization and oversight of the Departmental Representative.
- .3 Diesel and gasoline delivery vehicles, including bulk tankers shall be parked more than 100 metres from any streams, wetlands, water bodies or watercourses. Gravity fed fuel systems are not allowed. Manual or electric pump delivery systems shall be used. Fuelling personnel shall maintain presence at and immediate attention to the fuelling operation.
- .4 Mobile fuel containers (e.g. slip tanks, small fuel carboys) shall remain in the service vehicle at all times. Protection and containment of approved fuel storage sites is addressed in # 4 of Pollution Control above.
- .5 Equipment used on the project shall be fuelled with E10, and low sulfur diesel fuels and shall conform to local emission requirements. The Contractor is to ensure that unnecessary idling of vehicles is avoided.
- .6 Oil changes, lubricant changes, greasing and machinery repairs shall be performed at locations approved by the ESO or the Departmental Representative. Waste lubrication products (e.g. oil filters, used containers, used oil, etc.) shall be secured in spill-proof containers and properly recycled or disposed of at an approved facility. No waste petroleum, lubricant products or related materials are to be discarded, buried or disposed of in borrow pits, turnouts, picnic areas, viewpoints, etc., anywhere within Glacier National Park.
- .7 The Contractor shall ensure that all equipment is inspected daily for fluid/fuel leaks and maintained in good working order.
- .8 Fuel containers and lubricant products shall be stored only in secure locations specified by the Departmental Representative. Fuel tanks or other potentially deleterious substance containers shall be secured to ensure they are tamperproof and cannot be drained by vandals when left overnight in Glacier National Park. Alternatively, the Contractor may hire a security person employed to prevent vandalism at the contractor's expense.

1.11 **OPERATION OF EQUIPMENT**

- .1 Equipment movements shall be restricted to the 'footprint' of the construction area. The work limits shall be identified by stake and ribbon or other methods approved by the Departmental Representative. Unless authorized by the Departmental Representative, activities beyond the work limits are not permitted. No machinery will enter, work in or cross over streams, rivers, wetlands, water bodies or watercourses, nor damage aquatic and riparian habitat or trees and plant communities. Some of the construction shall require working close to watercourses or water bodies. In these instances, the Contractor is to describe measures to be employed to ensure fugitive materials (e.g. rocks, soil, branches) and especially deleterious substances (e.g. chemicals) do not enter any watercourses, to the satisfaction of the Departmental Representative and ESO.
- .2 The Contractor shall instruct workers to prevent pushing, placement, raveling, storage or stockpiling of any materials (e.g. slash, rock, fill or topsoil) in the trees bordering the right-of-way or into watercourses or water bodies.
- .3 When, in the opinion of Parks Canada, negligence on the part of the Contractor results in damage or destruction of vegetation, or other environmental or aesthetic features beyond the designated work area, the Contractor shall be responsible, at his or her expense, for complete restoration including the replacement of trees, shrubs, topsoil, grass, etc., to the satisfaction of the Departmental Representative and ESO.
- .4 Restrict vehicle movements to work limits.
- .5 Workers private vehicles are to remain within the construction footprint.

1.12 **FIRE PREVENTION AND CONTROL**

- .1 A fire extinguisher shall be carried and available for use on each machine and at locations within the plant in the event of fire. Basic firefighting equipment recommended (e.g. a water truck; minimum 500 Imperial gallons with 500 feet of fire hose and a pump capable of producing 45 psi water pressure at the nozzle, three shovels, two pulaskis, and two five gallon backpack pumps) shall be maintained at the construction site at a location known and easily accessible to all the Contractors' staff. Contractor's staff shall receive basic training in early response to wildfire events during the "environmental briefing".
- .2 Water can be obtained from the adjacent Beaver River following the Contractor applying for a Restricted Activity Permit (RAP) to the Owner or as pre-approved by the Departmental Representative and ESO. An excavation to the water table will be required to access groundwater for use by the Contractor. The Departmental Representative will identify a suitable location for this excavation. The Contractor will be responsible to make the excavation, and extend it to greater depths in the event that the water table drops.
- .3 A water truck may be necessary and will depend on the timing of the contract (e.g. not required during winter or snow covered conditions).
- .4 Construction equipment shall be operated in a manner and with all original manufacturers' safety devices to prevent ignition of flammable materials in the area.

- .5 Care shall be taken while smoking on the construction site to ensure that the accidental ignition of any flammable material is prevented. Fires or burning of waste materials is not permitted.
- .6 In case of fire, the Contractor or worker shall take immediate action to extinguish the fire provided it is safe to do so. The ESO and the Departmental Representative shall be notified of any fire immediately. If not available, Jasper Dispatch will be contacted at 1-887-852-3100.
- .7 Fires or burning of waste materials is not permitted.

1.13 **WILDLIFE**

- .1 During the Environmental Briefing all personnel shall be instructed by the ESO on procedures to follow in the event of wildlife appearance near or within the work site and any other wildlife concerns.
- .2 Avoid or terminate activities on site that attract or disturb wildlife and vacate the area and stay away from the immediate location if bears, cougars, wolves, elk or moose display aggressive behaviour or persistent intrusion. Extra care to control materials that might attract wildlife (e.g. lunches and food scraps) must be exercised at all times.
- .3 Notify the ESO and Departmental Representative immediately about dens, litters, nests, carcasses (road kills), bear activity or encounters on or around the site or crew accommodation. Other wildlife-related encounters are to be reported within 24 hours. If the ESO or Departmental Representative is not available, Jasper Dispatch will be contacted at 1-887-852-3100.

1.14 **RELICS AND ANTIQUITIES**

- .1 Artifacts, relics, antiquities and items of historical interest such as cornerstones, commemorative plaques, inscribed tablets and similar objects found on the work site shall be reported to the ESO or the Departmental Representative immediately. The Contractor and workers shall wait for instructions before proceeding with their work.
- .2 All historical or archaeological objects found in Glacier National Park are protected under the National Parks Act and Regulations and are the property of Parks Canada. The Contractor and workers shall protect any articles found and request direction from the ESO or the Departmental Representative.

1.15 **WASTE MATERIALS STORAGE AND REMOVAL**

- .1 The Contractor and workers shall dispose of hazardous wastes in conformance with the Environmental Contaminants Act and applicable provincial regulations while observing the Code of Good Practice for Management of Hazardous and Toxic Wastes at Federal Establishments.
- .2 All wastes originating from construction, trade, hazardous and domestic sources, shall not be mixed, but will be kept separate.

- .3 Construction, trade, hazardous waste and domestic waste materials shall not be burned, buried or discarded at the construction site or elsewhere in Glacier National Park. These wastes shall be contained and removed in a timely and approved manner by the Contractor and workers, and disposed of at an appropriate waste landfill site located outside the park. Construction waste storage containers, provided by the Contractor, shall be emptied by the Contractor when 90% full. Waste containers will have lids, and waste loads shall be covered while being transported.
- .4 A concerted effort shall be made by the Contractor and workers to reduce, reuse and recycle materials.
- .5 All efforts to prevent wildlife from obtaining food, garbage or other domestic wastes shall be made by the Contractor and contract staff while undertaking their work in Glacier National Park. Such wildlife attractants shall not be stored at the work site overnight. Lunches, coolers and food products, including waste food products, shall be securely stored away from access by animals. Daily removal of food scraps, food wrappers, pop cans or other attractive products to bear proof containers is mandatory. It is incumbent on the Contractor to notify Parks Canada and make specific arrangements to have garbage collected by Parks Canada when using existing Parks Canada receptacles.
- .6 The Contractor and workers shall immediately report any circumstances related to food/garbage (e.g. overflowing container or strong smell) and wildlife to the ESO or the Departmental Representative. If neither can be reached, the Contractor/worker shall immediately contact Jasper Dispatch at 1-887-852-3100 and report the details.
- .7 Sanitary facilities, such as a portable container toilet, shall be provided by the Contractor and maintained in a clean condition.

1.16 MISCELLANEOUS SITE MANAGEMENT CONTINGENCIES

- .1 The Contractor shall prepare an EPP that details how the work limits will be marked and what procedures will be employed to ensure trespass outside these limits does not occur, to the satisfaction of the Departmental Representative and the ESO.
- .2 A Contractor's office and work headquarters material laydown, equipment parking and storage area will be permitted at Km 4 or as approved by the Departmental Representative and ESO.
- .3 The National Park Act regulations prohibit anyone working within Glacier National Park from using public campground facilities.
- .4 Removal and storage of snow shall be arranged with the ESO and the Departmental Representative.
- .5 The Contractor shall control blowing dust and debris generated from the construction site by means such as covering or wetting down dry materials and rubbish. Dust control measures for temporary access roads may also have to be initiated.
- .6 Security services at the construction site may be desirable or necessary during the contract, especially during quiet times. Fuel tanks or other potentially deleterious

substance containers must be secured by the Contractor to ensure they are tamperproof and cannot be drained by vandals at his own cost.

- .7 Pets shall not be brought to or maintained at the construction site or worker's camp.
- .8 Should the Contractor require/request a water source, the Departmental Representative, in consultation with the ESO, may give direction as to an alternative location to be used. Specific intake measures are required when water is approved to be withdrawn from open watercourses.

Part 2 Products

- .1 **Not Used.**

Part 3 Execution

3.1 CLEARING AND GRUBBING

- .1 The Contractor shall ensure that the substrate or riparian area of streams, rivers or watercourses, whether open water or frozen over shall not be disturbed by tracked, wheeled or self-propelled equipment, (e.g. a skidder or truck). The ESO or Departmental Representative will provide direction in the case of work occurring near any wetland area or watercourses.
- .2 The Contractor shall take all measures to ensure that trees do not fall into streams, rivers, wetlands or water bodies or outside the clearing limits as marked by colored flagging. Generally, work within a 30 metre buffer of watercourses, water bodies or wetlands requires the close oversight of the ESO or the Departmental Representative.
- .3 Trees inadvertently felled into streams, rivers, watercourses or outside the clearing limits shall be removed by means (e.g. winch) so as not to damage the substrate or any standing trees left outside the clearing limits. Machinery shall not go outside the clearing limits, or into streams, rivers, watercourses or water bodies to remove felled trees.
- .4 Logs and other salvage materials are to be conveyed to and placed at the storage site without spread of debris or damage to other standing trees or landscape resources outside the marked clearing or storage limits. They shall not be skidded through wetlands, waterways or water bodies.
- .5 During the grubbing component, stumps, roots, imbedded logs and other non-soil debris shall be pulled and shaken free of loose soil and rocks before transport to Mountain Creek Road site as directed by the Departmental Representative.
- .6 No slash clearing, pickup or grubbing shall occur outside of the designated area or within 1 metre of the drip line of existing forest.
- .7 Existing areas of vegetation disturbed as a result of this contract shall be rehabilitated using approved topsoil from the park and a native grass seed mix to be specified.

- .8 Schedule construction and clearing activities around important wildlife windows. No clearing is to take place within the Mount Revelstoke-Glacier (MRG) nesting bird window (April 1 through August 31) without first having conducted nest surveys and obtaining approval to commence from the Departmental Representative. Any variance for vegetation removal must be obtained from the ESO in advance of works (Parks Canada 2012b).

3.2 STRIPPING

- .1 A contingency plan for control of dust generated from the construction site shall be prepared, with materials availability arranged in the event of their need. In the event of a work program shutdown during inclement weather (e.g. winter conditions unfavourable for construction) erosion control of bared soils or excavated materials stockpiles will be required. The Contractor's EPP will describe measures to be implemented in such a circumstance.
- .2 Stripping close to the any watercourse, water body or wetland shall employ methods to ensure materials are not pushed, fall or are eroded into the water or wetlands. Generally, work within a 30 metre buffer of waterways or wetlands requires the close oversight of the ESO and the Departmental Representative.
- .3 No stripping shall occur outside of the designated area or within 1 metre of the drip line of existing forest.
- .4 Stripped soil (including fine forest litter) materials shall be placed and stored at locations and in amounts and form as instructed by the Departmental Representative, for later reclamation use on graded slopes. Stripping piles may require erosion control, sedimentation protection or stabilization, depending on the location and anticipated duration of storage. At the Departmental Representatives direction, the Contractor shall prepare a plan for management of each stripping pile.

3.3 MATERIAL LOADING, HAULING, PLACEMENT AND GRADE BUILDING

- .1 During grade construction conducted close to any watercourse, water body or wetland the Contractor shall ensure materials are not pushed, fall or are eroded into the water or wetlands. Generally, work within a 30 metre buffer of waterways or wetlands requires the close oversight of the ESO and the Departmental Representative.
- .2 No grade building shall occur outside of the designated area or within 1 metre of the drip line of existing forest. Any material inadvertently falling outside the work limits is to be removed promptly in a manner that does not damage trees or vegetation at that location. Materials shall be placed at storage sites or on the grade without spillage outside the working limits. Any material inadvertently falling outside the work limits is to be removed promptly in a manner that does not damage trees or vegetation at that location.

3.4 EXCAVATING AND PLACEMENT

- .1 Excavation will be undertaken according to the approved Grading Plan for the ROW.

- .2 Materials shall be placed at storage sites or on the grade without spillage outside the working limits. Any material inadvertently falling outside the work limits is to be removed promptly in a manner that does not damage trees or vegetation at that location.
- .3 All sediment control measures shall be implemented by the Contractor prior to the commencement of the work in the vicinity of water bodies, watercourses, and wetlands.
- .4 Special precautions may have to be taken during excavation in the vicinity of intermittent or active drainage channels. See "Specific Concerns".
- .5 If sediments enter watercourses during any excavation nearby or at its banks, the Contractor shall ensure that sediment levels in the waters of the river or creeks do not exceed specified limits and meet the "desired end result" limits outlined. See "Specific Concerns".
- .6 Placement of rip rap and backfill at creeks shall be undertaken without contacting the watercourse or wetted margins of the stream, unless approved by the Departmental Representative.
- .7 Fisheries protection windows shall be observed for Beaver River, and any other watercourse in this contract and will guide the timing of the work so that stream disturbance is prevented. See "Specific Concerns".
- .8 If a pump-out sump to dewater excavation sites will be required, the Contractor is to prepare an EPP that details how the dewatering shall be undertaken, to the satisfaction of the Departmental Representative and the E.S.O. Special attention is to be given to the environmental sensitivity of the discharge area, freezing conditions operation, overflow avoidance, decanting and settlement pond reclamation. Water containing suspended materials shall not be pumped into watercourses, drainage systems or on to land, except with the permission of the Departmental Representative and the E.S.O.

3.5 **SPECIFIC CONCERNS RELATIVE TO EROSION CONTROL AND SEDIMENTATION**

- .1 The Contractor shall prepare an Erosion and Sedimentation Management Plan for the components of this contract that are undertaken in proximity to watercourses, wetlands or riparian environments. This plan shall be to the satisfaction of the Departmental Representative and ESO. If sediment ponds are required, they shall be designed to settle all sediment particles 0.02 mm or larger. The ponds shall also be designed to handle 1:5 year storm events, with overflow spill capacity for 1:10 year storm events and emergency spillway capacity for 1:100 year storm events.
- .2 An important desired end result is to allow no release into watercourses of sediments in levels that are deleterious to fish or that would harmfully alter, disrupt, or destroy fish habitat. Similarly there is to be no sediment release into areas of vegetation growth or sensitive areas of sediments in levels that would adversely alter growing or hydraulic conditions. The target is 0 mg/L of TSS over background levels. The threshold is a maximum instantaneous increase of 25 mg/L over background levels when background levels are <250 mg/L, or a maximum instantaneous increase of 10% over background levels when background levels are >250 mg/L. This threshold shall not be exceeded.

3.6 SPECIFIC CONCERNS RELATIVE TO SENSITIVE SITES AND ACTIVITIES

- .1 Grade construction near streams, rivers, wetlands, water bodies or watercourses must be undertaken with care to prevent damage to aquatic and riparian habitat or associated tree and plant communities. A large and mobile spill kit shall be kept at hand during construction at these sensitive sites in proximity to watercourses.

END OF SECTION

Part 1 General

1.1 PRECEDENCE

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

1.2 MEASUREMENT PROCEDURES

- .1 This work shall be incidental to contract and will not be measured for payment.

1.3 REFERENCES

- .1 BC MoTI - Standard Specifications for Highway Construction Manual (Latest Edition).
- .2 Canadian Standards Association (CSA)
 - .1 CAN/CSA-A23.2-04, Methods of Test and Standard Practices for Concrete

1.4 QUALITY OBLIGATION

- .1 The Contractor shall complete all of the Works to at least the standard of quality required by the Contract using equal of superior materials as those specified or required by applicable regulation or legislation and shall rectify and make good, at their cost, all instances where they have not done so regardless of whether the Departmental Representative or Owner has requested them to do so or is aware of an issue.

1.5 TESTING BY THE CONTRACTOR

- .1 Testing required to provide quality control to assure that the Work strictly complies with the Contract requirements shall include, but not be limited to:
 - .1 All testing specified in the Contract Documents; and
 - .2 Any other testing required as a condition for deviation from the specified Contract procedures.
- .2 Testing proposed shall be in accordance with the BC MoTI - Standard Specifications for Highway Construction Manual (current edition), CSA codes or as stated in these specifications; whichever is more stringent.
- .3 The Contractor shall be fully responsible and bear all costs for all quality control testing and shall conduct such testing in the following manner:
 - .1 Provide testing facilities and personnel for the tests and inform the Departmental Representative in advance to enable the Departmental Representative to witness the tests if it so desired;
 - .2 Notify the Departmental Representative when sampling will be conducted;

- .3 Within one Day after completion of testing, submit test results to the Departmental Representative; and
- .4 Identify test reports with the name and address of the organization performing all tests, and the date of the tests.
- .4 Approval of tested samples will be for characteristics or use named in such approval and shall not change or modify any Contract requirements.
- .5 Testing agencies, their inspectors, and their representatives are not authorized to revoke, alter, relax, enlarge or release any requirement of the Contract Documents, nor to approve or accept any part of the Work.

1.6 **CONTRACTOR'S QUALITY CONTROL PROGRAM**

- .1 The Contractor shall prepare and adhere to a Quality Control Program. The purpose of the program shall be to ensure the performance of the Work in accordance with Contract requirements.
- .2 The Contractor shall record and promptly notify the Departmental Representatives in writing of all instances where a work item or activity has not met a requirement of the Contract.
- .3 The Quality Control Program shall be described in a Quality Control Manual. The Contractor shall submit the Manual to the Departmental Representative for review in accordance with Section 01 33 00, Submittal Procedures. The Manual shall develop a logical system for tracking and documenting the Quality Control of the Work. A systematic format and a set of procedures patterned on a recognized Quality Control Standard will be acceptable, subject to review by the Departmental Representative.

1.7 **THE QUALITY CONTROL MANUAL SHALL INCLUDE THE FOLLOWING INFORMATION**

- .1 Distribution list, providing a list of names to whom the Manual shall be distributed;
- .2 Title page, identifying the Contract, Contractor and copy number;
- .3 Revision page, identifying the revision number and date of the Manual;
- .4 Table of contents;
- .5 Revision control, tabulating the revision number, date of revision, description of revisions and authorized signature;
- .6 Details of measuring and testing equipment including methods and frequency of calibration;
- .7 Purchasing details of all materials and equipment including procurement documents and vendor's Quality Control Program standards;

- .8 Procedures for inspection of incoming items, in-process inspection and final inspection and tagging of all supply items;
- .9 Details of special processes as identified by the Departmental Representative, including qualifications of personnel and certification;
- .10 Procedures for shipping, packaging and storage of materials;
- .11 Procedures for maintaining quality records and Statements of Compliance, including filing and storage of documents for a period of one year after Completion of the Works;
- .12 Details of any non-conformance, including identification and recording of deficiencies, tagging procedures for "HOLD" or "REJECT" items, and final disposition of non-conformance forms by the Quality Control Manager;
- .13 Inspection and test checklists, including tabulated checklists describing all manufacturing and delivery activities such as Inspection or Test, frequency of tests, description of tests, acceptance criteria of tests, such as verification, witnessing or holding tests and sign-off by the Quality Control Manager and the Departmental Representative, if the Departmental Representative witnesses the tests; and
- .14 Forms used to ensure the application of the inspection and test checklist requirements. These forms shall be identified in the checklists and describe all testing requirements for Specification compliance.
- .15 The Quality Control Manual shall include samples of all forms to be filled in by the Quality Control Inspectors. All forms shall be signed by the Quality Control Manager and submitted promptly to the Departmental Representative who will add its review signature.
- .16 An independent check of all Work shall be performed by the Contractor. The Contractor shall appoint Quality Control Inspectors to ensure compliance of products and workmanship with Contract requirements. The same personnel may not be used to perform a given task and to check the quality and accuracy of the task.
- .17 At completion of the Work a bound and itemized copy of all Quality Control documents and reports shall be prepared by the Contractor's Quality Manager and submitted to the Departmental Representative.

1.8 **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 any part of Work to be examined if Work is suspected to be not in accordance with Contract Documents. If, upon examination such work is found not in accordance with Contract Documents, correct such Work and pay cost of examination and correction.

1.9 **INDEPENDENT INSPECTION AGENCIES**

- .1 Independent Inspection/Testing Agencies will be engaged by the Departmental Representative for purpose of inspecting and/or testing portions of Work. Cost of such services will be borne by Departmental Representative.
- .2 Employment of inspection/testing agencies does not relax responsibility to perform Work in accordance with Contract Documents.
- .3 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 the Departmental Representative at no cost to the Departmental Representative.

1.10 **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.

1.11 **PROCEDURES**

- .1 Notify appropriate agency and Departmental Representative in advance of requirement for tests, in order that attendance arrangements can be made.
- .2 Provide labour and facilities to obtain and handle samples and materials on site.

1.12 **REJECTED WORK**

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

Contract Documents, amount of which shall be determined by Departmental Representative.

1.13 REPORTS

- .1 Submit one (1) electronic copy of all inspection and test reports to Departmental Representative in accordance with Section 01 33 00 Submittals Procedures.

1.14 TESTS AND MIX DESIGNS

- .1 Furnish test results and designs as may be requested.

1.15 MILL TESTS

- .1 Submit mill test certificates as required of specification sections.

Part 2 Products

- .1 Not Used.

Part 3 Execution

- .1 Not Used.

END OF SECTION

Part 1 **General**

1.1 **MEASUREMENT PROCEDURES**

- .1 All work of this section shall be incidental to contract and will not be measured for payment.

1.2 **INSTALLATION AND REMOVAL**

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

1.3 **SITE STORAGE / LOADING**

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

1.4 **CONSTRUCTION PARKING**

- .1 Provide and maintain adequate access and parking at the project site in areas approved by the Departmental Representative.
- .2 Build and maintain temporary roads and provide snow removal during period of Work.
- .3 If authorized to use existing roads for access to project site, maintain such roads for duration of Contract and make good damage resulting from Contractors' use of roads.

1.5 **SECURITY**

- .1 If required by the Contractor, provide and pay for responsible security personnel to guard site and contents of site after working hours and during holidays. For extended shut-downs, the Contractor shall provide the level of security as required to protect the Work. The Contractor is advised that some random acts of vandalism to equipment and thefts have occurred within the Park.

1.6 **OFFICES**

- .1 Provide office heated to 22°C, lighted 750 lux and ventilated, of sufficient size to accommodate site meetings and furnished with drawing laydown table.
- .2 Provide a clearly marked and fully stocked first-aid case in a readily available location.

1.7 **EQUIPMENT, TOOL AND MATERIALS STORAGE**

- .1 Provide and maintain, in a 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 a manner to cause least interference with work activities.

1.8 **SANITARY FACILITIES**

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

1.9 **CONSTRUCTION SIGNAGE**

- .1 No other signs or advertisements, other than warning and traffic control signs, are permitted on site.
- .2 Signs and notices for safety and instruction shall be in both official languages Graphic symbols shall conform to CAN3-Z321.
- .3 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.

Part 2 Products

- .1 Not Used.

Part 3 Execution

- .1 Not Used.

END OF SECTION

- Part 1 **General**
- 1.1 **PRECEDENCE**
- .1 For Federal Government projects, Division 1 Sections take precedence over technical specification sections in other Divisions of this Project Manual.
- 1.2 **MEASUREMENT PROCEDURES**
- .1 This work shall be incidental to contract and will not be measured for payment.
- 1.3 **INSTALLATION AND REMOVAL**
- .1 Provide temporary controls in order to execute Work expeditiously.
- .2 Remove from site all such work after use.
- 1.4 **HOARDING**
- .1 Provide barriers around trees and plants designated to remain. Protect from damage by equipment and construction procedures.
- 1.5 **GUARD RAILS AND BARRICADES**
- .1 Provide secure, rigid guard rails and barricades around deep excavations.
- 1.6 **WEATHER ENCLOSURES**
- .1 Not used.
- 1.7 **DUST TIGHT SCREENS**
- .1 Not used.
- 1.8 **ACCESS TO SITE**
- .1 Provide and maintain access roads, as may be required for access to Work.
- 1.9 **PUBLIC TRAFFIC FLOW**
- .1 Provide and maintain competent signal flag operators, traffic signals, barricades and flares, lights, or lanterns as required to perform Work and protect the public.
- 1.10 **PROTECTION FOR OFF-SITE AND PUBLIC PROPERTY**
- .1 Protect surrounding public property from damage during performance of Work.
- .2 Be responsible for damage incurred.
- 1.11 **PROTECTION OF BUILDING FINISHES**

.1 Not used.

Part 2 Products

.1 Not Used.

Part 3 Execution

.1 Not Used.

END OF SECTION

Part 1 **General**

1.1 **REFERENCE STANDARDS**

- .1 Within text of each specifications section, reference may be made to reference standards.
- .2 Conform to these reference standards, in whole or in part as specifically requested in specifications.
- .3 If there is question as to whether any product or system is in conformance with applicable standards, Departmental Representative reserves right to have such products or systems tested to prove or disprove conformance.
- .4 Cost for such testing will be borne by Departmental Representative in event of conformance with Contract Documents or by Contractor in event of non-conformance.
- .5 Conform to latest date of issue of referenced standards in effect on date of submission of Tenders, except where specific date or issue is specifically noted.

1.2 **QUALITY**

- .1 Products, materials, equipment and articles (referred to as products throughout specifications) incorporated in Work shall be new, not damaged or defective, and of best quality (compatible with specifications) for purpose intended. If requested, furnish evidence as to type, source and quality of products provided.
- .2 Defective products, whenever identified prior to completion of Work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility, but is precaution against oversight or error. Remove and replace defective products at own expense and be responsible for delays and expenses caused by rejection.
- .3 Should any dispute arise as to quality or fitness of products, decision rests strictly with Departmental Representative based upon requirements of Contract Documents.
- .4 Unless otherwise indicated in specifications, maintain uniformity of manufacture for any particular or like item throughout building.

1.3 **AVAILABILITY**

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

1.4 **STORAGE, HANDLING AND PROTECTION**

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

1.5 **TRANSPORTATION**

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

1.6 **MANUFACTURER'S INSTRUCTIONS**

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

1.7 **QUALITY OF WORK**

- .1 Ensure Quality of Work is of highest standard, executed by workers experienced and skilled in respective duties for which they are employed. Immediately notify

Departmental Representative if required Work is such as to make it impractical to produce required results.

- .2 Do not employ anyone unskilled in their required duties. Departmental Representative reserves right to require dismissal from site, workers deemed incompetent or careless.
- .3 Decisions as to standard or fitness of Quality of Work in cases of dispute rest solely with Departmental Representative whose decision is final.

1.8 **CO-ORDINATION**

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

1.9 **CONCEALMENT**

- .1 The Contractor shall not conceal or otherwise cover up work without first providing 24hrs notice of their intention to do so to the Departmental Representative so that they may make arrangements to inspect work if they deem it necessary.
- .2 The Departmental Representative will inspect all work prior to any concrete pours. The Contractor shall notify the Departmental Representative 24 hours before any pour for inspection.

1.10 **REMEDIAL WORK**

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

1.11 **FASTENINGS**

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

- .6 Fastenings that cause spalling or cracking of material to which anchorage is made are not acceptable.

1.12 **PROTECTION OF WORK IN PROGRESS**

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

Part 2 Products

- .1 Not Used.

Part 3 Execution

- .1 Not Used.

END OF SECTION

Part 1 **General**

1.1 **MEASUREMENT PROCEDURES**

- .1 This work shall be incidental to contract and will not be measured for payment.

1.2 **REFERENCES**

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

1.3 **QUALIFICATIONS OF SURVEYOR**

- .1 Qualified surveyor, licensed to practise in Place of Work, acceptable to Departmental Representative.

1.4 **SURVEY / LAYOUT REQUIREMENTS**

- .1 The Departmental Representative will indicate the beginning and end of the project and sufficient reference points and other information for horizontal and vertical control, to be used by the Contractor for his detailed layout. The Contractor shall protect and shall not remove or destroy, or permit to be removed or destroyed, the stakes or marks set as reference points by the Departmental Representative. Subsequent to the initial reference points staking performed by the Departmental Representative, the Contractor shall perform all layout, survey and construction staking necessary to meet specified requirements for any type of construction.

1.5 **SURVEY REFERENCE POINTS**

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

1.6 **SURVEY REQUIREMENTS**

- .1 Contractor will be responsible for all staking and layout including but not limited to:
 - .1 Establish lines and levels, locate and lay out, by instrumentation.
 - .2 Stake for grading, cut and fill.

- .3 Stake slopes and top of embankment, sub-base course, base course and centreline for paving.
- .4 Accuracy:
 - .1 All survey work shall be tied into the existing Control Monument Network with grid coordinates in UTM Zone 11 NAD 83. Departmental Representative will provide information on control points.
 - .2 All traverses will be closed and balanced. All level loops and traverses will be tied into the Control Monument Network.
 - .3 Secondary Control Points will be tied into and relative to Control Monument Network. Accuracy for Control Points surveys shall be to second order:
 - .4 Horizontal shall be less than $r = 5(d+0.2)$ where "r" is in cm and "d" is in km
 - .5 Vertical shall be less than $0.008 \times \sqrt{k}$ where k is distance in kilometres.
- .5 Staking accuracy shall be:
 - .1 In bush areas, all elevations shall be within 0.1m of correct elevation.
 - .2 In open ground, all elevations shall be within 0.05 m of correct elevation.
 - .3 On highway surface, all elevations shall be within 0.01 m of correct elevation.
 - .4 Reference Survey Control Points that are in danger of being damaged or destroyed.
- .2 Departmental Representative will complete all measurement surveys.

1.7 RECORDS

- .1 Maintain a complete, accurate log of control and survey work as it progresses.
- .2 Record locations of maintained, re-routed and abandoned service lines.

1.8 SUBMITTALS

- .1 Submit name and address of Surveyor to Departmental Representative prior to surveying.
- .2 On request of Departmental Representative, submit documentation to verify accuracy of field engineering work.
- .3 Submit certificate signed by surveyor certifying those elevations and locations of completed Work that conform with Contract Documents.

Project No. 201619
August 2016
Parks Canada Agency

Snowsheds Lighting
Len's LED Lighting
Trans Canada Highway
Glacier National Park

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Part 2 Products

.1 Not Used.

Part 3 Execution

.1 Not Used.

END OF SECTION

Part 1 **General**

1.1 **PRECEDENCE**

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

1.2 **MEASUREMENT PROCEDURES**

- .1 This work shall be incidental to contract and will not be measured for payment.

1.3 **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 regularly scheduled times or dispose of as directed by Departmental Representative. Do not burn waste materials on site.
- .3 Clear snow and ice from access to work areas during active construction periods and when access to environmental protection facilities required outside active construction times.
- .4 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .5 One bear proof container will be provided by Parks Canada. Contractor to provide any additional on-site bear proof containers he requires for collection of waste materials and debris.
- .6 Remove waste material and debris from site at end of each working day.
- .7 Dispose of waste materials and debris off site.
- .8 Store volatile waste in covered metal containers, and remove from premises at end of each working day.
- .9 Provide adequate ventilation during use of volatile or noxious substances.
- .10 Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.

1.4 **FINAL CLEANING**

- .1 When Work is Substantially Performed, remove surplus products, tools, construction machinery and equipment not required for performance of remaining Work.
- .2 Prior to final review, remove surplus products, tools, construction machinery and equipment.

- .3 Remove waste products and debris including that caused by Owner or other Contractors.
- .4 Remove waste materials from site at regularly scheduled times or dispose of as directed by Departmental Representative. Do not burn waste materials on site.
- .5 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .6 Inspect finishes, and ensure specified workmanship and operation.
- .7 Remove dirt and other disfiguration from exterior surfaces.
- .8 Sweep and wash clean paved areas.
- .9 Clean drainage systems.

Part 2 Products

- .1 **Not Used.**

Part 3 Execution

- .1 **Not Used.**

END OF SECTION

Part 1 General

1.1 PRECEDENCE

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

1.2 MEASUREMENT PROCEDURES

- .1 This work shall be incidental to contract and will not be measured for payment.

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.

- .2 Departmental Representative's Inspection: Departmental Representative and Contractor will perform inspection of Work to identify obvious defects or deficiencies. Contractor shall correct Work accordingly.

- .3 Completion: submit written certificate that the 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 Work is complete and ready for Final Inspection.

- .4 Final Inspection: when items noted above are completed, request final inspection of Work by Departmental Representative, and Contractor. If Work is deemed incomplete by Departmental Representative, complete outstanding items and request re-inspection.

Part 2 Products

- .1 Not Used.

Part 3 Execution

- .1 Not Used.

END OF SECTION

Part 1 **General**

1.1 **PRECEDENCE**

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

1.2 **FINALISATION DOCUMENTATION**

- .1 The Contractor shall prepare all finalisation documentation and closeout submittals as identified in the Contract to a high standard and submit them to the Departmental Representative for review and make changes as reasonably requested before resubmission.

1.3 **AS-BUILTS AND SAMPLES**

- .1 In addition to requirements in General Conditions, maintain at the site for Departmental Representative one record copy of:

- .1 Contract Drawings.
- .2 Specifications.
- .3 Addenda.
- .4 Change Orders and other modifications to the Contract.
- .5 Reviewed shop drawings, product data, and samples.
- .6 Field test records.
- .7 Inspection certificates.
- .8 Manufacturer's certificates.

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

1.4 **RECORDING ACTUAL SITE CONDITIONS**

- .1 Record information on set of black line opaque Drawings and in copy of the Project Manual.
- .2 Record information concurrently with construction progress. Do not conceal Work until required information is recorded.
- .3 Contract Drawings and shop drawings: legibly mark each item to record actual construction, including:
 - .1 Field changes of dimension and detail.
 - .2 Changes made by change orders.
 - .3 Details not on original Contract Drawings.
 - .4 References to related shop drawings and modifications.
- .4 Specifications: legibly mark each item to record actual construction, including:
 - .1 Changes made by Addenda and change orders.

1.5 **FINAL SURVEY**

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

1.6 **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.

Part 2 Products

- .1 **Not Used.**

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Snowsheds Lighting
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Part 3 Execution

.1 **Not Used.**

END OF SECTION

Part 1 **General**

1.1 **PRECEDENCE**

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

1.2 **MEASUREMENT PROCEDURES**

- .1 This work shall be incidental to contract and will not be measured for payment.

1.3 **REFERENCES**

- .1 Export and Import of Hazardous Waste Regulations (EIHW Regulations), SOR/92-637.
- .2 National Fire Code of Canada 1995.
- .3 Transportation of Dangerous Goods Act, 1992 (TDG Act) [1992], (c. 34).
- .4 Transportation of Dangerous Goods Regulations (T-19.01-SOR/2001-286).

1.4 **DEFINITIONS**

- .1 Dangerous Goods: Product, substance, or organism that is specifically listed or meets the hazard criteria established in Transportation of Dangerous Goods Regulations.
- .2 Hazardous Material: Product, substance, or organism that is used for its original purpose; and that is either dangerous goods or a material that may cause adverse impact to the environment or adversely affect health of persons, animals, or plant life when released into the environment.
- .3 Hazardous Waste: Any hazardous material that is no longer used for its original purpose and that is intended for recycling, treatment or disposal.
- .4 Workplace Hazardous Materials Information System (WHMIS): A Canada-wide system designed to give employers and workers information about hazardous materials used in the workplace. Under WHMIS, information on hazardous materials is to be provided on container labels, material safety data sheets (MSDS), and worker education programs. WHMIS is put into effect by a combination of federal and provincial laws.

1.5 **SUBMITTALS**

- .1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit to Departmental Representative current Material Safety Data Sheet (MSDS) for each hazardous material required prior to bringing hazardous material on site.
- .3 Submit hazardous materials management plan to Departmental Representative that identifies all hazardous materials, their use, their location, personal protective equipment requirements, and disposal arrangements.

1.6 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 Transport hazardous materials and wastes in accordance with Transportation of Dangerous Goods Act, Transportation of Dangerous Goods Regulations, and applicable provincial regulations.
- .4 Storage and Handling Requirements:
 - .1 Co-ordinate storage of hazardous materials with Departmental Representative and abide by internal requirements for labelling and storage of materials and wastes.
 - .2 Store and handle hazardous materials and wastes in accordance with applicable federal and provincial laws, regulations, codes, and guidelines.
 - .3 Store and handle flammable and combustible materials in accordance with National Fire Code of Canada requirements.
 - .4 All explosives must be mixed outside of the Park and delivered to the site. No storage of explosives shall be allowed within the National Parks.
 - .5 Keep no more than 45 litres of flammable and combustible liquids such as gasoline, kerosene and naphtha for ready use.
 - .6 Store flammable and combustible liquids in approved safety cans bearing the Underwriters' Laboratory of Canada or Factory Mutual seal of approval.
 - .7 Storage of quantities of flammable and combustible liquids exceeding 45 litres for work purposes requires the written approval of the Departmental Representative.
 - .8 Transfer of flammable and combustible liquids is prohibited within buildings.
 - .9 Transfer flammable and combustible liquids away from open flames or heat-producing devices.
 - .10 Solvents or cleaning agents must be non-flammable or have flash point above 38 degrees C.
 - .11 Store flammable and combustible waste liquids for disposal in approved containers located in safe, ventilated area. Keep quantities to minimum.
 - .12 Observe smoking regulations, smoking is prohibited in areas where hazardous materials are stored, used, or handled.

- .13 Storage requirements for quantities of hazardous materials and wastes in excess of 5 kg for solids, and 5 litres for liquids:
- .14 Store hazardous materials and wastes in closed and sealed containers.
- .15 Label containers of hazardous materials and wastes in accordance with WHMIS.
- .16 Store hazardous materials and wastes in containers compatible with that material or waste.
- .17 Segregate incompatible materials and wastes.
- .18 Ensure that different hazardous materials or hazardous wastes are stored in separate containers.
- .19 Store hazardous materials and wastes in secure storage area with controlled access.
- .20 Maintain clear egress from storage area.
- .21 Store hazardous materials and wastes in location that will prevent them from spilling into environment.
- .22 Have appropriate emergency spill response equipment available near storage area, including personal protective equipment.
- .23 Maintain inventory of hazardous materials and wastes, including product name, quantity, and date when storage began.

Part 2 Products

2.1 MATERIALS

- .1 Only bring on site the quantity of hazardous materials required to perform Work.
- .2 Maintain MSDSs in proximity to where the materials are being used. Communicate this location to personnel who may have contact with hazardous materials.

Part 3 Execution

3.1 DISPOSAL

- .1 Dispose of hazardous waste materials in accordance with applicable federal and provincial acts, regulations, and guidelines.
- .2 Recycle hazardous wastes for which there is an approved, cost effective recycling process available.
- .3 Send hazardous wastes only to authorized hazardous waste disposal or treatment facilities.

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

END OF SECTION

Part 1 **General**

1.1 PRECEDENCE

- .1 General requirements that are common to NMS sections found in Division 26 – Electrical, Division 27 – Communications and Division 28 - Electronic Safety and Security.

1.2 RELATED SECTIONS

- .1 26 05 02 – Provisions for Payment - Electrical
- .2 26 05 20 – Wire and Box Connectors (0-1000V)
- .3 26 05 21 – Wires and Cables (0-1000V)
- .4 26 05 22 – Connectors and Terminations
- .5 26 05 28 – Grounding
- .6 26 05 29 – Hangers and Supports for Electrical Systems
- .7 26 05 32 – Outlet Boxes, Conduit Boxes and Fittings
- .8 26 05 34 – Conduits, Conduit Fastenings and Conduit Fittings
- .9 26 05 44 – Installation of Cables in Trenches and Ducts
- .10 26 27 16 – Outdoor Equipment Enclosures
- .11 26 56 19 – Snowshed Lighting
- .12 35 65 76 – Direct Buried Underground Cable Conduits
- .13 26 24 16.01 – Panelboards Breaker Type
- .14 26 28 16.02 – Moulded Case Circuit Breakers
- .15 26 29 03 – Control Devices
- .16 26 56 19 – Lighting and Power Control system
- .17 27 10 05 – Cabling for Communications Systems
- .18 30 90 00 – Electrical System Testing and Commissioning
- .19 30 92 00 – Finalisation Documentation

1.3 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA C22.1-12, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.
- .2 Electrical and Electronic Manufacturer's Association of Canada (EEMAC)
 - .1 EEMAC 2Y-1-1958, Light Gray Colour for Indoor Switch Gear.
- .3 BC Ministry of Transportation and Infrastructure Electrical and Signing Material Standards
- .4 Health Canada / Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .5 All inspections and tests shall be in accordance with, but not limited to, the following applicable codes and standards except as provided otherwise in this Section.
 - .1 International Electrical Testing Association - NETA
 - .2 National Electrical Manufacturer's Association – NEMA
 - .3 Canadian Electrical Manufacturers Association - CEMA
 - .4 American Society for Testing and Materials - ASTM
 - .5 Institute of Electrical and Electronic Engineers – IEEE
 - .6 1584-2002, Guide for Performing Arc-Flash Hazard Calculations
 - .7 American National Standards Institute – ANSI
 - .8 ANSI Z535.4-2002, Product Safety Signs and Labels
 - .9 Canadian Electrical Code - Parts 1 and 2
 - .10 Canadian Standards Association – CSA
 - .1 CSA Z462-12, Workplace electrical safety, provides assistance in determining the severity of potential exposure, planning safe work practices, and selecting personal protective equipment to protect against shock and arc flash hazards.

- .11 Insulated Power Cable Engineers Association - IPCEA
 - .12 National Fire Protection Association - NFPA
 - .13 ANSI/NFPA 70B: Electrical Equipment Maintenance
 - .14 WCB Regulations
 - .15 CANICSA-B72-M87: Lightning Protection Code
 - .16 Municipal By-Laws
- .6 All inspections and tests shall utilize the following references:
- .1 Project design drawings and specifications
 - .2 Shop drawings and submittals
 - .3 Manufacturer's instruction manuals applicable to each particular apparatus
 - .4 Applicable NETA acceptance testing work scope sections per NETA ATS 2003

1.4 **REMOVALS OF REDUNDANT MATERIALS AND EQUIPMENT**

- .1 All redundant distribution equipment, control equipment, conduit, building systems, cables and wiring shall be removed from site and disposed of in a manner consistent with local Waste Management Plans at the Contractor's expense.

1.5 **DOCUMENTS**

- .1 Without relieving the Contractor of his responsibilities, the Specifications have been divided into approximate trade sections for convenience. These Sections do not, however, limit the responsibility of any subcontractor or supplier. The Departmental Representative will not arbitrate on any dispute between the subcontractors' responsibilities. The onus of defining the extent of the subcontractors' work remains with the Contractor, who, when awarding subcontracts, will ensure that the area of responsibility of any particular subcontractor is set out in full detail.
- .2 The words "provide" and "install" shall be taken to mean supply, install, test, and commission.

1.6 **SCOPE OF WORK**

- .1 Provide all equipment, materials, labour, and services set out herein and as shown on the Drawings to deliver a complete and operational LED lighting installation and all related electrical systems associated with the Len's LED lighting, Snowshed Lighting Control System.
- .2 The following summarizes the project scope of work which includes, but is not limited to:

- .1 Len's Snowshed Lighting:
 - .1 Supply and installation of LED lighting for Len's Snowshed and all associated equipment, mounts, cables, conduit, wiring, and junction boxes for connection to lighting distribution panel.
 - .2 Supply and installation of a snowshed lighting control system for the Len's Snowshed, including luminaire control unit, lighting controller, uninterruptible power supply, HMI unit, network switch, Ethernet I/O device, resistance temperature detector, powerline communications module, contactor relays, enclosure, and all associated equipment, cables, conduit and wiring. Integration of existing building alarm system at Len's Substation with new Lighting Control Cabinet.
 - .3 Supply and installation of a hand-off-auto switch cabinet and all associated equipment, cables, conduit and wiring.
- .2 Removal of existing luminaires, mounting brackets, wireways and wiring within Len's Snowshed. Supply and installation of LEDs for existing streetlight davit poles and flasher luminaires, including all associated equipment, junction boxes, flasher panels and lighting control units, mounts, cables, conduit, and wiring.
- .3 Provide testing and commissioning of the electrical services and systems provided under this Contract.
- .4 Provide vibration isolation equipment and materials including seismic restraints and anchoring.
- .5 Provide shop drawings, spare parts, manuals, and as-built drawings.
- .6 Provide all permits, licences and fees required by the authorities having jurisdiction.
- .7 Provide installation, testing, and commissioning of materials and equipment supplied by others where shown on the drawings and specifications.

1.7 **WORK RESTRICTIONS**

- .1 Coordinate any work requiring traffic interruption with the Owner's Representative.

1.8 **RESPONSIBILITY AND COORDINATION**

- .1 Provide all labour, materials, equipment, tools, and incidentals necessary to provide a complete electrical installation as indicated on the Drawings and as set out in these Specifications.
- .2 The Contractor shall advise the Departmental Representative during the tender period of any specified material or equipment which is either no longer available from manufacturers or whose delivery is likely to exceed the requirements of the anticipated Construction Schedule. Failure of the Contractor to perform the above shall cause the Contractor to

supply, at his own expense, alternate material or equipment as selected by the Departmental Representative at a later date. Alternatively, the Contractor shall procure the specified material or equipment at his own additional expense by means of air freight or other special means of transportation.

- .3 The Drawings and Specifications complement each other and what is called for by one is binding as if called for by both. If there is any doubt as to the meaning or true intent due to a discrepancy between the Drawings and Specifications, obtain a ruling from the Departmental Representative prior to tender closing. Failing this, the most expensive alternative is to be allowed for.
- .4 Advise the Departmental Representative of any specified equipment, material, or installation of same which appears inadequate or unsuitable or which is in violation of laws, ordinances, rules, or regulations of authorities having jurisdiction. Provide all labour and materials which are obviously necessary or reasonably implied to be necessary to complete the work as if the work was shown on the Drawings and/or described in the Specifications.
- .5 Check Drawings of all trades and coordinate the installation of all material and equipment to ensure adequate space and free access and to maintain headroom limitations for all proposed and indicated future work. Work out jointly, with all Subcontractors on the site, solutions to interference problems. Coordinate all work before fabricating or installing any material or equipment. It is incumbent on all Subcontractors on the site to ensure that all materials and equipment fit into the allocated spaces and that all equipment can be properly inspected, serviced, and replaced if and when required. Advise the Departmental Representative of space problems before fabricating or installing any material or equipment. Demonstrate to the Departmental Representative on completion of his work that all equipment and material installed by him can be properly and safely serviced and replaced. Make no deviations from the intent of the design, or any involving additional cost, without the Departmental Representative's written direction.
- .6 Where electrical work and materials are noted as being provided by the Owner or under other Divisions of these Specifications, the responsibility for integrating, to the extent required, such work and materials into the complete installation, shall remain within Division 26, 27 and 28.
- .7 Ensure that any building structure loaded during the installation is adequate to carry such load.
- .8 Coordinate the Acceptance Testing with the Owner and Departmental Representative.
- .9 Coordinate the factory field-testing and assistance per the requirements of this Section.
- .10 Perform all testing after installation and before energizing. All systems shall pass tests prior to being put into service.
- .11 The Contractor, in coordination with the equipment manufacturer's representatives, shall confirm the test schedule with the Departmental Representative prior to the test. The Contractor shall coordinate the test schedule so that the Departmental Representative can witness the testing, if required.

- .12 The Contractor shall deliver test results to the Departmental Representative within 7 working days of any given test.
- .13 Testing and calibration of electrical equipment shall be completed prior to the start of commissioning activities. When required during commissioning, the Contractor shall retest and re-calibrate equipment to support the commissioning activities.

1.9 PROTECTION

- .1 Protect exposed live equipment during construction for personnel safety.
- .2 Shield and mark live parts "LIVE 120 VOLTS", or with appropriate voltage.
- .3 Arrange for installation of temporary doors for rooms containing electrical distribution equipment. Keep these doors locked except when under direct supervision of electrician.

1.10 DRAWINGS AND MEASUREMENTS

- .1 Drawings are generally diagrammatic and are intended to indicate the scope and general arrangement of work.
- .2 The Drawings show approximate locations of outlets, equipment and apparatus but the right is reserved to make such changes in location before installation of the work as may be necessary to centre the lights or meet the exigencies of construction in any way. No extra will be allowed and conversely, no credit shall be expected for such changes unless for each item of work the distance moved exceeds 3 m prior to final installation of same.
- .3 Take field measurements where equipment and material dimensions are dependent upon building dimensions.

1.11 FASTENING AND SUPPORTS

- .1 Secure equipment to masonry, tile and plaster surfaces with nylon shields.

1.12 APPROVALS

- .1 Without limiting or restricting the contents of the Contract General Conditions, requests for approval of the substitution of materials pertaining to electrical work prior to awarding of any contract must be submitted to the Departmental Representative so that they are received by the Departmental Representative at least five (5) working days prior to the close of tender.
- .2 All submissions shall include the following information:
 - .1 Name and identification of specified item.
 - .2 Manufacturer, brand name, and catalogue number of the alternative item proposed.
 - .3 Detailed technical data and characteristics of alternative item such as dimensions, voltage, power requirements, performance characteristics, etc.

- .4 Request for lighting fixture substitutions must be followed by photometric data and proper shop drawings.
- .5 A list of any and all changes to the installation which may be required as a result of the substitution.
- .3 Materials, equipment, apparatus, light fixtures, or other products specified by manufacturers' brand name, type, or catalogue number are so specified in one of two ways:
 - .1 Specified item followed by the words "or equal" or "approved equal" or preceded by the words "equivalent to" or "equal to"; when the Specification is so worded, it is intended to establish a specific standard of quality and style but the item may be substituted for, provided written approval is stated in the form of an Addendum. It is the responsibility of the Contractor to assure that all features of the specified items are supplied as part of the substitute item. If written approval of a substitute item is not issued in the form of an Addendum, the item shall be supplied precisely as specified.
 - .2 Specified item not followed or preceded by any such qualifying phrases: When the specification is so worded, the item shall be supplied as specified and NO approved equals or equivalents will be allowed.
- .4 Review by the Departmental Representative of alternate materials as permitted above is only a general approval in principal and shall not relieve the Contractor of his responsibility to ensure that any approved alternate materials perform in the same manner and with the same intent as the originally specified material would have otherwise performed.
- .5 Where such substitutions alter the design or space requirements indicated on the Drawings, include all material, labour, design, and engineering costs for the revised design and construction including costs of all other trades affected and those incurred by the Architect and/or Departmental Representative .
- .6 It is the Contractor's responsibility to ensure substituted products are approved and that suppliers have written approval indicating conditions of any such approval. Alternate manufacturers who do not have such approval shall not be used in the work. If requested by the Departmental Representative, the Contractor for Divisions 26, 27 and 28 shall submit for inspection, samples of both the specified and the proposed substitute items on short notice.

1.13 **EQUIPMENT LIST**

- .1 Within 10 days of contract award and prior to placing orders, submit to the Departmental Representative a list of standard and special equipment to be supplied within Division 26, 27 and 28. List to include item identification, manufacturer, catalogue numbers where applicable, custom features where applicable, and the names of the installers if other than the prime sub-trade.

1.14 **DELIVERY AND STORAGE**

- .1 Store all electrical equipment and devices other than conduits, fittings, boxes, and ducts in a heated and ventilated space, and protect from construction damage. Include in the tender price all costs related to such storage.
- .2 Conduits, fittings, boxes, and ducts may be stored outside if properly protected against the weather.
- .3 Ship and store floor mounted equipment in upright position.
- .4 Ship equipment in adequate containers to assure it arrives undamaged at the site.
- .5 Keep equipment doors locked. Protect equipment from damage and dust.
- .6 Block moving parts when necessary to prevent damage during movement and shipment of equipment.
- .7 Remove from the site, and replace with new, all materials showing evidence of damage or rust.

1.15 **SUBMITTALS**

- .1 Shop Drawings
 - .1 Submit detailed shop drawings for a minimum of the following equipment:
 - .1 Equipment data sheets for all equipment listed on the drawings and in the specifications.
 - .2 Fiber and LAN systems.
 - .3 Lighting control system.
 - .4 Electrical equipment junction boxes and cabinets.
 - .5 Mounting brackets.
 - .2 All custom and engineered product shop drawings shall bear the stamp of a Professional Engineer registered in the province of British Columbia.
 - .3 Manufacture or purchase of equipment must not be commenced until shop drawings have been approved by the Departmental Representative.
 - .4 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.
 - .5 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that

such items have been coordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross-references to design drawings and specifications.

- .6 Allow 10 days for review of each submission.
- .7 Submit shop and setting drawings or diagrams to the Departmental Representative sufficiently in advance of requirements to allow time for review and comment. Provide shop drawings in electronic format, Adobe Acrobat "pdf." The drawing will be retained by the Departmental Representative for their office use and a copy will be marked and returned to the Contractor for correction if necessary, further reproduction, and distribution as required. Provide shop drawings in AutoCAD 2008 format where required for major equipment as noted in individual sections herein.
 - .1 Shop drawings shall be neatly drafted and shall be complete and detailed and shall be provided as stipulated elsewhere in these Specifications. This requirement is mandatory for such items as switchboards; custom-fabricated equipment panels, consoles, or racks; and custom-fabricated lighting fixtures and communication systems.
 - .2 All shop drawings shall use metric dimensions. Scaled drawings shall use metric scale.
 - .3 Ensure that all cable pit and cable trench locations are clearly shown and dimensioned on all shop drawings of high voltage and other switchgear.
 - .4 Shop drawings shall bear specific names for each and every unit assembly defined thereon, the name of the project where installation is to take place, the name of the manufacturer, and the date of the drawing including notation of latest revision, if any.
 - .5 Except as may be necessary to indicate operation of switchgear and similar apparatus and to show field interconnections, detailed wiring diagrams of component assemblies need not be included with shop drawings unless requested by the Departmental Representative. However, such wiring diagrams shall be included as part of the Maintenance Manual as required by these Specifications.
 - .6 Indicate details of construction, dimensions, locations of cable pits and trenches, capacities, weights and electrical performance characteristics of equipment and materials.
 - .7 Shop drawings may be prepared by the Contractor, or manufacturer's drawings will be accepted. Drawings required for one and the same system shall be submitted as a complete package. Incomplete system packages will not be reviewed and will be returned unmarked.
 - .8 Shop drawings shall be reviewed by the Contractor prior to submission to the Departmental Representative. Shop drawings not bearing Contractor's approval stamp, approval date, signature, and project name will be returned without comment.

- .9 Manufacturers' brochures (product data) submitted as shop drawings shall clearly indicate type (i.e., lighting fixture Type AD, intercom station Type B, etc.) and all features as specified as part of the unit(s).
- .10 Facsimile shop Drawings will not be accepted.
- .11 Review of shop drawings by the Departmental Representative is for the sole purpose of ascertaining conformance with the general design intent. The review shall not mean approval of the detail design inherent in the shop drawings, responsibility for which shall remain with the Contractor submitting same, and such review shall not relieve the Contractor of his responsibility for errors or omissions in the shop drawings or of his responsibility for meeting all requirements of the Contract Documents. The Contractor is responsible for dimensions to be confirmed and correlated at the job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for coordination of the work of all sub-trades.
- .12 Ensure that copies of all shop drawings are available at the job site.
- .8 Test Procedures:
 - .1 Submittals shall be in accordance with Conditions of the Contract.
 - .2 Submit the qualifications of the individual(s) doing testing and commissioning according to this Section for approval.
 - .3 Submit the coordinated test schedule for approval.
 - .4 Submit detailed test procedures corresponding to the requirements in this Section for approval. The test procedures shall be detailed test instructions, written with sufficient step-by-step information to allow a test to be repeated under identical conditions. List all setpoint values and acceptable results for each condition tested.
 - .5 Submit a preliminary copy of the hand-written field test results to the Departmental Representative and the Contractor within one (1) week after the test is completed.
 - .6 Prior to energization of equipment, submit a letter certifying that the electrical installation being energized complies with contract documents, applicable codes, and proper system operation.
 - .7 The test reports shall be compiled and submitted in formal form with a summary.
- .9 Maintenance Manuals:
 - .1 Submission:
 - .1 Prepare instructions and data using personnel experienced in maintenance and operation of described products.

- .2 Copy will be returned after final inspection, with Departmental Representative's comments.
 - .3 Revise content of documents as required prior to final submittal.
 - .4 Two weeks prior to Substantial Performance of the Work, submit to the Departmental Representative, four final copies of operating and maintenance manuals in English.
 - .5 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.
 - .6 If requested, furnish evidence as to type, source and quality of products provided.
 - .7 Defective products will be rejected, regardless of previous inspections. Replace products at own expense.
 - .8 Pay costs of transportation.
- .10 Format
- .1 Organize data in the form of an instructional manual.
 - .2 Binders: vinyl, hard covered, 3 'D' ring, loose leaf 219 x 279 mm with spine and face pockets.
 - .3 When multiple binders are used, correlate data into related consistent groupings. 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 systems under Section numbers and sequence of Table of Contents.
 - .6 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.
 - .7 Text: Manufacturer's printed data, or typewritten data.
 - .8 Drawings: provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

- .11 Contents – Each Volume:
 - .1 Table of Contents: provide title of project;
 - .1 Date of submission; names,
 - .2 Addresses, and telephone numbers of Departmental Representative and Contractor with name of responsible parties;
 - .3 Schedule of products and systems, indexed to content of volume.
 - .2 For each product or system:
 - .1 List names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.
 - .3 Product Data: mark each sheet to clearly identify specific products and component parts, and data applicable to installation; delete inapplicable information.
 - .4 Drawings: supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.
 - .5 Typewritten Text: as required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.
 - .6 Guarantees, Warrantees 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.
- .12 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.
- .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 summer, winter, and any special operating instructions.
 - .5 Maintenance Requirements: include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
 - .6 Provide servicing and lubrication schedule, and list of lubricants required.
 - .7 Include manufacturer's printed operation and maintenance instructions.
 - .8 Include sequence of operation by controls manufacturer.
 - .9 Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
 - .10 Provide installed control diagrams by controls manufacturer.
 - .11 Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
 - .12 Additional requirements: As specified in individual specification sections.
- .13 "As-Built" Drawings
- .1 Refer to Contract Documents.
 - .2 Upon completion of the work, all changes and site information shall be transferred to one set of electrical drawings by the contractor.
 - .3 Return "As-Built" drawings complete with electrical contractor's "As-Built" stamp and signature to the Departmental Representative for review.
 - .4 Notwithstanding the above, maintain in the job site office in up-to-date condition, one (1) complete set of whiteprints of each of the Electrical Contract Drawings and one (1) set of Specifications, including Revision Drawings, marked clearly and indelibly in red, indicating "As-Built" conditions where such conditions deviate from the original directions of the

Contract Documents, and indicating final installation of feeders and branch circuits.

- .5 "As-Built" drawing markings shall include but shall not be limited to the following:
 - .1 All changes in circuiting.
 - .2 Size and routing of all conduits for branch circuits including power, lighting, and systems. Note that branch circuit wiring is generally not shown on Drawings. Accurately record on "As-Built" drawings the size and routing of all installed raceways and cables.
 - .3 Number and size of conductors in raceways and cables
 - .4 Location of all junction and pull boxes
 - .5 Location of all access panels
 - .6 Location of all conduit or duct stubs, installed equipment, devices, and fixtures
 - .7 All changes to electrical installation resulting from Addenda, Change Orders, and Field Instructions (Architectural / Engineering Instructions)
 - .8 Exact location of all services left for future work
 - .9 Location by accurate horizontal and vertical dimensions of the routes and terminations of all raceways and cables installed underground beyond the building.
 - .10 Exact labeling of each communication system cable at each telephone and data outlet location. Locate label numbers adjacent each communication outlet indicated on drawings. Label numbers to match those at the Communication Room cable end.
 - .11 Where extensive changes have been made to an area to the point where it is not practical to update the original tender drawing, the area in question shall be enclosed with a heavy dotted line and reference made to the applicable Change Order, Instruction, and/or associated Revision Drawing.
 - .12 For each and every "As-Built" drawing, reference shall be neatly drawn inside the framed space above the title block, listing all Contemplated Change Orders, Instructions, and Revision Drawing

Numbers applicable to the particular "As-Built" drawing in question.

- .13 Each "As-Built" drawing as defined above shall bear the Contractor's identification and signature, the date of record, and the notation: "We hereby certify that these Drawings represent the building as built."
- .14 All Addenda and Revision Drawings not having their details transferred onto the submitted "as-built" drawings shall be included in the submission using the same drawing format as previously described.

1.16 **SUBSTANTIAL PERFORMANCE INSPECTION**

- .1 Before the Departmental Representative is requested to make a Substantial Performance inspection, submit written confirmation that:
 - .1 All wiring devices, cover plates, motor controls, lighting fixtures, and other equipment are operational, plumb, clean, and correctly labelled.
 - .2 All distribution equipment (cabinets, panels, distribution transformers, etc.) has been cleaned and vacuumed.
 - .3 All Test Reports have been submitted.
 - .4 All auxiliary systems have been tested as required and are in good and proper working order.
 - .5 All certificates of final acceptance from the authorities having jurisdiction have been received and submitted to the Departmental Representative.
 - .6 Factory finished equipment has been cleaned, touched up, or refinished as necessary to present a new appearance.
 - .7 All sealing of conduits, cables, cable trays, wireways, etc. at wall, ceiling, and floor penetrations have been completed.
 - .8 All lighting fixtures including lenses and reflectors have been properly cleaned as specified.
 - .9 All loose equipment including spare parts and replacement parts have been turned over to the Owner and receipts obtained for same.
 - .10 The Maintenance Manuals have been submitted.
 - .11 All demonstrations and instructions to the Owner have been completed.
- .2 The Departmental Representative's Substantial Performance inspection is a pre-requisite to

Substantial Performance.

- .3 Provision of the above shall not be construed as compliance with all administrative documentation required.
- .4 Notwithstanding any other provisions of the Contract, failure to complete all of the above shall give cause to deny the issuance of a Substantial Performance Certificate.

1.17 **DESIGN REQUIREMENTS**

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

1.18 **QUALITY ASSURANCE**

- .1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control
- .2 Qualifications: electrical Work to be carried out by qualified, licensed electricians who hold valid Master Electrical Contractor license or apprentices in accordance with authorities having jurisdiction as per the conditions of Electrical Safety Regulation within the Electrical Safety Act and the Building Code and By-Laws.
 - .1 Employees registered in provincial apprentices program: permitted, under direct supervision of qualified licensed electrician, to perform installation tasks.
 - .2 Submit list showing names and qualifications of key supervisory personnel.
- .3 Site Meetings:
 - .1 In accordance with overall project schedule.

1.19 **FIELD QUALITY CONTROL**

- .1 Site Meetings: as part of Manufacturer's Field Services described schedule site visits, to review Work, at stages listed.
 - .1 After delivery and storage of products, and when preparatory Work is complete but before installation begins.
 - .2 Twice during progress of Work at 25% and 60% complete.
 - .3 Upon completion of Work, after cleaning is carried out.

- .2 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 30 - Health and Safety Requirements.

1.20 DELIVERY, STORAGE AND HANDLING

- .1 Material Delivery Schedule: provide Departmental Representative with schedule within 1 week after award of Contract.
- .2 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance Specifications.

1.21 SAFETY AND PRECAUTIONS

- .1 Safety practices shall include, but are not limited to, the following requirements:
 - .1 Workers' Compensation Board Regulations
 - .2 Municipal By-Laws
 - .3 Canadian Electrical Code
 - .4 Electrical Safety Act of BC
 - .5 Municipal, Provincial and Canadian Building Code
- .2 Tests shall be performed with apparatus de-energized unless otherwise specified (e.g., rotation, phasing).
- .3 Power circuits shall have conductors shorted to ground by an approved hotline grounded device.
- .4 In all cases, work shall not proceed until the Contractor's safety representative has determined that it is safe to do so.
- .5 The Contractor shall have sufficient protective barriers and warning signs available, where necessary, to conduct specified tests safely.
- .6 The Project safety procedures shall be reviewed and accepted by the Contractor and all sub-trades.

Part 2 Products

2.1 MATERIALS AND EQUIPMENT

- .1 Material and equipment to be CSA certified. Where CSA certified material and equipment are not available, obtain special approval from inspection authorities before delivery to site and submit such approval as described in PART 1 - Submittals.
- .2 Factory assemble control panels and component assemblies.

2.2 WARNING SIGNS

- .1 Warning Signs: in accordance with requirements of inspection authorities.
- .2 Provide Arc Flash labels on electrical equipment.
- .3 Lamicoïd signs, minimum size 175 x 250 mm.

2.3 WIRING TERMINATIONS

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

2.4 EQUIPMENT IDENTIFICATION

- .1 Identify electrical equipment with nameplates and labels as follows:
 - .1 Nameplates: lamicoïd 3mm thick plastic engraving sheet matt white finish face, black core, lettering accurately aligned and engraved into core mechanically attached with stainless steel 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: lamicoïd labels with 6 mm high letters unless specified otherwise.
- .3 Wording on nameplates and labels to be approved by Departmental Representative prior to manufacture.
- .4 Allow for minimum of twenty-five (25) letters per nameplate and label.
- .5 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.
- .6 Disconnects, starters and contactors: indicate equipment being controlled and voltage.
- .7 Terminal cabinets and pull boxes: indicate system and voltage.
- .8 Transformers: indicate capacity, primary and secondary voltages.

2.5 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.
- .4 Use colour coded wires in communication cables, matched throughout system.

2.6 CONDUIT AND CABLE IDENTIFICATION

- .1 Colour code conduits, boxes and metallic sheathed cables.
- .2 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15m intervals.
- .3 Colours: 25mm wide prime colour and 20mm wide auxiliary colour.

	Prime	Auxiliary
up to 250 V	Yellow	
up to 600 V	Yellow	Green
Telephone	Green	
Other Communication Systems	Green	Blue
Fire Alarm	Red	
Emergency Voice	Red	Blue
Other Security Systems	Red	Yellow

2.7 FINISHES

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

2.8 TEST EQUIPMENT

- .1 All test equipment shall be furnished by the Contractor.
- .2 Test instrument calibration
 - .1 The Contractor shall have a calibration program which maintains all applicable test instrumentation within rated accuracy.
 - .2 The accuracy shall be traceable to the National Bureau of Standards in an unbroken chain.
 - .3 Up-to-date calibration labels shall be visible on all test equipment.
- .3 Use of torque wrenches
 - .1 Use calibrated torque wrenches for all bolted connections on buses and power cable

terminations. Mark the head of the bolt with a coloured marking pen after its being torqued to manufacturer's recommended value.

Part 3 Execution

3.1 INSTALLATION

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

3.2 NAMEPLATES AND LABELS

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

3.3 CONDUIT AND CABLE INSTALLATION

- .1 See Appropriate Sections

3.4 LOCATION OF OUTLETS

- .1 NOT USED

3.5 MOUNTING HEIGHTS

- .1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.
- .2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.

3.6 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 - Submittals: phase and neutral currents on panelboards, dry-core transformers operating under normal load, as well as hour and date on which each load was measured, and voltage at time of test.
- .2 Conduct following tests:

- .1 Power distribution system including phasing, voltage, grounding and load balancing.
- .2 Lighting systems installations.
- .3 Circuits originating from branch distribution panels.
- .4 Lighting and its control.
- .5 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 - SUBMITTALS.
 - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
 - .3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

3.7 **CLEANING**

- .1 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.
- .2 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.
- .3 Repair or replace, at no cost to the Owner, any equipment or structures damaged by the execution of Contract to its original condition.

3.8 **SYSTEM STARTUP AND DEMONSTRATION**

- .1 Demonstrate to and instruct the Departmental Representative on operating, testing and

maintenance procedures for all electrical systems using the assistance of specialist sub-trades and manufacturer's representatives for instruction and include all costs in the tender.

- .2 Systems to be demonstrated shall include, but not be limited to, the following:
 - .1 Lighting control system
 - .2 Labeling and identification schemes.
 - .3 Use of Maintenance Manuals.
- .3 Arrange an acceptable time with the Owner and the Departmental Representative and submit a program of instruction and demonstration for the Departmental Representative's approval. Assume that the Owner's representative is not familiar with any of the special equipment and/or systems installed.
- .4 Submit to the Departmental Representative, at the time of Substantial Performance inspection, a complete list of systems stating for each system:
 - .1 Date instructions were given to the Owner's staff.
 - .2 Duration of instruction.
 - .3 Name of persons instructed.
 - .4 Other parties present (manufacturer's representative, Departmental Representative, etc.).
 - .5 Signature of the Owner's staff stating that they properly understood the system installation, operation, and maintenance requirements and identifying any systems or equipment which were not demonstrated to their satisfaction and which must be re-demonstrated.
- .5 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.
- .6 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.

3.9 **REPORTS**

- .1 Contractor shall prepare test reports on the systems tested. Include a copy of each test report in the Operation and Maintenance Manuals.
- .2 The Contractor shall prepare test reports including the following:
 - .1 Summary of project

- .2 Description of equipment tested
- .3 Description of test
- .4 Test results including re-testing results
- .5 Test dates
- .6 Tester's name
- .7 Witnesses (when required)
- .8 Corrective work
- .9 Acceptance criteria
- .10 Conclusions and recommendations
- .11 Appendix, including appropriate test form

END OF SECTION

Part 1 **General**

1.1 **SECTION INCLUDES**

- .1 This Section covers items common to Sections of Divisions 26 and 28.
- .2 This Section provides the description and measurement for payment for the Electrical Work described herein and as shown on the Plans, Specifications, and Standard Drawings. Include all work considered incidental to the contract within the applicable payment clauses.
- .3 This Section of the Specifications forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.
- .4 All work shown on the drawings and specifications that is not specifically defined in the payment items described within this section shall be considered incidental to the work. No extra payment will be made. The Contractor is required to provide all labour, equipment and materials necessary to provide a complete working system.
- .5 Payment for an item shall cover all costs of labour, equipment, material, supervision to satisfactorily complete the work indicated on the drawings and described in the specifications, and shall cover all costs of mobilization, demobilization, cleanup, coordination with others, and all incidental or other work required to complete the item of work to the satisfaction of the Departmental Representative.

1.2 **RELATED SECTIONS**

- .1 26 05 00 – Common Work Results for Electrical
- .2 26 05 20 – Wire and Box Connectors (0-1000V)
- .3 26 05 21 – Wires and Cables (0-1000V)
- .4 26 05 22 – Connectors and Terminations
- .5 26 05 28 – Grounding
- .6 26 05 29 – Hangers and Supports for Electrical Systems
- .7 26 05 32 – Outlet Boxes, Conduit Boxes and Fittings
- .8 26 05 34 – Conduits, Conduit Fastenings and Conduit Fittings
- .9 26 05 44 – Installation of Cables in Trenches and Ducts
- .10 26 27 16 – Outdoor Equipment Enclosures
- .11 26 56 19 – Snowshed Lighting
- .12 35 65 76 – Direct Buried Underground Cable Conduits

- .13 26 24 16.01 – Panelboards Breaker Type
- .14 26 28 16.02 – Moulded Case Circuit Breakers
- .15 27 10 05 - Cabling for Communications Systems
- .16 30 90 00 – Electrical System Testing and Commissioning
- .17 30 92 00 – Finalisation Documentation

Part 2 Measurement for Payment Descriptions

2.1 UNIT PRICE ITEMS

- .1 Payment for the supply and storage of 382W LED luminaires shall be made in accordance with **“Unit Price Item 1a) – Supply and store of 382W LED Luminaire c/w SOW cable to wireway, 3 mounting brackets, dimming module, fuse and in line disconnect .”** Payment will be made at the Unit Price per luminaire supplied and securely stored within Western Canada.
 - .1 The Unit Price includes all costs for the supply and storage of the 382W luminaire c/w, SOW cable to wireway, 3 mounting brackets, dimming module, fuse and in line disconnect.
 - .2 The Contractor shall store the supplied equipment at a location in Western Canada at their cost prior to March 31, 2017. Payment will only be made following the inspection of supplied equipment by the Departmental Representative.
 - .3 Payment of supply and storage costs does not relieve the Contractor of their responsibility for the equipment. They remain wholly responsible for the equipment until Contract Completion.
- .2 Payment for the installation of 382W LED luminaires shall be made in accordance with **“Unit Price Item 1b) – Install 382W LED Luminaire c/w SOW cable to wireway, 3 mounting brackets, dimming module, fuse and in line disconnect and supply and installation of 3 custom angle mounting brackets** Payment will be made at the Unit Price per luminaire acceptably installed in accordance with the Drawings.
 - .1 The Unit Price includes all costs for the installation of the 382W luminaire c/w, SOW cable to wireway, 3 mounting brackets, dimming module, fuse and in line disconnect and supply and installation of the 3 custom angle mounting brackets and all other labour, materials, and equipment required to complete the Works.
- .3 Payment for the supply and storage of 181W LED luminaires shall be made in accordance with **“Unit Price Item 1c) – Supply and store of 181W LED Luminaire c/w SOW cable to wireway, 2 mounting brackets, dimming module, fuse and in line disconnect”** Payment will be made at the Unit Price per luminaire supplied and securely stored within Western Canada.

- .1 The Unit Price includes all costs for the supply and storage of the 181W luminaire c/w, SOW cable to wireway, 2 mounting brackets, dimming module, fuse and in line disconnect.
- .2 The Contractor shall store the supplied equipment at a location in Western Canada at their cost prior to March 31, 2017. Payment will only be made following the inspection of supplied equipment by the Departmental Representative.
- .3 Payment of supply and storage costs does not relieve the Contractor of their responsibility for the equipment. They remain wholly responsible for the equipment until Contract Completion.
- .4 Payment for the installation of 181W LED luminaires shall be made in accordance with **“Unit Price Item 1d) - Install 181W LED Luminaire c/w SOW cable to wireway, 2 mounting brackets, dimming module, 2 custom angle mounting brackets, fuse and in line disconnect and supply and installation of 2 custom angle mounting brackets”** Payment will be made at the Unit Price per luminaire acceptably installed in accordance with the Drawings.
 - .1 The Unit Price includes all costs for the installation of the 181W luminaire c/w, SOW cable to wireway, 2 mounting brackets, dimming module, fuse and in line disconnect and supply and installation of the 2 custom angle mounting brackets and all other labour, materials, and equipment required to complete the Works.
- .5 Payment for the supply and install of Aluminum Junction Boxes, T-Tap splices, and fuses shall be made in accordance with **“Unit Price Item 1e) – Supply and install Aluminum Junction Boxes, T-Tap splices, and disconnects”**. Payment will be made at the Unit Price per junction box.
 - .1 The Unit Price includes all costs for the supply and installation of the junction box, T-Tap splices, disconnects, mounting hardware, and all other labour, materials, and equipment required to complete the Works.
- .6 Payment for the supply and install of island flashers shall be made in accordance with **“Unit Price Item 1f) – Supply and install island flashers”**. Payment will be made at the Unit Price per island flasher.
 - .1 The Unit Price includes all costs for the supply and installation of the island flasher, junction boxes, mounting hardware, wiring, and all other labour, materials, and equipment required to complete the Works.
- .7 Payment for the supply and install of luminaires on existing poles shall be made in accordance with **“Unit Price Item 1g) – Upgrade existing HPS fixture to LED fixture, supply and install conduit and wiring”**. Payment will be made at the Unit Price per luminaire pole.
 - .1 The Unit Price includes all costs for the supply and installation of the luminaire fixture, conduit, wiring, and all other labour, materials, and equipment required to complete the Works.

- .8 Payment for the supply and install of the Approach Systems Junction Box shall be made in accordance with **“Unit Price Item 1h) – Supply and install Approach Systems Junction Box”**. Payment will be made at the Unit Price per junction box.
- .1 The Unit Price includes all costs for the supply and installation of the approach systems junction box, including dimming module, relay, flasher module, mounts, hardware, fittings, and all other labour, materials, and equipment required to complete the works.
- .9 Payment for the supply and install of transformer cabinets shall be made in accordance with **“Unit Price Item 1i) – Supply and install transformer cabinet (347V to 120V)”**. Payment will be made at the Unit Price per transformer cabinet.
- .1 The Unit Price includes all costs for the supply and installation of the transformer cabinet, including all internal equipment, mounts, hardware, grounding system and fitting, and all other labour, materials, and equipment required to complete the Works.

2.2 LUMP SUM ITEMS

- .1 Payment for the supply and installation of the unistrut and conduit system shall be made in accordance with **“Lump Sum Price Item 4a) – Supply and installation of unistrut and conduit system”**. Payment will be made at a Lump Sum Price for the whole of the Work.
- .1 The Lump Sum Price includes all costs for supply and installation of unistrut, conduit, mounting brackets, and hardware, and all other labour, materials, and equipment required to complete the Works.
- .2 Payment for the supply and installation of the tunnel wiring shall be made in accordance with **“Lump Sum Price Item 4b) – Supply and installation of tunnel wiring”**. Payment will be made at a Lump Sum Price for the whole of the Work.
- .1 The Lump Sum Price includes all costs for the supply and installation of the wiring, supporting hardware, terminations, connectors, and all other labour, materials, and equipment required to complete the Works.
- .3 Removal of existing Len's snowshed lighting shall be made in accordance with **“Lump Sum Price Item 4c) – Removal of existing Tunnel Lighting”**. Payment will be made at the lump sum price for the whole of the work.
- .1 The **Unit Price Lump Sum Price** includes all costs for the removal of the existing tunnel lighting, including all internal equipment, mounts, hardware, fitting, wireways, wiring and all other labour, materials, and equipment required to complete the works.

2.3 LIGHTING CONTROL SYSTEM

- .1 Payment for the supply and installation of the lighting instrumentation shall be made in accordance with **“Lump Sum Price Item 4 5a) –Supply and installation of Lighting**

Control System in Len's substation". Payment will be made at a Lump Sum Price for the whole of the Work.

- .1 The Lump Sum Price includes all costs for the supply and installation of the lighting control system complete with Lighting Control Cabinet, HOA Cabinet, and associated conduit, junction boxes, fittings, supporting hardware, RTDs, Ethernet I/O devices, UPSs, terminations, connectors, and all other labour, materials and equipment required to complete the Works.
- .2 Payment for the supply and installation of the fiber shall be made in accordance with **"Lump Sum Price Item 4 5b) –Supply and installation of fibre"**. Payment will be made at a Lump Sum Price for the whole of the Work.
 - .1 The Lump Sum Price includes all costs for the supply, installation and testing of the fiber within the substation building and associated, fittings, supporting hardware, terminations, connectors, conduit and all other labour, materials, and equipment required to complete the Works.
- .3 Removal of existing Len's lighting control kiosk shall be made in accordance with **"Unit Price Item 5c) – Removal of existing Lighting Control Kiosk"**. Payment will be made at the lump sum price for the whole of the work.
 - .1 The Unit Price includes all costs for the removal of the existing Lighting Control Kiosk including all internal equipment, mounts, hardware, fittings, wireways, wiring and all other labour, materials, and equipment required to complete the works.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-C22.2 No.18.1-13, Metallic Outlet Boxes
 - .2 CAN/CSA-C22.2 No.18.2-06 (R2009), Nonmetallic Outlet Boxes
 - .3 CAN/CSA-C22.2 No.18.3-12, Conduit Tubing, and Cable Fittings
 - .4 CAN/CSA-C22.2 No.18.4-04 (R2009), Hardware for the Support of Conduit, Tubing
 - .5 CAN/CSA-C22.2 No.18.5-02 (R2012), Positioning Devices
 - .6 CSA C22.2 No.65-03 (R2008), Wire Connectors.
- .2 Electrical and Electronic Manufacturers' Association of Canada (EEMAC)
 - .1 EEMAC 1Y-2, 1961 Bushing Stud Connectors and Aluminum Adapters (1200 Ampere Maximum Rating).
- .3 National Electrical Manufacturers Association (NEMA)

Part 2 Products

2.1 MATERIALS

- .1 Pressure type wire connectors to: CSA C22.2 No.65, with current carrying parts of copper sized to fit copper conductors as required.
- .2 Fixture type splicing connectors to: CSA C22.2 No.65, with current carrying parts of copper 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 conductors.
 - .2 Clamp for stranded copper conductors.
 - .3 Clamp for stranded aluminum conductors.
 - .4 Stud clamp bolts.
 - .5 Bolts for copper conductors.

- .6 Bolts for aluminum conductors.
- .7 Sized for conductors.
- .4 Clamps or connectors for armoured cable and flexible conduit as required to:
CAN/CSA-C22.2No.18 (all subsections).

Part 3 Execution

3.1 INSTALLATION

- .1 Remove insulation carefully from ends of conductors 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 CSA C22.2No.65.
 - .3 Install fixture type connectors and tighten. Replace insulating cap.
 - .4 Install bushing stud connectors in accordance with EEMAC 1Y-2.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 26 05 20 – Wire and Box Connectors (0-1000V).

1.2 REFERENCES

- .1 CSA C22.2 No .0.3-09, Test Methods for Electrical Wires and Cables.
- .2 CAN/CSA-C22.2 No. 131-07, Type TECK 90 Cable.
- .3 CSA C22.2 No. 49, Type SOOW cable.

1.3 PRODUCT DATA

- .1 Provide product data in accordance with Section 26 05 00 – Common Work Results for Electrical.

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 600V insulation of cross-linked thermosetting polyethylene material rated RW90 XLPE, Jacketed.

2.2 TECK 90 CABLE

- .1 Cable: to CAN/CSA-C22.2 No. 131.
- .2 Conductors:
 - .1 Grounding conductor: copper.
 - .2 Circuit conductors: copper, size as indicated.
- .3 Insulation:
 - .1 Ethylene propylene rubber EP.
 - .2 Cross-linked polyethylene XLPE.
 - .3 Rating: 600V and 1000V (as required).
- .4 Inner jacket: polyvinyl chloride material.

- .5 Armour: interlocking galvanized steel.
- .6 Overall covering: thermoplastic polyvinyl chloride material.
- .7 Fastenings:
 - .1 One-hole zinc straps to secure surface cables 50 mm and smaller. Two-hole steel straps for cables larger than 50 mm.
 - .2 Channel type supports for two or more cables at 750mm centers.
 - .3 Threaded rods: 6 mm diameter to support suspended channels.
- .8 Connectors:
 - .1 Watertight approved for TECK cable.

2.3 **ARMOURED CABLES**

- .1 Conductors: insulated, copper, size as indicated.
- .2 Type: AC90.
- .3 Armour: interlocking type fabricated from galvanized steel strip.
- .4 Type: PVC flame retardant jacket over thermoplastic armour and compliant to applicable Building Code classification for this project.
- .5 Connectors: anti short connectors.

2.4 **CONTROL CABLES**

- .1 600V type: stranded copper conductors, sizes as indicated with RE90 (x-link) with shielding of metallized tapes each pair of conductors and overall covering thermoplastic jacket with sheath of interlocked galvanized steel armour and jacket over sheath of PVC thermosetting compound.

2.5 **SOW AND SOOW CABLE**

- .1 All cable called out on the drawings as SOW or SOOW shall be 600V Type SOOW cable, sized as indicated on the drawings with thermoset insulation and a thermoset jacket that is outdoor rated and resistant to oil, sunlight, and water.

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 tests before energizing electrical system.

3.2 GENERAL CABLE INSTALLATION

- .1 Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors (0-1000 V).
- .2 Cable Colour Coding: to Section 26 05 00 Common Work Results for Electrical.
- .3 Conductor length for parallel feeders to be identical.
- .4 Lace or clip groups of feeder cables at distribution centres, pull boxes, and termination points.
- .5 Wiring in walls: typically drop or loop vertically from above to better facilitate future renovations. Generally wiring from below and horizontal wiring in walls to be avoided unless indicated.
- .6 Branch circuit wiring for surge suppression receptacles and permanently wired computer and electronic equipment to be 2-wire circuits only, i.e. common neutrals not permitted.
- .7 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.
 - .2 In underground ducts in accordance with Section 26 05 44.

3.4 INSTALLATION OF TECK90 CABLE (0 -1000 V)

- .1 Group cables wherever possible on channels.
- .2 Install cable exposed, securely supported by straps or hangers.
- .3 Install cables in cable trays as per the Electrical Code to ensure that the ampacity of conductor meets or exceeds the ampacity of the upstream protective devices.
- .4 Terminate cables in accordance with Section 26 05 20 – Wire and Box Connectors (0-1000V).

3.5 INSTALLATION OF SOOW AND CONTROL CABLES

- .1 Install control cables and SOOW cables as noted on Drawings.
- .2 Where applicable, ground control cable shield.
- .3 Secure cables at intervals no greater than 300mm using ty-wrap and anchor base.

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3.6 **INSTALLATION OF ARMOURED CABLES**

- .1 Group cables wherever possible on channels.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA C22.2 No.65-03 (R2008) Wire Connectors.
 - .2 CSA C22.2 No.41-07 (R2012), Grounding and Bonding Equipment.

1.2 PRODUCT DATA

- .1 Submit product data in accordance with Section 26 05 00 – Common Work Results for Electrical.

Part 2 Products

2.1 CONNECTORS AND TERMINATIONS

- .1 Copper long barrel compression connectors to CSA C22.2No.65 as required sized for conductors. Standard of Acceptance: Elastimold or approved alternate.
- .2 Contact aid for aluminum cables where applicable.
- .3 2, 3, and 4 way joint boxes weatherproof type in accordance with Section 26 05 33 - Raceway and Boxes for Electrical Systems.
- .4 Cable terminations shall be Elastimold Shrink Fit Ranger 2 Terminations or approved alternate.
- .5 Cable splice shall be Elastimold PCJ Style 2 cable joints or approved alternate.

Part 3 Execution

3.1 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.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 26 05 01 – Common Work Results – Electrical.

1.2 REFERENCES

- .1 American National Standards Institute/Institute of Electrical and Electronics Engineers (ANSI/IEEE)
 - .1 ANSI/IEEE 837-2002, Qualifying Permanent Connections Used in Substation Grounding.
 - .2 Canadian Standards Association, (CSA International)
 - .3 CSA C22.2 No.0.4-[M1982(R1993)], Bonding and Grounding of Electrical Equipment (Protective Grounding).

1.3 SUBMITTALS

- .1 Provide submittals in accordance with Section 26 05 00 – Common Work Results for Electrical.
- .2 Product Data:
 - .1 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

Part 2 Products

2.1 MATERIALS

- .1 Grounding Conductors: bare stranded copper, size as indicated.
- .2 Insulated Grounding Conductors: insulated coloured green, type TWH stranded soft annealed copper wire, size as indicated.
- .3 Accessories: non-corroding, necessary for complete grounding system, type, size material as indicated, including but not necessarily limited to:
 - .1 Grounding and bonding bushings.

- .2 Grounding studs.
- .3 Protective type clamps.
- .4 Bolted type conductor connectors.
- .5 Bonding jumpers, straps.
- .6 Pressure wire connectors.
- .4 Wire connectors and terminations: as indicated.

Part 3 Execution

3.1 INSTALLATION

- .1 Install continuous grounding system including, electrodes, conductors, connectors and accessories as indicated and to requirements of local authority having jurisdiction. Where EMT is used, run ground wire in conduit.
- .2 Install connectors in accordance with manufacturer's instructions.
- .3 Protect exposed grounding conductors during and after construction from mechanical injury.
- .4 Use mechanical connectors for grounding connections to equipment provided with lugs.
- .5 Install bonding wire for flexible conduit, connected at both ends to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.
- .6 Install flexible ground straps for bus duct enclosure joints, where such bonding is not inherently provided with equipment.
- .7 Bond single conductor, metallic armoured cables to cabinet at supply end.
- .8 Use tinned copper conductors for aluminum structures.
- .9 Do not use bare copper conductors near un-jacketed lead sheath cables.

3.2 EQUIPMENT GROUNDING

- .1 Install grounding connections as indicated to typical station equipment including: neutral, gradient control mats. Non-current-carrying parts of: transformers, generators, motors, circuit breakers, current transformers, frames of gang-operated switches and fuse cutout bases. Cable sheaths, raceways, pipe work, screen guards, switchboards, potential transformers. Meter and relay cases. Any exposed building metal, within or forming part of enclosure. Sub-station fences, pothead bodies, outdoor lighting.
- .2 Ground hinged doors to main frame of electrical equipment enclosure with flexible jumper.

- .3 Connect metallic piping (water, oil, air, etc.) inside station to main ground bus at several locations, including each service location within station.

3.3 GROUNDING IN MANHOLES

- .1 Install conveniently located grounding stud, electrode, minimum size 6 AWG stranded copper conductor, in each manhole.
- .2 Install ground rod with lug for grounding connection in each manhole so that top projects through bottom of manhole.

3.4 CABLE SHEATH GROUNDING

- .1 Bond single conductor, metallic sheathed cables together at one end only. Break sheath continuity by inserting insulating sleeves in cables.
- .2 Use No. 6 AWG flexible copper wire soldered, not clamped, to cable sheath.
- .3 Connect bonded cables to ground with No. 2/0 AWG copper conductor.

3.5 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Inspect grounding and perform ground resistance test before backfill.
- .3 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of Departmental Representative and local authority having jurisdiction.
- .4 Perform test before energizing electrical system.
- .5 Provide step-and-touch potential calculations using measured station ground resistance measurements. Submit test result and inspection certificate before energizing electrical system.
- .6 Disconnect ground fault indicator during tests.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

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

Part 2 Products

2.1 SUPPORT CHANNELS

- .1 U shape, size 41 x 41mm, 2.5mm thick, surface mounted and suspended with stainless steel hardware.

Part 3 Execution

3.1 INSTALLATION

- .1 Secure equipment to masonry, tile and plaster surfaces with lead anchors or nylon shields.
- .2 Secure equipment to poured concrete with expandable inserts.
- .3 Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.
- .4 Secure surface mounted equipment with twist clip fasteners to inverted T-bar ceilings. Ensure that "T" bars are adequately supported to carry weight of equipment specified before installation.
- .5 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.
- .6 Fasten exposed conduit or cables to building construction or support system using straps.
 - .1 One-hole stainless steel straps to secure surface conduits and cables 50mm and smaller.
 - .2 Two-hole stainless steel straps for conduits and cables larger than 50mm.
 - .3 Beam clamps to secure conduit to exposed steel work.
- .7 Suspended support systems.
 - .1 Support individual cable or conduit runs with 6mm dia threaded rods and spring clips.
 - .2 Support 2 or more cables or conduits on channels supported by 6mm dia threaded rod hangers where direct fastening to building construction is impractical.

- .8 For surface mounting of two or more conduits use channels at 1000mm on centre spacing unless otherwise noted on the drawings.
- .9 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.
- .10 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.
- .11 Do not use wire lashing or perforated strap to support or secure raceways or cables.
- .12 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of the Departmental Representative.
- .13 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA C22.1-2012, Canadian Electrical Code, Part 1.

1.2 SUBMITTALS

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

Part 2 Products

2.1 OUTLET AND CONDUIT BOXES GENERAL

- .1 Size boxes in accordance with CSA C22.1.
- .2 102mm square or larger outlet boxes as required or as noted on Drawings.
- .3 Gang boxes where wiring devices are grouped.
- .4 Blank cover plates for boxes without wiring devices.
- .5 347V outlet boxes for 347V switching devices.
- .6 Combination boxes with barriers where outlets for more than one system are grouped.

2.2 GALVANIZED STEEL OUTLET BOXES

- .1 One-piece electro-galvanized construction.
- .2 Single and multi-gang flush device boxes for flush installation, minimum size 76 x 50 x 38mm or as indicated. 102mm square outlet boxes when more than one conduit enters one side with extension and plaster rings as required.
- .3 Utility boxes for outlets connected to surface-mounted EMT conduit, minimum size 102 x 54 x 48mm.
- .4 102mm square or octagonal outlet boxes for lighting fixture outlets.

2.3 CONDUIT BOXES

- .1 Cast FS or FD NEMA 4X RPVC boxes with factory-threaded hubs and mounting feet for surface wiring of devices or as specified on Drawings.

2.4 OUTLET BOXES FOR NON-METALLIC SHEATHED CABLE

- .1 Electro-galvanized, sectional, screw ganging steel boxes, minimum size 76 x 50 x 63mm 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.
- .5 Threaded conduit hub shall be used where noted on Drawings.

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, Outlet Boxes, Conduit Boxes, and Fitting and Associated Hardware.
 - .2 CAN/CSA C22.2 No. 18-13, Metallic Outlet Boxes.
 - .3 CAN/CSA-C22.2 No..18.2-06 (R2009), Nonmetallic Outlet Boxes
 - .4 CAN/CSA-C22.2 No.18.3-12, Conduit, Tubing, and Cable Fittings
 - .5 CAN/CSA-C22.2 No.18.4-04 (R2009), Hardware for the Support of Conduit, Tubing
 - .6 CAN/CSA-C22.2 No.18.5-02 (R2012), Positioning Devices
 - .7 CSA C22.2 No. 45, Rigid Metal Conduit.
 - .8 CSA C22.2 No. 56-04, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
 - .9 CSA C22.2 No. 83-M1985 (R2003), Electrical Metallic Tubing.
 - .10 CSA C22.2 No. 211.2-06 (R2011), Rigid PVC (Unplasticized) Conduit.
 - .11 CAN/CSA C22.2 No. 227.2.1-04 (R2009), Liquid Tight Flexible Nonmetallic Conduit.

1.2 SUBMITTALS

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

Part 2 Products

2.1 CONDUITS

- .1 Rigid aluminum conduit: to CSA C22.2 No. 45.
- .2 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings.
- .3 Rigid PVC conduit: unplasticized polyvinyl chloride to CSA C22.2 No. 211.2.

.1 Couplings, adapters, bends and fittings shall be RPVC and conform to CSA C22.2 No.85.

.4 Flexible metal conduit: to CSA C22.2 No. 56, liquid-tight flexible metal.

.5 Flexible PVC conduit: to CAN/CSA-C22.2 No. 227.3.

.6 HDPE conduit: to UL651B - UL Standard for Safety Continuous Length HDPE Conduit

2.2 CONDUIT FASTENINGS

.1 One-hole malleable iron straps to secure surface conduits 50mm and smaller.

.2 Two-hole malleable iron straps for conduits larger than 50mm.

.3 Beam clamps to secure conduits to exposed steel work.

.4 Channel type supports for two or more conduits at 1000mm on centre.

.5 Threaded rods, 6mm diameter, to support suspended channels.

2.3 CONDUIT FITTINGS

.1 Fittings: manufactured for use with conduit specified. Coating: same as conduit.

.2 Ensure factory "ells" where 90 degrees bends for 25mm and larger conduits.

.3 Watertight connectors and couplings for EMT.

.1 Set-screws are not acceptable.

2.4 FISH CORD

.1 Polypropylene.

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 conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.

.2 Conceal conduits except in mechanical and electrical service rooms.

- .3 Surface mount conduits as shown on the drawings.
- .4 Use rigid aluminum conduit (RAC) for all exposed areas except where specified otherwise.
- .5 Use rigid PVC conduit underground and in corrosive areas.
- .6 Use liquid tight flexible metal conduit for connection to vibrating equipment in damp, wet or corrosive locations.
- .7 RPVC conduit shall be installed using CSA certified cement.
- .8 Each low voltage system shall have dedicated raceways that run continuous from source to destination.
- .9 EMT and RAC conduits shall be installed with raintight connectors.
- .10 Electrical and telephone service conduit shall be installed to BC Hydro and Telus standards.
- .11 Minimum conduit size for lighting and power circuits: 19mm.
- .12 Bend conduit cold:
 - .1 Replace conduit if kinked or flattened more than 1/10th of its original diameter.
- .13 Mechanically bend steel conduit over 19mm diameter.
- .14 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.
- .15 Install fish cord in all conduits (empty and with wiring).
- .16 Remove and replace blocked conduit sections.
 - .1 Do not use liquids to clean out conduits.
- .17 Dry conduits out before installing wire.

3.3 **SURFACE CONDUITS**

- .1 Run parallel or perpendicular to building lines.
- .2 Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.
- .3 Run conduits in flanged portion of structural steel.
- .4 Group conduits wherever possible on surface channels.
- .5 Do not pass conduits through structural members except as indicated.

- .6 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

3.4 **CONCEALED CONDUITS**

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

3.5 **CONDUITS UNDERGROUND**

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

3.6 **CLEANING**

- .1 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 SECTIONS

- .1 Section 26 05 01 - Common Work Results - Electrical.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International)
- .2 Insulated Cable Engineers Association, Inc. (ICEA)

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 CABLE INSTALLATION IN DUCTS

- .1 Burial of underground conduits and ducts: to Canadian Electrical Code and BC Hydro Underground Distribution Standard ES53 whichever the most stringent.
- .2 Install cables as indicated in ducts.
 - .1 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 are properly terminated, seal ends of lead covered cables 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 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 01 - Common Work Results - Electrical.
- .2 Perform tests using qualified personnel. Provide necessary instruments and equipment.
- .3 Check phase rotation and identify each phase conductor of each feeder.

- .4 Check each feeder for continuity, short circuits and grounds. Ensure resistance to ground of circuits is not less than 50 mega-ohms.
- .5 Pre-acceptance tests.
 - .1 After installing cable but before splicing and terminating, perform insulation resistance test with 1000 V Megger on each phase conductor.
 - .2 Check insulation resistance after each splice and/or termination to ensure that cable system is ready for acceptance testing.
- .6 Acceptance Tests
 - .1 Ensure that terminations and accessory equipment are disconnected.
 - .2 Ground shields, ground wires, metallic armour and conductors not under test.
 - .3 High Potential (Hipot) Testing.
 - .4 Conduct Hipot testing in accordance with manufacturer's recommendations.
 - .5 Leakage Current Testing.
 - .6 Raise voltage in steps from zero to maximum values as specified by manufacturer for type of cable being tested.
 - .7 Hold maximum voltage for time period specified by manufacturer.
 - .8 Record leakage current at each step.
- .7 Provide Departmental Representative with list of test results showing location at which each test was made, circuit tested and result of each test.
- .8 Remove and replace entire length of cable if cable fails to meet any of test criteria.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 The Munsell System of Colour Notation.

1.2 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings and product data in accordance with Specifications.

Part 2 Products

2.1 MATERIALS

- .1 Entire enclosure capable of withstanding maximum impact force of 86MN/m² area without rupture of material.
- .2 Cover: tamperproof, bolt-on, domed to shed water, drip shield.
- .3 Door: hinged, 3 point latching, with padlocking means.
- .4 Ventilation panel constructed to allow air circulation yet preventing entry of foreign objects, wild life, and vermin.
- .5 Enclosure construction such as to allow any configuration of single or ganged enclosures.
- .6 Enclosure capable of being shipped in knocked-down condition.
- .7 Enclosure to adhere to 1202 B Type Cabinet Specifications for MOTI Type B Cabinet:
 - .1 1202.06.1 Product Operating Conditions
 - .2 1202.07.1 General Material Requirements
 - .3 1202.07.2 Connecting Hardware
 - .4 1202.07.3 Mounting Hardware
 - .5 1202.08.2 Physical Construction
 - .6 1202.08.03 Welding
 - .7 1202.08.5 Door Gaskets
 - .8 1202.08.6 Front Door Lock
 - .9 1202.08.8 Document Pouch

- .10 1202.08.9 Cabinet Venting
- .11 1202.08.12 Cabinet Environmental Requirements
- .12 1202.09 Cabinet Finish
- .13 1202.12 Cabinet Electrical

Part 3 Execution

3.1 INSTALLATION

- .1 Assemble enclosure in accordance with manufacturer's instructions and mount where noted on the drawings.
- .2 Mount equipment in enclosure.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Materials and installation for LED snowshed lighting and associated control system.

1.2 RELATED SECTIONS

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

1.3 REFERENCES

- .1 The publications listed below form a part of this specification to the extent referenced. Publications are referenced within the text by their basic designation only.
- .2 Canadian Standards Association (CSA International)
- .3 American National Standards Institute (ANSI)
 - .1 ANSI C62.41.1-2002 – IEEE Guide on the Surge Environment in Low-Voltage (1000V and less) AC Power Circuits
 - .2 ANSI C62.41.2-2002 – IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000V and less) AC Power Circuits
 - .3 ANSI C82.SSL1 – SSL Drivers (in ANSI development)
 - .4 ANSI C136.31-2001 – American National Standard for Roadway Lighting Equipment – Luminaire Vibration
- .4 American Society for Testing and Materials International (ASTM)
 - .1 ASTM B117-97 – Standard Practice for Operating Salt Spray (Fog) Apparatus
 - .2 ASTM G53 – Standard Practice for Operating Light and Water Exposure Apparatus (Fluorescent UV – Condensation Type) for Exposure of Non-metallic Materials
- .5 Illuminating Engineering Society of North America (IESNA)
 - .1 LM-79-08, IESNA Approved Method for the Electrical and Photometric Measurements of Solid-State Lighting Products
 - .2 LM-80-08, IESNA Approved Method for Measuring Lumen Maintenance of LED Light Sources
 - .3 TM-15-11, Luminaire Classification System for Outdoor Luminaires
 - .4 TM-21-11, Projecting Long Term Lumen Maintenance of LED Light Sources

.5 RP-22-11, Tunnel Lighting

.6 International Electrotechnical Commission (IEC)

.1 IEC 60529 – Degrees of Protection provided by enclosures (IPCode)

.7 National Electrical Manufacturers Association (NEMA)

.1 ANSI/NEMA/ANSI C78.377-2008 – American National Standard for the Chromaticity of Solid State Lighting Products

1.4 RELATED DOCUMENTS

.1 Contract Drawings and conditions of Contract (including General Conditions, Special Conditions, Specifications, and all related addendum) apply to the work of this section.

1.5 QUALITY ASSURANCE

.1 Submit a production model luminaire sample identical (including LED package) of the product proposed to be installed for inspection. Departmental Representative may request independent testing of sample luminaires to verify luminaire performance and compliance with the specifications. Conduct testing per the applicable IESNA and ANSI approved methods for products using Solid-State Lighting (SSL) sources. Test laboratories must be either National Voluntary Laboratory Accreditation Program (NVLAP) accredited for solid-state lighting testing as part of the Energy-Efficient Lighting Products laboratory accreditation program or other qualified labs.

.2 If luminaires are believed to be underperforming in early life, the Departmental Representative may choose to take field measurements between 2,000 and 3,000 operating hours of the completion of installation to confirm that lighting levels are in accordance with the site-specific photometric requirements in this specification. If uniformity is more than 15% worse or average light levels are more than 15% below the commissioned system and the luminaire locations in the field are as designed, the luminaire manufacturer must provide additional luminaires to achieve the specified light levels and uniformity. Variance from specified tolerances may be allowed provided prior approval by Departmental Representative.

1.6 SITE LIGHTING SYSTEM PERFORMANCE

.1 The reference LED design for the snowshed lighting and control system is detailed on the Drawings. The luminaires and control system must meet the requirements of the Specifications and Drawings and perform to achieve the luminance values noted on the Drawings.

.2 Total Len's snowshed lighting load not to exceed 105000 kW

.3 Light Loss Factor

- .1 Light Loss Factor (LLF) must be greater than or equal to 0.65 and is to be calculated as: $LLF = LLD \times LDD$, where
Lamp Lumen Depreciation (LLD) = per Section 2.2.1.6.
Luminaire Dirt Depreciation (LDD) = 0.77 for all luminaires.

.4 Site Lighting Requirements

- .1 Defined as the entirety of the driving lanes at locations shown in the Drawings. Snowshed tunnel are to be treated as a fully enclosed tunnel (no daylight contribution).

.5 Tunnel Surface Classification

- .1 Use R3 road surface classification for calculations.
- .2 Tunnel walls are concrete and typically dirty; use low wall reflectance for calculations.

1.7 SUBMITTALS

- .1 Submit product data in accordance with Section 26 05 00 – Common Work Results for Electrical.
- .2 Submit shed lighting simulation using AGI software. Provide AGI model to the Departmental Representative for review.
 - .1 Owner will provide AutoCAD drawings of the snowshed for use in the AGI simulation.
- .3 Performance Reports – submit the following for approval by the Departmental Representative:
 - .1 Computer generated photometric analysis of proposed Day 1 (defined as the initial luminance values), of the lighting installation. Submittal should include the following requirements:
Provide luminance measurements.
 - .2 Computer generated photometric analysis of End-of-useful life date (see Part 2) of the lighting installation, submittal should include the following requirements:
Provide luminance measurements.
Computer calculation must use LLF values per section 1.6.

- .3 Luminaire photometric reports per IESNA LM-79-08 including: laboratory name, report number, date, luminaire catalogue number, and luminaire / light source specifications. Report must contain lumen values in Glare zone per IESNA TM-15-11 and an iso-footcandle diagram as well as documentation that specified standards and test methods were followed.
- .4 Provide documentation of the expected useful life as defined in the TM-21 and all calculations applied in deriving the proposed LLD and useful life.
- .5 Provide safety certification and file number as required for the luminaire family that must be listed, labeled, or identified per the Canadian Electrical Code (CEC).
- .4 Provide design, implementation and validation of lighting control system electrical drawings, including 3 sets of drawings as follows for approval by the Departmental Representative:
 - .1 "For Comment"
 - .2 "For Construction"
 - .3 "As Built"

1.8 **WARRANTY**

- .1 In addition to warranty provisions covered elsewhere in the Specifications, the following warranties are to be provided:
 - .1 A written five-year replacement warranty for material, fixture finish, and workmanship. Finish warranty must include warranty against failure or substantial deterioration such as blistering, cracking, peeling, chalking, or fading.
 - .2 A written five-year replacement material warranty for defective or non-starting LED source assemblies and drivers.
 - .3 A written two-year replacement material warranty on all control equipment.
 - .4 A written five-year replacement warranty for luminaires producing inadequately-maintained luminance levels prior to the end of warranty period, as prorated from levels expected. Warranty must cover all lighting sources (LED package, LED array, or LED module) including, but not limited to the LED die, encapsulate, and phosphor. If the expected useful life of the luminaire is not maintained, then the manufacturer must replace the light source(s) or luminaire as needed.
- .2 All warranties include supply of new product or material and shipping to site.
- .3 Warranty period begins on date of Substantial Performance. The supplier is to provide appropriate signed warranty certificates. Certificates must be received prior to final payment.

Part 2 Products**2.1 GENERAL**

- .1 Standard of acceptance for control system and luminaires is the type indicated on Drawings and as specified.
- .2 Fixtures of the same type must be provided by one manufacturer.
- .3 Specific manufacturer and model number references are indicated as a standard of performance and quality. Other manufacturers' models may be supplied provided the product meets or exceeds the specifications. If alternate fixtures are provided, the snowshed lighting solution must achieve design criteria and control functionality outlined in the Drawings and Specifications.

2.2 LIGHT SOURCE REQUIREMENTS

- .1 LED sources must meet the following requirements:
 - .1 Luminaires must be rated for -40°C to +50°C operation.
 - .2 Correlated Color Temperature (CCT) shall be between 4000 K and 4400 K.
 - .3 Minimum luminaire efficacy of 70 lumen/watt per IES LM-79.
 - .4 Minimum colour rendering index (CRI) of 70.
 - .5 Duv tolerance of 0.001 ± 0.006 .
 - .6 Lumen Depreciation of LED Light Sources
 - .7 Minimum Luminaire Lumen Depreciation (LLD) is 0.85. LLD will be determined by the manufacturer and be based on the percentage of initial lumen output at 50,000 operating hours at 15C ambient temperature. LLD must be calculated in accordance with IESNA LM-80 and TM-21 for the selected driving current of the fixture. The luminaires will operate continuously during daytime hours and at a dimmed level during nighttime hours.

2.3 LUMINAIRE REQUIREMENTS

- .1 Each LED tunnel luminaire includes:
 - .1 LED electronic driver
 - .2 Weather-resistant housing
 - .3 LED dimming and on/off control module
 - .4 Surge protection device

- .5 Optical system
- .2 Housing and Finish
 - .1 The reference design provides a long linear luminaire housing that is ideal for a tunnel with low ceiling and provides clearances from vehicle impact. The reference design for the snowshed lighting is as per RP-22 and it also serves as active delineation for drivers in the tunnel. Consider this requirement in the design of alternative lighting solutions.
 - .2 Sealed housing, easily accessible tool-less entry without removal. Protected by electrolytic oxidation (class 15). Flat tempered glass protector with IP66K tightness (according to IEC-EN60598) and impact resistance rating of IK08 (according to IEC-EN62262).
 - .3 Aluminum for enclosure to 6063-T6.
 - .4 Eliminate emission of noise from wind, and resist build-up of icicles.
 - .5 CSA or ULC rated for locations subject to high pressure (up to 100psi).
 - .6 Powder coat finish or equivalent.
 - .7 Polyester Triglycidyl Isocyanurate (TGIC) super durable polyester powder coat with nominal thickness of at least 3 mils and minimum pull-off strength exceeding 1000 PSI as tested in accordance with ASTM D4541.
 - .8 Grey finish colour (RAL 7040).
 - .9 Easily replaceable LED driver, surge protection, dimming controller and optical systems mounted internally with quick disconnect style luminaire disconnects.
 - .10 Stainless steel screws. Captive screws are required on any components that require maintenance after installation.
 - .11 Resistant to debris build-up including bird droppings, snow, slush, and mud.
 - .12 Fully assemble and test luminaires before shipment from factory.
 - .13 Provide a finish that is resistant to UV, salt spray, and humidity as per ASTM's G7, B117, and D2247 testing procedures.
 - .14 Provide a breather vent in the luminaire to prevent contraction and expansion related to fluctuations in the luminaires internal temperature.
 - .15 Locality-appropriate governing mark and certification.
- .3 Mechanical Vibration

- .1 Capable of 1.5G at the resonant frequency of the luminaire applied at the center of gravity of the luminaire per ANSI C136.31 without damage to the luminaire.
- .4 Thermal Management System
 - .1 Heat sinking integrated within the housing with no fans, pumps, or any moving parts and/or liquids.
- .5 Mounting
 - .1 Provide a housing that is designed to fit on the upper wall of the tunnel and protrudes no more than 275mm if angled. If not angled the product shall protrude no more than 200mm.
- .6 Labeling
 - .1 Label each fixture with a unique identifier 3 characters long.
 - .2 Waterproof label meeting ANSI C136.15-2011 located outside the cover and visible from the ground.
- .7 LED Driver and Optical Assembly
 - .1 Designed so that individual LED failures will not impact the operation of more than four other LED's.
 - .2 No polycarbonate or any other synthetic material products (unless it can be proved they are UV stabilized).
 - .3 Lens discolouration at any point in the warranty period will be considered a product failure.
 - .4 Optical system rated to IP-66K.
- .8 Operating Environment
 - .1 Luminaire shall be able to operate normally in:
 - .1 Ambient temperatures from -40 degrees C to 50 degrees C;
 - .2 Driving rain;
 - .3 Snow and sleet;
 - .4 Fog; and
 - .5 Dirty environment.

.9 Expected Useful Life (Light Output) and Depreciation

- .1 The required useful life of the luminaire is 50,000 hours.
- .2 Achieve L85 lumen output or greater at 50,000 hours with no catastrophic failures, based on an ambient temperature of 15C.
- .3 Calculate the projected lumen maintenance in accordance with TM-21 and at the proposed fixture's selected driving current.
- .4 At the end of the useful life, the luminaire must be capable of providing the luminance levels and uniformity specified in these Specifications and on the Drawings.

.10 Electrical System Requirements

- .1 Stand-alone (easy to be replaced) surge protection device (SPD) compliant with ANSI/IEEE C.62.41-2-2002, Rating Category C – High Operation to meet 10KV/10KA Surge level. Reference Table - Test 1: 0.5 μ S – 100Hz Ring Wave Specification, Table - Test 2: 1.2/50 μ S – 8/20 μ S Combination Wave Specification Table - Test 3: Electrical Fast Transient (EFT) Specification. Primary Fuse Protection : Provide double fusing with fuse holder appropriately sized to the current. Fuse voltage must be greater than or equal to the voltages indicated in these Specifications.
- .2 Under voltage protection via shutoff and short circuit protection via current limitation
- .3 Internal luminaire design must incorporate modular quick disconnect electrical connections

2.4 **POWER SUPPLY / DRIVER REQUIREMENTS**

- .1 Power Supply Units including drivers must meet the following requirements:
 - .1 Minimum efficiency of 90%
 - .2 Rated to operate between -40 degrees C to +50 degrees C.
 - .3 Operating voltage: 347V \pm 10%, 60Hz.
 - .4 Power supplies can be UL Class I or II output.
 - .5 Operating frequency of 50/60Hz.
 - .6 Power Factor (PF) of greater than 0.95.
 - .7 Total Harmonic Distortion (THD) of less than 20%.

- .8 Rated life of greater than 50,000 hours.
- .9 Output operating frequency sufficient to avoid visible flicker.
- .10 Rated for wet locations.
- .11 Class A sound rating per ANSI Standard C62.41.

2.5 CONTROL REQUIREMENTS

- .1 Provide a control system capable of the following general functions:
 - .1 Dim the lighting based on day of year and the longitude and latitude of the snowshed.
 - .2 Dim the lighting based on age and cleaning cycle.
 - .3 Ability to dim the lights using internal and external luminance meters.
 - .4 Ability to communicate with existing adjacent snowshed lighting controllers and Administration Building lighting control system to ensure that the lighting levels are the same.
- .2 Control system to communicate with luminaires via power line communication. No wireless solution or solution requiring additional cabling or wiring will be accepted.
- .3 Ability to address each luminaire individually, turn each on and off individually, dim each individually, and supervise lamp status and consumption.
- .4 Contractor and Manufacturer Representative to design, integrate, test and commission the following control methods:
 - .1 Tunnel controller
 - .2 Astronomical Time Clock
 - .3 Key-switch control
- .5 Furnish switches or relays in NEMA I General purpose enclosure unless noted otherwise. Switches located on the exterior or in wet locations must have NEMA 3R, 4, or 4X enclosures as noted or required.
- .6 Provide adequate filtering and surge suppression to ensure reliable operation of lighting system.
- .7 Control system includes:
 - .1 Standalone climate controlled cabinet/kiosk enclosure complete with:
 - .1 Redundant network controller;

- .2 Powerline communication module;
 - .3 Minimum 15" Touch screen display;
 - .4 Uninterruptible Power Supply
 - .5 Industrial Ethernet switch; and
 - .6 All internal cabling and interconnection modules.
- .2 Luminaire dimming controllers
 - .3 Lockable HOA cabinet with:
 - .1 1 HOA Switch for tunnel luminaires
 - .2 1 HOA switch for approach luminaires
 - .8 Ensure cabinet/kiosk fits within space allocation specified in the Drawings. Maintain sufficient spacing for maintenance access and to meet CEC spacing and access requirements.
 - .9 Ensure cabinet/kiosk fits through the access door to the substation.
 - .10 Provide a Manufacturer's Representative to perform the following services:
 - .1 Design, implementation, and validation of snowshed lighting and lighting control system, including key-switch control.
 - .2 Design, implementation, and validation of a Graphical User Interface specific to this project.
 - .3 Design, implementation, and validation of all network parameters to connect to the customer IP network (cellular or fibre) for remote Access and future adjacent snowshed systems.
 - .4 Design and validation of a Factory Acceptance Test Plan.
 - .5 Execution of the Factory Acceptance Test Plan.
 - .6 Presentation of the functionally tested system to the Departmental Representative prior to shipment onsite.
 - .7 Design and validation of a Site Acceptance Test Plan.
 - .8 Execution of the Site Acceptance Test Plan.
 - .9 Design, implementation, and validation of the Installation, Operation and Maintenance User Manual.

- .10 Provide a one (1) day on-site and in-classroom, at a Parks Canada supplied maintenance facility) that includes practical hand-on training session.

Part 3 Execution

3.1 INSTALLATION

- .1 Disconnect all power sources prior to installation.
- .2 Follow manufacturers' recommended installation procedures.
- .3 Configure system per Drawings and Specifications.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Materials and installation for standard and custom breaker type panelboards.

1.2 RELATED SECTIONS

- .1 Section 26 05 00 - Common Work Results - Electrical.
- .2 Section 26 28 16.02 - Moulded Case Circuit Breakers.

1.3 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA C22.2No.29-M1989 (R2009), Panelboards and enclosed Panelboards.

1.4 SHOP DRAWINGS

- .1 Contractor to submit panel layout drawing prior to fabrication.
- .2 Drawings to include electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.

Part 2 Products

2.1 PANELBOARDS

- .1 Panelboards: to CSA C22.2 No.29 and product of one manufacturer.
 - .1 Install circuit breakers in panelboards before shipment.
 - .2 In addition to CSA requirements manufacturer's nameplate must show fault current that panel including breakers has been built to withstand.
- .2 120/240V panelboards: bus and breakers rated for 10kA (symmetrical) interrupting capacity or as indicated.
- .3 600V panelboards: bus and breakers rated for 25kA (symmetrical) interrupting capacity or as indicated.
- .4 Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number and phase.
- .5 Panelboards: mains, number of circuits, and number and size of branch circuit breakers as indicated.

- .6 Provide new panelboards complete with minimum number of circuits as indicated in Drawings.
- .7 Two keys for each panelboard and key panelboards alike.
- .8 Copper bus with neutral of same ampere rating as mains.
- .9 Mains: suitable for bolt-on breakers.
- .10 Trim with concealed front bolts and hinges.
- .11 Trim and door finish: baked grey enamel.

2.2 **BREAKERS**

- .1 Breakers: to Section 26 28 16.02 - Moulded Case Circuit Breakers.
- .2 Breakers shall be supplied with thermal and magnetic tripping in panelboards except as indicated otherwise.
- .3 Main breaker: separately mounted on top or bottom of panel to suit cable entry. When mounted vertically, down position should open breaker.
- .4 Two (2) lock-out devices for each panel installed. Turn over lock-out devices to Owner.

2.3 **EQUIPMENT IDENTIFICATION**

- .1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results – Electrical.
- .2 Nameplate for each panelboard size 4 engraved.
- .3 Nameplate for each circuit in distribution panelboards size 2 engraved.
- .4 Complete circuit directory with typewritten legend showing location and load of each circuit.

Part 3 Execution

3.1 **INSTALLATION**

- .1 Locate panelboards as indicated and mount securely, plumb, true and square, to adjoining surfaces.
- .2 Connect loads to circuits.
- .3 Connect neutral conductors to common neutral bus with respective neutral identified.

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PANELBOARDS

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END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Materials for moulded-case circuit breakers.

1.2 RELATED SECTIONS

- .1 Section 26 13 18 – Switchgear Assemblies.
- .2 Section 26 24 16.01 – Panel Boards – Breaker Type

1.3 REFERENCES

- .1 Canadian Standards Association (CSA International).
 - .1 CSA-C22.2 No. 5-09, Moulded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, tenth edition, and the second edition of NMX-J-266-ANCE).

1.4 SUBMITTALS

- .1 Submit product data to Departmental Representative prior to ordering material in accordance with Section 26 05 00 – Common Work Results for Electrical.
- .2 Include time-current characteristic curves for breakers with ampacity of 20A and over or with interrupting capacity of 22,000 A symmetrical (RMS) and over at system voltage.

Part 2 Products

2.1 BREAKERS GENERAL

- .1 Moulded-case circuit breakers: to CSA C22.2 No. 5
- .2 Bolt-on moulded case circuit breaker: quick- make, quick-break type, for manual and automatic operation with temperature compensation for 40 degrees C ambient.
- .3 Common-trip breakers: with single handle for multi-pole applications.
- .4 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting.
 - .1 Trip settings on breakers with adjustable trips to range from 3-8 times current rating.
- .5 Circuit breakers with interchangeable trips as indicated.

.6 Circuit breakers to have the following minimum symmetrical RMS interrupting capacity rating.

.1 120/240V Breakers: 10kA

.2 600V Breakers: 25kA

2.2 THERMAL MAGNETIC BREAKERS

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

Part 3 Execution

3.1 INSTALLATION

.1 Install circuit breakers as indicated.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Canadian Standards Association (CSA International)
- .2 CSA-C22.2 No. 214-02, Communications Cables (Bi-National standard with UL 444).
- .3 CSA-C22.2 No. 232-M1988 (R2004), Optical Fibre Cables.
- .4 Telecommunications Industry Association (TIA)/Electronic Industries Alliance (EIA)
- .5 TIA/EIA-568-B.3-(2000), Optical Fibre Cabling Components Standard.
- .6 TIA/EIA-606-A-(2002), Administration Standard for the Commercial Telecommunications Infrastructure.
- .7 TIA TSB-140-2004, Telecommunications Systems Bulletin - Additional Guidelines for Field-Testing Length, Loss and Polarity of Optical Fibre Cabling Systems.
- .8 TIA-598-C-(2005), Optical Fibre Cable Color Coding.

1.2 DEFINITIONS

- .1 Refer to TIA/EIA-598-C, Annex A for definitions of terms: optical-fibre interconnect, distribution, and breakout cables.

1.3 REQUIREMENTS

- .1 Supply and install 4C fibre optic cable between Lighting Control Cabinet and existing fibre patch panel in Len's bunker building. Terminate all strands at each end and provide OTDR testing for entire cable length.
- .2 All workmanship, material and/or installation practices and activity shall be equal to or better than the standards established by the CAN/CSA T529/T530 Standards and the Canadian Electrical Code.
- .3 The Contractor must have a minimum of two (2) years' experience installing and testing single-mode cables of all types.

1.4 SUBMITTALS

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

Part 2 Products

2.1 OPTICAL-FIBRE CABLE

- .1 8.3/125 micron, single mode, 48 strands to CSA-C22.2 No. 232.

- .2 All dielectric construction.
- .3 Suitable for outdoor use in conduit.
- .4 Non gel filled.
- .5 Single loose buffer tube.
- .6 Maximum attenuation of 0.4 dB/km measured at room temperature at 1310nm.

Part 3 Execution

3.1 FIBRE OPTIC CABLE

- .1 Fibre optic cable shall be installed in a continuous run in conduit between the patch panel and the network switch (i.e. no splices are allowed except within the patch panels).
- .2 When installing cable in conduits, concrete vaults, and junction boxes, the Contractor shall ensure the cable does not exceed the minimum bend radius or pulling tension. Each cable shall be labelled within 10cm of the terminated ends with a tag and text stating the fibre optic cable identifier and destination name. Cables shall be tagged in the concrete vaults, junction boxes and all other access points with the fibre optic cable identifier and with "CAUTION, FIBRE OPTIC CABLE" tags.
- .3 Excess cable inside concrete vaults and junction boxes shall be coiled and mechanically secured in place with hook and pile fastener (e.g. Velcro™) ties such that the minimum bend radius is not exceeded and the cable is suspended above the concrete vault or junction box bottom. The hook and pile fastener straps are to provide 'breakaway' protection in the event of an accidental dig up between pull boxes.

3.2 TESTING

- .1 Before and after installation, each segment of each fibre shall be tested using an Optical Time Domain Reflectometer (OTDR) and power meter equipment. Testing shall be done in each direction on each fibre and at 1300nm and 1550nm wavelengths. Launch cable shall be used as per the OTDR manufacturer's specifications. The Contractor shall provide a typewritten report and digital test files detailing the results of each test, including OTDR test results in graphical format, cable length, any fibre breaks or anomalies, attenuation of the fibre's connectors, and fibre uniformity, complete with a concise summary of the results.
- .2 The Contractor shall provide on-reel testing prior to cable installation. In the "Comments" section of the OTDR software the contractor shall include: Loss per kilometre, helix factor, and length of cable. These figures are with the cable specification and usually attached to the reel. OTDR pulse width and acquisition time shall be adjusted until a clean trace is obtained. A clean trace is where the end of the fibre is significantly above the noise level. 1.5km launch box shall be used at the test point of the fibre. All anomalies shall be noted and included in the report. All test results shall be recorded onto a CD and submitted.

- .3 The Contractor shall provide splice testing during fibre splicing. Loose tube, maximum loss of splice shall be less than 0.03 dB. If this cannot be met after three splice attempts then the Departmental Representative shall be informed and the splice marked: "Out of Specification". OTDR wavelength shall be 1550nm. Pulse width and acquisition time shall be adjusted so that the splice can be seen even though the splice is within specification. All anomalies shall be noted and reported to Departmental Representative.
- .4 The Contractor shall provide Final Acceptance Testing. Final Acceptance Testing shall consist of light source/power meter testing, and OTDR bi-directional testing.
- .1 Light source/power meter testing shall be provided in either MS EXCEL or MS WORD format and include: dates of tests, contractor, names of technicians, addresses of test locations, cable manufacturer, loose tube or ribbon, number of fibres, test instrument manufacturer and model numbers with last calibration date, length of launch reel (1500m) or pigtails if used, and wavelengths. Light source/power meter testing shall be completed first to ensure that no fibres have been crossed. Wavelengths shall be 1310nm, and 1550nm.
- .2 OTDR bi-directional testing shall be provided. The fibre shall be tested from each end with the same OTDR parameters. OTDR wavelength shall be 1310nm, and 1550 nm. Pulse width and acquisition time shall be adjusted so that the end of the fibre is clearly seen. 1.5km fibre launch box shall be used at the test point of the fibre. Any anomalies shall be noted and reported to Departmental Representative. All OTDR test results shall be either in "EXFO" trace format or a format acceptable by the Departmental Representative. All test results shall be recorded onto a CD and submitted.
- .3 The Contractor shall document the following in the "Comments" section of the OTDR software: number of fibres in the cable, loose tube or ribbon, length of launch reel if one is being used, test location (street address), last calibration dates. All attenuation measurements shall be carried out using approved industry standard test equipment and materials. All measuring equipment shall be in good working condition and accompanied by current calibration certificates.
- .5 Any section of cable found to be defective or below specified thresholds shall be replaced and retested at the contractors cost.

END OF SECTION

Part 1 General

1.1 DESCRIPTION OF WORK

- .1 The Contractor shall complete all electrical system testing and commissioning in accordance with the related specification sections and the Drawings and to the standard and format noted or if no standard or format is noted, a professional standard and format of the kind typically provided in large federally funded projects of a similar technical nature and submit them to the Departmental Representative for acceptance.

Part 2 RELATED SECTION

- .1 Section 01 33 00 – Submittal Procedures.
- .2 Section 01 45 00 - Quality Control.
- .3 Section 01 71 00 - Examination and Preparation.
- .4 Section 01 77 00 - Closeout Procedures.
- .5 Section 26 05 00 – Common Work Results for Electrical

Part 3 MEASUREMENT PROCEDURES

- .1 Payment for the electrical system testing and commissioning Len's lighting will be made in accordance with "**Lump Sum Item 6a) – Electrical System Testing and Commissioning**" and payment shall be full compensation for all required effort by the Contractor.
 - .1 Payment will be made on the Departmental Representative's acceptance of all required finalisation documentation.
- .2 Mobilization and demobilization required for this Work shall be incidental to "**Lump Sum Price Item 1 – Mobilization / Demobilization**", and no additional payment will be made.
- .3 Traffic Control required for this Work shall be incidental to "**Lump Sum Price Item 2 – Traffic Accommodation**" and no separate payment will be made to the Contractor.

END OF SECTION

Part 1 **General**

1.1 **DESCRIPTION OF WORK**

.1 The Contractor shall prepare all finalization documentation to the standard and format noted or if no standard or format is noted, a professional standard and format of the kind typically provided in large federally funded projects of a similar technical nature and submit them to the Departmental Representative for acceptance.

.1 Finalization documentation should be read to mean all documentation required under the Contract whether specifically noted as finalisation documentation or not. They may be, among other things, closeout submittals, drawings, manuals, records, reports, photographs, electronic files, samples, mock-ups, and anything else reasonably required by the Departmental Representative for the purpose of taking responsible ownership of the Works and finalising the Contract.

1.2 **RELATED SECTION**

- .1 Section 01 33 00 – Submittal Procedures.
- .2 Section 01 45 00 - Quality Control.
- .3 Section 01 71 00 - Examination and Preparation.
- .4 Section 01 77 00 - Closeout Procedures.
- .5 Section 26 05 00 – Common Work Results for Electrical

1.3 **MEASUREMENT PROCEDURES**

.1 Payment for the finalization documentation will be made in accordance with “**Lump Sum Item 6b) – Finalization Documentation**” and payment shall be full compensation for all required effort by the Contractor.

.1 Payment will be made on the Departmental Representative's acceptance of all required finalisation documentation.

END OF SECTION

Part 1 General

1.1 SUBMITTALS

- .1 Provide submittals in accordance with Section 26 05 00 – Common Work Results for Electrical.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

Part 2 Products

2.1 PVC DUCTS AND FITTINGS

- .1 Rigid PVC duct: Type DB2/ES2, with fabricated fittings, for direct burial.
 - .1 Nominal length: 6m plus or minus 12 mm.
- .2 Rigid PVC bends, couplings, reducers, bell end fittings, plugs, caps, adaptors same product material as duct, to make a complete installation.
- .3 Factory bends shall not be used in conduit runs, except for where shown on the Drawings or approved by the Departmental Representative in the field. Where factory 90 degree bends are approved the radius shall be greater than 900mm.
- .4 Rigid PVC 90 degrees, 45 degrees bends and 5 degrees angle couplings as required.

2.2 HDPE DUCTS AND FITTINGS

- .1 HDPE conduit: to UL651B - UL Standard for Safety Continuous Length HDPE Conduit
- .2 HDPE bends, couplings, reducers, bell end fittings, plugs, caps, adaptors same product material as duct, to make a complete installation.
- .3 Factory bends shall not be used in conduit runs, except for where shown on the Drawings or approved by the Departmental Representative in the field. Where factory 90 degree bends are approved the radius shall be greater than 900mm.

2.3 SOLVENT WELD COMPOUND

- .1 Solvent cement for PVC duct joints.

2.4 CABLE PULLING EQUIPMENT

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

2.5 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.

2.6 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 1.5m and smooth transition throughout duct length.
- .4 Slope ducts with 1 to 400 minimum slope.
- .5 Install plugs and cap both ends of ducts to prevent entrance of foreign materials during and after construction.
- .6 Pull through each duct steel mandrel not less than 300 mm long and of diameter 6 mm less than internal diameter of duct, followed by stiff bristle brush to remove sand, earth and other foreign material.
 - .1 Pull stiff bristle brush through each duct immediately before pulling-in cables.
- .7 Install a pull rope continuous throughout each duct run with 3m 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.

END OF SECTION