



SPECIFICATION

Project No. R.095823.001

Public Works and Government Services Canada

Runway Lighting Replacement/Rehabilitation (Transport Canada) –

Churchill Airport

Churchill, MB

Solicitation No. ET025-200103/A



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END OF SECTION 00 01 00

1.0 WORK DESCRIPTION

- .1 Work under this Contract comprises the following Electrical Works at the Churchill Airport in the Province of Manitoba. This list is intended for informative purposes and may not be reflective of precise scope of work as defined in the Contract documents.
 - .1 Replacement of Runway 07-25 medium intensity edge lighting complete with associated cabling and pull pits
 - .2 Replacement of Taxiway B edge lighting complete with associated cabling and pull pits.
 - .3 Replacement of existing Runway 07 and Runway 25 PAPI systems complete with new concrete foundations, associated cabling and pull pits.
 - .4 Replacement of two wind direction indicators complete with concrete foundation, associated cabling and pull pits.
 - .5 Replacement / installation of new LED illuminated guidance signs complete with associated cabling and infrastructure
 - .6 Installation of Runway 25 RTIL system c/w associated cabling and infrastructure

2.0 WORK INCLUDED

- .1 The Work, unless specifically stated otherwise, shall include the furnishing of all Material, Product, Plant, labour and transportation necessary to complete The Work. The intent is that the Contractor provides a complete job.
- .2 The Work shall not be deemed complete until all components are placed in operation by the Contractor and are operating satisfactorily.
- .3 Any minor item of The Work not called for in the specifications or shown on the drawings but clearly required to meet the intent of design and normally provided for the proper operation of The Work shall be provided as if specifically called for in the Contract Documents.

3.0 DOCUMENTS REQUIRED

- .1 Maintain at the job site at least one copy of each of the following:
 - Contract Drawings
 - Specifications
 - Addenda
 - Change Orders, Field Orders, Notices
 - Reviewed Shop Drawings
 - Modifications to the Contract
 - Field Test Reports
 - Construction Schedule
 - Manufacturer's Installation and Application Instructions
 - Occupational Health and Safety Regulations and Workers' Compensation Board Regulations;
- and have readily available any referenced or specified Standards.

4.0 SPECIFICATIONS

- .1 Sentence structure in parts of the specifications is abbreviated, and phrases such as "shall be," and "the Contractor shall" are deliberately omitted. Such sentences shall be read as though they are complete.
- .2 The use of the word "Provide" means "supply and install"; or "supply labour and materials for the installation of". It does not mean supply only.
- .3 The word "concealed" in connection with piping, electrical work, controls and wherever used in other sections shall mean "hidden from sight" as in ceiling spaces or furred out spaces, and not normally visible to persons in the construction area.
- .4 The word "exposed" in connection with piping, electrical work, controls and whenever used in other sections shall mean visible to persons within a building, in normal working areas.

5.0 STANDARDS

- .1 Wherever standards (e.g., CSA, ASTM and others), are referred to in these Contract Documents the current edition shall apply.
- .2 Where there is a clear conflict between the referenced Standard and the Contract Documents, the Contract Documents shall apply.
- .3 Where there is an ambiguity between a Standard and any term of these Contract Documents, the Departmental Representative shall, in the first instance, give an interpretation of the intent of the Contract.

END OF SECTION 01 01 00

1.0 THE WORKSITE

- .1 The Departmental Representative will provide the lands as delimited on the Drawings upon which the Work is to be constructed.

2.0 CONTRACTOR'S USE OF THE WORKSITE

- .1 The Contractor shall have exclusive use and control of the Worksite, provided that the Contractor shall permit access to the Departmental Representative, the Departmental Representative and Other Contractors on the Worksite for purposes of inspections, reviews, tests and carrying out work related to The Work.
- .2 Contractor's use of the Worksite for storage is limited to areas as delimited on the Drawing.
- .3 The Departmental Representative shall have unfettered use of thoroughfares, streets, lanes and other areas within the Worksite until the Contractor requires those areas for execution of The Work, and after the Contractor has finished the portions of The Work in those areas.
- .4 Unless otherwise agreed with the Departmental Representative, the Contractor shall give 48 hours' notice to the Departmental Representative before entering a particular Area of the Worksite to execute The Work.
- .5 Up to the end of the period of Notice and after the Contractor has fully completed its operations in a particular Area, the Departmental Representative shall have use of the Area and shall be responsible for Health and Safety Requirements and security in that Area.

During the Contractor's use of a particular Area of the Worksite to execute The Work, the Contractor shall be responsible primarily for security and for ensuring compliance with Health and Safety Regulations.

- .6 The Contractor shall be responsible for access to the Worksite by means of temporary roads, tote roads, or agreements with the appropriate authorities to use existing means of access.

END OF SECTION 01 01 50

1.0 GENERAL

- .1 The Laws and Regulations of the Province of Manitoba shall govern.

2.0 BURNING

- .1 Restrictions of federal, provincial and municipal authorities shall be complied with, and permits shall be obtained by the Contractor.

3.0 REGULATIONS, STANDARDS AND CODES

- .1 Codes, Standards and Regulations are specified in other sections of the specifications and the Work shall be done in accordance with those Codes, Standards and Regulations where applicable.

END OF SECTION 01 06 00

1.0 ABBREVIATIONS, SPECIFICATIONS, METHODS, STANDARDS

.1 General

AASHTO	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
ARCA	Alberta Roofing Contractors Association
ASCE	American Society of Civil Engineers
ASTM	American Society for Testing and Materials
AWPA	American Wood Preservers Associations
AWS	American Welding Society
BCLMA	B.C. Lumber Manufacturer's Association
CAN	National Standard of Canada
CCA	Canadian Construction Association
CISC	Canadian Institute of Steel Construction
CITC	Canadian Institute of Timber Construction
CPCI	Canadian Prestressed Concrete Institute
CRCA	Canadian Roofing Contractors Association
CSA	Canadian Standards Association
CWB	Canadian Welding Bureau
ISO	International Organization for Standardization
NBC	National Building Code
PCI	Prestressed Concrete Institute
PMBC	Plywood Manufacturer's Association
SJI	Steel Joist Institute
SSPC	Steel Structures Painting Council
WCB	Worker's Compensation Board

.2 Utilities

API	American Petroleum Institute
AWWA	American Water Works Association
CGA	Canadian Gas Association
CGSB	Canadian General Standards Board
CSPI	Corrugated Steel Pipe Institute
IAO	Insurer's Advisory Organization
RTAC	Roads and Transportation Association of Canada
ULC	Underwriters Laboratories of Canada
USA	United States of America Standards (ASA)

.3 Mechanical

AFBMA	Anti Friction Bearing Manufacturer's Association
AGMA	American Gear Manufacturer's Association
AMCA	Air Moving and Conditioning Association
ANSI	American National Standards Institute
ACR	Air Conditioning and Refrigeration Institute
ASHRAE	American Society of Heating Refrigerating and Air Conditioning Engineers
NFPA	National Fire Protection Association
SAE	Society of Automotive Engineers

.4 Electrical

AIEE	American Institute of Electrical Engineers
CEC	Canadian Electrical Code
EEMAC	Electrical and Electronic Manufacturers Association of Canada
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronic Engineers
IES	Illuminating Engineers Society
IPCEA	Insulated Power Cable Engineer's Association
LEMA	Lighting Equipment Manufacturer's Association
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
NESC	National Electrical Safety Code

.5 Use of Abbreviations

These abbreviations refer to Specifications, Methods and Standards issued by the respective Association, and the abbreviations are used in the specifications.

Alphanumeric designations following the abbreviations denote the specification, method, or standard.

2.0 ABBREVIATIONS – METRIC

.1 General

The specifications are metric and metric usage is based upon SI units in accordance with CSA Standard CAN/CSA-Z234.1 Canadian Metric Practice Guide. In this specification SI units are abbreviated in accordance with the Metric Units and Abbreviations below.

.2 Linear Measure

Metre	m
Millimetre	mm
Kilometre	km
micrometre	micro-m

.3 Area

Square metre	m ²
Square millimetre	mm ²

	Hectare	ha
.4	Volume	
	Cubic metre	m ³
	Litre	L
.5	Mass and Density	
	Kilogram	kg
	Gram	g
	Tonne	t
	Kilogram per metre	kg/m
	Gram per metre	g/m
	Kilogram per square metre	kg/m ²
	Gram per square metre	g/m ²
	Kilogram per cubic metre	kg/m ³
.6	Temperature	
	Degree Celsius	°C
.7	Force, Pressure, Stress	
	Newton	N
	Kilonewton	kN
	Pascal	Pa
	Kilopascal	kPa
	Megapascal	MPa
.8	Velocity, Rate of Flow	
	Metre per second	m/s
	Metre per hour	m/h
	Kilometre per hour	km/h
	Litre per second	L/s
	Cubic metre per second	m ³ /s
.9	Power, Energy, Heat, Work	
	Watt	W
	Kilowatt	kW
	Kilowatt hour	kWh
	Joule	J
.10	Electricity	
	Ampere	A
	Volt	V

END OF SECTION 01 07 00

1.0 GENERAL

- 1.1 Payments will be made on the basis of the lump sum prices bid and the unit prices bid in the "Bid and Acceptance Form" submitted with the tender, and in accordance with the General Conditions.
- 1.2 The prices bid for various items of work, unless specifically noted otherwise, shall include the supply of all labour, plant, material and product equipment necessary to construct The Work in accordance with the specifications.
- 1.3 The prices bid for supply and installation shall be full compensation for supplying, hauling, installing, cleaning, testing, and placing in service together with all other work subsidiary and incidental thereto for which separate payment is not provided elsewhere.
- 1.4 The method of measurement of the quantities for payment and the basis for payment will be in accordance with the following items of this section or as detailed in the various specifications contained in this document. All measurement will be done by the Departmental Representative using generally accepted field survey methods.
- 1.5 Where the Tender shows separate items for supply and installation, the unit prices or lump sum prices bid for supply shall include supplying, delivering, loading, unloading and all allowances for handling, storage, breakage and waste. Payment will be made only for material actually installed in the work.
- 1.6 Progress Payment for supply-only items shall be made only for material and product on the worksite and in the contractor's care, and shall then become the property of the Departmental Representative.
- 1.7 Other materials on site, whether existing structures, vegetation, topsoil, gravel, sand or other excavated or piled materials, are the property of the Departmental Representative. Only those materials specifically noted in the specification or on drawings as belonging to the Contractor shall become the Contractor's property. For the purpose of this contract, any materials called for Off-Site disposal belong to the Contractor. On-site disposal shall imply the materials belong to the Departmental Representative and that disposal shall be in designated areas on the airport property.
- 1.8 Where there are excess excavated materials, unsuitable materials excavated or materials of any kind that are excavated but not used in The Work, such materials are not the property of the Contractor unless authorized in writing by the Departmental Representative or specified to be disposed of by the Contractor.
- 1.9 Restoration of existing surfaces disturbed by construction to pre-existing or better condition is incidental to the Work.

2.0 LUMP SUM CONTRACTS

- 2.1 Payments will be made on the basis of the following:
 - 2.1.1 Lump Sum and Unit Prices prices bid in the "Bid and Acceptance" form,
 - 2.1.2 Changes in THE WORK for items not covered by unit prices, in accordance with GC.

3.0 UNIT PRICE CONTRACT SPECIAL PROVISIONS AND BASIS OF MEASUREMENT & PAYMENT

The following sections are intended to provide supplemental detail to the contract items listed in the Unit Price Schedule, the associated specifications and the Contract Drawings. All of the information presented should be considered as a whole. The Contractor is advised that not all items within the Form of Tender may have an associated Special Provision.

For each Lump Sum item in the Unit Price Table, the Departmental Representative will, in cooperation with the Contractor, estimate the percentage of the item completed at the end of the payment period.

A TRENCHING – ITEMS 1.1, 1.2

1. The Contractor shall provide all trenching, backfilling, compaction, sand bedding and restoration as outlined in the drawings and Specifications. Where multiple circuits are installed along the same route, a common “joint-use” trench shall be provided. The “joint-use” trench is to be considered in the first section / item in the schedule of unit prices for which the “joint-use” trench applies
2. Payment for trenching shall be on the basis of lineal metre of trench measured in the field. Such unit prices shall include all earth excavation, trenching, backfilling, fill (if required), compaction, warning tape, removal and disposal of excess excavated material, and reconditioning of disturbed surface.
3. Earth excavation includes removal of rock and/or boulders up to 0.5m³.
4. Native material shall be used for backfill except no rocks or stones greater than 50mm diameter are to be used.
5. A 75mm bedding of sand is to be provided at the bottom of all trenches. A 75mm cover of sand is to be provided above all direct buried cables / polytubing.
6. Sand shall be mortar sand.
7. Note that the trench width will be wider where multiple raceways or cables are present. Factor the additional sand required into the item unit price.

B DIRECT BURIED RACEWAYS ITEMS 1.3, 1.4

1. Payment for this item shall be full compensation for all labour, materials and equipment necessary to install the raceways as shown on the drawings. Any associated trenching or sand will be paid under separate items.
2. Include sufficient allowance in the tendered price to install the raceways into manholes, pullpits and boxes.
3. Payment for this item will be based on linear metres of raceway measured horizontally along trenches from the source to the end use device. It shall be this contractor’s responsibility to factor the cost of all ropes, fittings, couplings, connections, surplus for elevation changes, surplus for offsets and vertical rises into his tendered price.

D. CABLES THROUGH DIRECT BURIED RACEWAYS ITEM 1.5, 1.6, 1.7, 1.8, 1.9, 1.10

1. The trenching and raceways and associated with the installation of these cables is covered under separate items.
2. Note that the estimated quantities shown in the tender form are “neat” measurement as scaled from

the plans. No allowance for cable loops, offsets, elevation changes, connection slack has been included in the estimated quantities.

3. The tendered price for the installation of cables through raceways shall include:
 - a) Supply and installation of all cables c/w all connections and connectors. The Contractor shall note that cable supply shall include any extra cable necessary for cable loops, connections, fittings, splices, offsets as well as all surplus cables brought above ground;
 - b) All other accessories including cable tags necessary to complete the installation to the satisfaction of the Departmental Representative.
4. Payment for these items shall be on the basis of lineal metre of installed wiring measured horizontally along trenches and ducts from the cable source to the end use device. It shall be this contractor's responsibility to factor the cost of all surplus cable and accessories required to make a complete system into his tendered price.

E. GROUND COUNTERPOISE - ITEMS 1.11, 1.12

1. Supply and install #8 AWG soft drawn bare copper with all direct buried runs of series cable in polytubing. Use #8 AWG, green TWU or RWU insulated for series cables installed through ducts.
2. Payment for this item shall be on the basis of lineal metre of duct or trench containing series edgelifighting cable measured horizontally along trenches or ducts. It shall be this contractor's responsibility to factor in the cost of all surplus wire, connectors and accessories required to make a complete system into the tendered price.

F. TECK CABLE – ITEMS 1.13, 1.14

1. The trenching and sand associated with the installation of these cables is covered under separate items.
2. Note that the estimated quantities shown in the tender form are "neat" measurement as scaled from the plans. No allowance for cable loops, offset, elevation changes, connection slack has been included in the estimated quantities.
3. Payment for TECK cable shall include:
 - i. The supply and installation of all cable complete with connectors and terminators.
 - ii. The supply and installation of all splice boxes necessary to install the cable along the routes shown on the drawings. The drawings may not show all required splice boxes. The Contractor is to provide continuous lengths of cable (free of splices) as far as is practicable.
 - iii. Polytubing sleeving over the cables above grade.
4. Payment for these items shall be on the basis of lineal metre of installed wiring measured horizontally along trenches and ducts from the cable source to the end use device. It shall be this contractor's responsibility to factor the cost of all surplus cable and polytubing and accessories required to make a complete system into his tendered price.

END OF SECTION 01 15 50

1.0 PRECONSTRUCTION MEETING

- .1 A Pre-construction meeting will be arranged by the Departmental Representative
- .2 The Pre-construction Meeting will be held at a location at or near the site.
- .3 The agenda for the Pre-construction Meeting shall be generated and distributed by the Departmental Representative and is to include, but is not limited to, the following:
 - .1 Confirm the Superintendent, Contractor's Project Manager, and the Departmental Representative's Resident personnel on the Worksite.
 - .2 Establish Worksite protocols for communication, reporting, inspection, etc.
 - .3 Clear up any ambiguities or questions of interpretation known at that time.
 - .4 Contractor shall present its detailed Work Schedule.
 - .5 Occupational Health and Safety relationships and responsibilities.
 - .6 Discuss other responsibilities of the Departmental Representative, the Contractor, and the Departmental Representative. Review General Conditions GC 5 to GC 11, inclusive.
- .4 The Departmental Representative shall distribute, by email, minutes after the meeting

2.0 PROGRESS MEETINGS

- .1 Progress meetings will be held on an as required basis as requested by the Departmental Representative. The agenda for the meetings shall be generated and distributed, by email, by the Departmental Representative.
- .2 The Contractor shall have in attendance the Superintendent, the Contractor's Project Manager and representatives of the Subcontractors if requested by the Departmental Representative.
- .3 The Departmental Representative will have the Departmental Representative's Project Manager or the Resident Engineer, or both, in attendance.
- .4 The Departmental Representative may have a representative in attendance.
- .5 Occupational Health and Safety incidents, records and procedures shall be part of the agenda for every progress meeting.
- .6 Minutes will be taken by the Departmental Representative and copies will be distributed to all attendees.

END OF SECTION 01 20 00

1.0 CONSTRUCTION SCHEDULE

- .1 Upon award of the Contract and prior to commencement of The Work, the Contractor shall submit for approval to the Departmental Representative a construction schedule in critical path format, or other format as approved by the Departmental Representative, showing all the principal phases of the work. No Progress Payment Claim shall be certified until an acceptable Construction Schedule has been received by the Departmental Representative.
- .2 The Construction Schedule shall be updated bi-weekly against actual progress of The Work by the Contractor. A copy of the updated schedule is to be provided to the Departmental Representative with each Progress Claim. Failure to comply will result in the Progress Claim being deemed incomplete until the updated schedule is provided.
- .3 If, in the opinion of the Departmental Representative, any Construction Schedule is inadequate as a control tool or if it does not show The Work being fully completed by the Contract Completion Date, the Departmental Representative may reject it and the Contractor shall provide a Construction Schedule and work program that is acceptable to The Departmental Representative.

END OF SECTION 01 31 00

1.0 REQUIREMENTS FOR SHOP DRAWINGS AND PRODUCT DATA

- .1 The Contractor shall arrange for the preparation of clearly identified shop drawings and submit shop drawings in digital form to the Departmental Representative. The Contractor shall provide clearly identified Product Data

Product Data shall include but not be limited to:

- 1.0 Product assembly drawings
 - 2.0 Materials list
 - 3.0 Principal dimensions
 - 4.0 Parts and components details
 - 5.0 Letters of compliance with recognized standards where required
 - 6.0 Operation data
 - 7.0 Operation curves
 - 8.0 Operation manuals where specified
 - 9.0 Product Name and Model Number
- .2 Shop drawings shall be accurately drawn to a scale sufficiently large to show all pertinent features of the item, and its method of connection to The Work and shall have sufficient space for the Contractor's stamp and the Departmental Representative's stamp.
 - .3 Shop drawings shall be in accordance with the International System of Units (S.I.) metric units.
 - .4 Prior to submission to the Departmental Representative the Contractor shall review all shop drawings. By this review, the Contractor represents that he has determined and verified all field measurements, field construction criteria, materials, catalogue numbers and similar data or will do so, and that he has checked and coordinated each shop drawing with the requirements of The Work and of the Contract Documents. The Contractor's review of each shop drawing shall be indicated by stamp, with the date and signature of a responsible person.
 - .5 The Contractor shall submit shop drawings to the Departmental Representative for his review with reasonable promptness and in orderly sequence so as to cause no delay in The Work or in the work of Other Contractors. If either the Contractor or the Departmental Representative so requests they shall jointly prepare a schedule fixing the dates for submission and return of shop drawings.
 - .6 The Departmental Representative will review and return shop drawings in accordance with a schedule agreed upon, at a maximum of two (2) weeks. The Departmental Representative's review shall be for conformity to the design concept and for general arrangement only and such review shall not relieve the Contractor of responsibility for errors or omissions in the shop drawings or of responsibility for meeting all requirements of the Contract Documents. A specific deviation on the shop drawings from the design concept requested by the Contractor may be approved or rejected in writing by the Departmental Representative.
 - .7 The Contractor shall make any changes in shop drawings which the Departmental Representative may require consistent with the Contract Documents and resubmit unless otherwise directed by the Departmental Representative. When resubmitting, the Contractor shall notify the Departmental Representative in writing of any revisions made by the Contractor other than those requested by the Departmental Representative, in his previous review.
 - .8 Each reviewed shop drawing will be stamped by the Departmental Representative with the following form of stamp:

Reviewed	()
Reviewed As Modified	()
Revise And Resubmit	()

Not Reviewed

()

This review by the Departmental Representative is for the sole purpose of ascertaining conformance with the general design concept. This review shall not constitute approval of the detail design inherent in the shop drawings, responsibility for which shall remain with the Contractor submitting same. Review by the Departmental Representative 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, for installation, and for co-ordination of the work of all sub-trades.

Departmental Representative

By:

Date:

2.0 DESIGN BY THE CONTRACTOR

- .1 When the Contractor is responsible for engineering design of portions of The Work, this shall be clearly and specifically indicated in the drawings or in the specifications of the Contract Documents.
- .2 Where the Contractor is required, either by law or regulation or by the Contract to provide engineering design, he shall use the services of a Professional Engineer registered in the Province of Manitoba, Canada and he shall submit Shop Drawings bearing the Seal and Signature of that Registered Professional Engineer.

3.0 SAMPLES

- .1 The Contractor shall submit for The Departmental Representative's approval such Manufacturers' and Suppliers' samples as the Departmental Representative may reasonably require. Samples shall be labelled as to origin and intended use in The Work and shall conform to the requirements of the Contract Documents.
- .2 Samples and sample mock ups prepared by the Contractor for the Departmental Representative's approval shall be retained on the site of The Work for comparison with the actual installation of the portions of The Work that the samples are intended to represent.
- .3 Upon conclusion of The Work, the samples and mock ups may be returned to the Contractor or to the Supplier or Manufacturer who provided them, and shall then be removed from the Worksite.

END OF SECTION 01 33 00

1.0 REQUIREMENTS FOR CONSTRUCTION PHOTOGRAPHS

- .1 During the progress of The Work and at the completion of the project as determined by the Departmental Representative, the Contractor shall take photographs that adequately cover the progress of The Work.
- .2 The photography is not required to be completed by a professional.
- .3 Sufficient views of The Work shall be taken to show all parts of The Work being undertaken during the progress period being photographed.
- .4 On completion of The Work, the Contractor shall submit all photographs of The Work. In electronic format.
- .5 The Departmental Representative reserves the right to take additional photographs of any part of The Work at any time.

END OF SECTION 01 38 00

1.0 GENERAL

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

2.0 QUALITY CONTROL TESTING BY CONTRACTOR

- .1 All material required to meet specifications shall by Quality Control (QC) tested by a certified material testing laboratory engaged and paid for by the Contractor. QC testing shall be considered incidental to the works.

3.0 QUALITY ASSURANCE TESTING BY THE DEPARTMENTAL REPRESENTATIVE

- .1 The Departmental Representative may retain and pay for the services of an independent testing agency for testing for quality assurance, for the Departmental Representative's purposes.
- .2 The Departmental Representative's testing agency may inspect and test Material, Product and The Work for conformance with the requirements of the Contract Documents; however, they do not undertake to check the quality of The Work on behalf of the Contractor nor to provide quality control.
- .3 Inspections and tests by the Departmental Representative's testing agency do not relieve the Contractor of his responsibility to supply Material and Product and to perform The Work in accordance with the requirements of the Contract Documents.
- .4 The Departmental Representative, at his discretion, may order or perform any additional inspections and tests for purposes of his own or for purposes of the Departmental Representative.
- .5 The Contractor shall coordinate with the Departmental Representative the scheduling of testing and inspection by the Departmental Representative's testing agencies, to enable testing to be done as necessary, without delay, and the Contractor shall notify the Departmental Representative sufficiently in advance of operations to allow for such inspection and tests by the Departmental Representative's testing agency.

4.0 CODE COMPLIANCE TESTING

- .1 Inspections and tests required by codes or ordinances, or by a plan approval authority, shall be the responsibility of and shall be paid for by the Contractor.
- .2 Copies of reports resulting from such inspections shall be submitted in a timely manner by the Contractor to the Departmental Representative.

5.0 RETESTING

- .1 When tests on Product, Material or completed portions of The Work carried out by the Contractor or the Contractor's testing agency or by the Departmental Representative's testing agency yield results not meeting the requirements of the Contract Documents, the Contractor, in addition to carrying out remedial work or replacement of the Product or Material shall provide for retesting of the remedied work and the replacement Product and Material. Retesting, including retesting by the Departmental Representative's testing agency, shall be at the Contractor's expense.
- .2 In every case where the Contractor has submitted test results which fail to meet the requirements of the Contract Documents, the Contractor shall submit within a practical and reasonable time results of a retest showing that the results are in accordance with the requirements of the Contract Documents.

END OF SECTION 01 40 00

1.0 TEMPORARY UTILITIES

.1 Natural Gas, Gasoline and Other Fuels

- .1 Provide s for natural gas, gasoline and other fuels required for the performance of The Work, in accordance with governing regulations and ordinances, and the Contract Documents.
- .2 Furnish and install all necessary temporary piping and upon completion of The Work remove all such temporary piping.

.2 Water

- .1 Provide for all water required for the performance of The Work, in accordance with governing regulations and ordinances, and the Contract Documents.
- .2 Furnish and install all necessary temporary piping and upon completion of The Work remove all such temporary piping.

.3 Electricity and Lighting

- .1 Provide for electricity and artificial lighting required for the performance of The Work, in accordance with governing regulations and ordinances, and the Contract Documents.
- .2 Furnish and install all necessary temporary wiring, distribution boxes, panels, etc., and upon completion of The Work, remove all such temporary installations.

.4 Heating and Ventilating

- .1 Provide for heating and ventilating, coverings and enclosures as necessary to protect and perform The Work.
- .2 Furnish and install all necessary temporary equipment, piping, wiring, ducting, and other materials to perform The Work and upon completion of The Work, remove all such temporary equipment.
- .3 Temporary heating and ventilating shall be in accordance with all governing regulations and ordinances, and the Contract Documents.
- .4 Temporary heating and ventilating shall be provided to:
 - .1 facilitate progress of The Work
 - .2 protect The Work and Product and Material against dampness and cold
 - .3 prevent moisture condensation on surfaces
 - .4 provide an atmosphere for curing Material as required
 - .5 provide adequate ventilation to meet safety regulations
 - .6 prevent hazardous accumulation of dust, fumes, mists, vapours or gases in areas occupied during construction
 - .7 ventilate storage spaces containing hazardous or volatile materials

.5 Sanitary Facilities

- .1 Furnish and install all required temporary toilet buildings with sanitary toilets for use of all workmen; comply with all minimum requirements of the Health Department or other public agency having jurisdiction; maintain in a sanitary condition at all times.

.6 Fire Protection

- .1 Provide for adequate fire protection of The Work and adjacent property.
- .2 Furnish and install temporary extinguishers, hydrants and other equipment, and upon completion of The Work remove all such temporary equipment.

.7 Communications

- .1 Provide, as deemed necessary, for all means of communications, such as phone, WIFI, etc.

2.0 CONSTRUCTION AIDS

.1 Temporary Plant

- .1 Provide, arrange for, maintain all temporary items such as, but not limited to, stairs, ladders, scaffolding, ramps, transportation of labour and Material, runways, chutes, hoists, elevators, tools, templates, as required for the completion of The Work.
- .2 The location of such items shall be such as to prevent interference with, marking of, or damage to any portion of The Work.
- .3 All such items shall conform to all applicable national and local ordinances regulating safety, and to the National Building Code of Canada, and to the requirements of the Contract Documents.

.2 Temporary Enclosures

- .1 Furnish, install, and maintain for the duration of construction all required scaffolds, tarpaulins, barricades, canopies, warning signs, steps, bridges, platforms, and other temporary construction necessary for proper completion of The Work in compliance with all pertinent safety and other regulations.

.3 Falsework and Temporary Construction Supports

- .1 The Contractor shall be responsible for means and methods used for the falsework and temporary construction supports.
- .2 If required by the Contract, employ a qualified Registered Professional Engineer for the design of temporary works, and design in accordance with CSA S269.1.
- .3 Record design calculations and drawings to show that temporary works are adequate. Provide design loads, material details, and dimensions. Sign and seal design calculations and drawings, and revisions thereto.
- .4 The Departmental Representative's approval to proceed with falsework and temporary construction supports shall not relieve the Contractor of his responsibility under the Contract. The Departmental Representative's review shall be for general conformance to the intent of design and for permanent effects on the Worksite, or areas adjacent to the Worksite.

.4 Temporary Excavation

- .1 The Contractor is responsible for the means and methods of making temporary excavations in order to install components of The Work.

.5 Winter Construction

- .1 Special construction methods required to perform The Work in severe weather shall be the responsibility of the Contractor.
- .2 Where the specifications call for work to be performed within a given temperature range or above a minimum temperature, it shall be The Contractor's responsibility to provide all temporary enclosures and heat necessary to provide the conditions specified.
- .3 Where compaction of backfill is specified, the Contractor shall perform The Work in a manner such that compaction can be achieved.

- .4 Where weather conditions are such that compaction of backfill consisting of excavated materials is not possible, the Contractor shall provide unfrozen granular material for backfill, at the Contractor's expense.
- .6 Access Roads
 - .1 Construct temporary access roads as necessary to perform The Work, and maintain temporary access roads until construction is over or until permanent access is established.
 - .2 Locations and drainage facilities for temporary access roads are subject to the approval of the Departmental Representative.

3.0 PROTECTION

- .1 Remove trees, fences and other structures from the site of The Work, as necessary to perform The Work.
- .2 Remove only those items that must be removed, or are clearly shown on the drawings to be removed.
- .3 Protect all remaining trees, plants, fences and other items from damage during construction.

4.0 EXISTING UTILITIES AND STRUCTURES

- .1 Existing utilities and structures include pipes, culverts, ditches or other items which are a part of an existing sewerage, drainage or water system; or which are a part of a gas, electrical, telephone, television, telecommunications or other utility system. Also included are sidewalks, curbs, gutters, swales, poles, fences or any other structures encountered during construction.
- .2 The Contractor shall be responsible for location, protection, removal or replacement of existing utilities and structures, or for repair of any damage which may occur during construction.
- .3 Existing utilities and structures may be shown on the drawings, or described in the specifications. Such information is shown for design purposes and the existence, location and detail given is information that is obtained during the design period and is not necessarily complete, correct or current.
- .4 The Contractor shall be responsible for establishing locations and state of use of all existing utilities that may affect The Work. The Contractor shall make satisfactory arrangements with the utilities companies involved for the location, protection and inspection of existing utilities.
- .5 Applicable utilities companies must be contacted by the Contractor well in advance of the work (3 business days minimum) to arrange for locates. Notice in writing shall be given by the Contractor to the utilities companies at least 48 hours before work commences in the vicinity of existing utilities.
- .6 The Contractor shall be responsible in protection of utilities, inspection of utilities, and all costs due to delays because of existing utilities and structures.
- .7 The Contractor shall provide for the uninterrupted flow of all water courses, sewers and drains encountered during The Work.
- .8 Access shall be maintained to all existing structures such as valves, hydrants, meter chambers and control structures at all times during construction.
- .9 If interruption of service provided by an existing utility is necessary, the planned shut down shall be approved by the owners of the utilities. Requests for shut down shall be made by the Contractor in writing at least 48 hours in advance.

- .10 The Contractor shall notify all customers or make arrangements with the utility company to notify all customers 24 hours in advance of a shut down.

5.0 TEMPORARY CONTROLS

- .1 Noise Controls
 - .1 Perform The Work in conformity with all municipal by laws with respect to noise, hours of work, night work and holiday work. Night work or holiday work requires the written permission of the Departmental Representative.
- .2 Dust Control
 - .1 Perform The Work in a manner that will not produce an objectionable amount of dust. Dust control measures shall be paid for by the Contractor.
- .3 Pollution Control
 - .1 Perform The Work in conformance with the applicable sections of the Provincial Regulations with respect to air and water pollution control requirements.
- .4 Disposal of Wastes
 - .1 Burying of rubbish and waste on site is not permitted.
 - .2 Disposal of waste or volatile materials into waterways, storm or sanitary sewers is not permitted.
 - .3 Pumping or draining water containing silt in suspension into waterways, sewers or drainage systems is prohibited.
 - .4 Abide by requirements of Statute, Bylaw and Regulations respecting disposal of wastes.
 - .5 Obtain required Permits for waste disposal.

6.0 WORK ADJACENT TO WATERWAYS

- .1 Do not operate construction equipment in waterways, nor remove borrow material nor dump fill material into waterways, except as approved and permitted by the appropriate authorities. Obtain any required Permits.

7.0 TRAFFIC CONTROL

- .1 The Contractor shall be responsible for the regulation of traffic during construction, and shall perform The Work in a manner that will cause the least disruption of traffic.
- .2 The Contractor shall co ordinate The Work with the Departmental Representative to reduce traffic problems.
- .3 Provision of flagmen, traffic signs, and other traffic controls shall be the Contractor's responsibility and shall be in accordance with the TAC Manual of Uniform Traffic Control Devices.
- .4 The Contractor shall supply all barriers, barricades, warning signs, detours, fences, flagmen and all other devices to protect the public. All applicable safety standards shall be followed.
- .5 The Contractor shall obtain approval to block traffic temporarily if it is necessary to do so to perform

The Work. Obtain the written approval of applicable municipal departments and the Departmental Representative. At least 48 hours prior to actually blocking traffic notify the following:

- .1 Roadway Authority
- .2 Public Works Departments
- .3 Utilities Companies
- .4 Fire Department
- .5 Police Department
- .6 Adequate construction parking, meeting local regulations, shall be provided by the Contractor.
- .7 Haul routes shall be maintained by the Contractor. They shall be kept open to traffic and shall be clean at all times.
- .8 Obtain permits as required to use public roads or streets for haul routes.

8.0 CONTRACTOR'S FIELD OFFICE

- .1 Furnish and install a field office building adequate in size and accommodation for all Contractor's offices, superintendent's office, supply and tool rooms throughout the entire construction period.

9.0 TEMPORARY USE OF OWNER'S FACILITIES AND THE WORK

- .1 If the Departmental Representative permits the Contractor to make temporary use of the Departmental Representative's facilities, the Contractor shall use the facilities with care, providing all maintenance and repair, and shall leave the facilities in good working order when he is finished.
- .2 If the Departmental Representative permits the Contractor to use facilities incorporated into The Work, the Contractor shall use them with care and be responsible for all maintenance and repair and for leaving the facilities in good order.
- .3 Permanent systems shall not be used by the Contractor without the written permission of the Departmental Representative.
- .4 Permanent heating systems shall not be used for temporary heating without the written permission of the Departmental Representative.
- .5 If the Contractor obtains written permission to use existing heating systems or other systems temporarily, before completion, the Contractor shall change lubricants, filters and other accessory items completely upon completion of The Work. Warranties shall be extended by the Contractor to ensure that the Departmental Representative receives the full warranty, as specified.
- .6 Temporary or trial usage by the Departmental Representative of any mechanical machinery, apparatus, equipment or any other work or materials supplied under the contract before final acceptance by the Departmental Representative is not to be construed as evidence of acceptance. The Departmental Representative shall have the privilege of such temporary and trial usage as soon as the Contractor shall claim that said work is completed.

END OF SECTION 01 50 00

1.0 CONTRACTOR SECURITY PROVISIONS

.1 General

- .1 "Restricted Area" means an area at an aerodrome identified by a sign as an area to which access is restricted to authorized persons.
- .2 "Restricted Area Pass" means a document or other piece of identification approved or issued by or under the authority of an aerodrome operator authorizing the holder to have access to a restricted area.
- .3 It is compulsory to display the Restricted Area Pass in a clearly visible fashion at all times within a Restricted Area.
- .4 The decision as to who may be authorized access to a Restricted Area shall be determined on a need and right of entry basis. No person shall be issued an Airport Restricted Pass unless need and right of entry has been established and/or substantiated as determined by the Aerodrome Operator.

.2 Contractor's Responsibility

- .1 The Contractor shall be responsible for compliance with all aspects of security requirements for his personnel.
- .2 Be responsible for construction personnel and vehicles, employees on project and requiring access to restricted areas.
- .3 Ensure the Superintendents, Foreman, Flagmen and key personnel of the subcontractor attend a briefing, at site, to be scheduled before the start of the project, regarding safety and security.
- .4 Designate a person who will be responsible to ensure all aspects of security and operational safety requirements are adhered to and have authority to take immediate action to rectify the situation. Such person should be available at all times during construction

.3 Security Barrier/Gates

- .1 Security barriers such as fences, gates, locks, etc. are used to prevent or deter access by unauthorized persons to airport restricted areas. In the event it is necessary to remove such barriers, they must be replaced, where practical, at the end of each work day. If it is necessary to remove such barriers for an extended period of time, unprotected restricted areas shall be enclosed with temporary boarding and/or fencing. The Departmental Representative must be immediately informed of any possibilities that a restricted area may be left unprotected at the end of a work day.
- .2 Failure to restore such security barriers when required will result in their restoration being recovered from the Contractor.
- .3 The Departmental Representative must be given prior notification when it is necessary to remove security barriers to permit access to construction areas. Security barriers will not be removed without the prior approval of the Departmental Representative.

.4 Daily Security

- .1 Ensure that accesses to restricted areas are secured at the end of each work day.
- .2 When work is to be carried out within restricted areas outside of normal working hours, the Departmental Representative must be notified and approve of area and time frame.

.5 Security Escort

- .1 Churchill Airport will provide or appoint personnel in possession of permanent restricted area

- passes to perform escort duties within airport restricted areas if required.
- .2 The Contractor will be required to cooperate with the security plan as part of the overall project schedule and The Plan of Construction Operations. The security plan and review of responsibilities is to be presented at the Pre-Construction Meeting.

END OF SECTION 01 54 00

1.0 REFERENCES

- .1 CSA S269.1 1975 Falsework for Construction Purposes.
- .2 CAN/CSA S269.2 M87 Access Scaffolding for Construction Purposes.
- .3 FCC No. 301 1982 Standard for Construction Operations

2.0 CONSTRUCTION SAFETY MEASURES

- .1 Observe construction safety measures of National Building Code 1995, Part 8, Provincial Government, Workers'/Workmen's Compensation Board and municipal authority provided that in any case of conflict or discrepancy more stringent requirements shall apply.

3.0 OVERLOADING

- .1 Ensure no part of Work is subjected to loading that will endanger its safety or will cause permanent deformation.

4.0 WHMIS

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

END OF SECTION 01 54 50

1.0 ENVIRONMENTAL MEASURES

1. Meet or exceed the requirements of all environmental legislation and regulations, including all amendments up to project date provided that in any case of conflict or discrepancy, the more stringent requirements will apply.

2.0 FIRES

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

3.0 DISPOSAL OF WASTES

- .1 Do not bury rubbish and waste materials on site unless approved by the Departmental Representative.
- .2 Do not dispose of waste or volatile materials, such as mineral spirits, oil or paint thinner into waterways, storm or sanitary sewers.
- .3 On-site excavated material disposal areas have been made available.
- .4 Dispose of wastes in accordance with the requirements of authorities having jurisdiction and to the satisfaction of the Departmental Representative.

4.0 DRAINAGE

- .1 Provide temporary drainage and pumping as necessary to keep excavations and site free from water.
- .2 Do not pump water containing suspended materials into waterways, sewer or drainage systems.
- .3 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with local authority requirements.
- .4 Provide construction sediment control and erosion protection devices as required.

5.0 SITE CLEARING AND PLANT PROTECTION

- .1 Protect trees and plants on site and adjacent properties where indicated.
- .2 Wrap in burlap, trees and shrubs adjacent to construction work, storage areas and trucking lanes, and encase with protective wood framework from grade level to height of 2 m.
- .3 Protect roots of designated trees to dripline during excavation and site grading to prevent disturbance or damage. Avoid unnecessary traffic, dumping and storage of materials over root zones.
- .4 Minimize stripping of topsoil and vegetation.
- .5 Restrict tree removal to areas indicated or designated by the Departmental Representative.

6.0 WORK ADJACENT TO WATERWAYS

- .1 Do not operate construction equipment in waterways.
- .2 Do not use waterway beds for borrow material without the Departmental Representative's approval.

- .3 Do not dump excavated fill, waste material or debris in waterways.
- .4 Design and construct temporary crossings to minimize erosion to waterways.
- .5 Do not skid logs or construction materials across waterways.
- .6 Avoid indicated spawning beds when constructing temporary crossings of waterways.
- .7 Do not blast under water or within 100 m of indicated spawning beds.

7.0 POLLUTION CONTROL

- .1 Maintain temporary erosion and pollution control features installed under this contract.
- .2 Control emissions from equipment and plant to local authorities emission requirements.
- .3 Prevent sandblasting and other extraneous materials from contaminating air beyond application area, by providing temporary enclosures.
 - .1 Cover or wet down dry materials and rubbish to prevent blowing dust and debris. Provide dust control for temporary roads.

8.0 STRAW BALE FLOW CHECKS AND BARRIERS

- .1 Install straw bales upstream of pumping unit in order to filter the solids and sediments of the water prior to pumping or discharging into existing drainage system.

9.0 CONSTRUCTION WASTES

- .1 Provide sufficient suitable refuse containers throughout the site to receive and control construction wastes. Keep containers closed to prevent contents from blowing around site.

10.0 EQUIPMENT MAINTENANCE AREAS

- .1 Prepare and submit for approval, a drawing showing a proposed equipment maintenance area. This area must be located a minimum of 30 m from a watercourse.

11.0 NON-MAINTENANCE RELATED SPILLS

- .1 Non-maintenance related spills are spills that occur due to mishandling of fuels during the fuelling process, failure of hoses or other components on equipment, etc.
- .2 Submit a contingency plan for dealing with such occurrences to the Departmental Representative for approval. The plan must describe in detail the action to be taken and the persons and the agencies to be notified in the event of such a spill.

12.0 DUST CONTROL

- .1 Excessive dust from construction activities creates a serious hazard for operational airports and must be controlled at all times.
- .2 Maintain sufficient watering equipment on site at all times to control construction dust.
- .3 Should the contractor fail to control dust emissions, the Departmental Representative reserves the right to order the Contractor to cease all operations until adequate measures have been taken. No

claims for delay of contract can be made by the Contractor on this item. Any costs incurred by the Departmental Representative or the Authority for this work shall be deducted from future progress payment certificates due to the Contractor.

13.0 ENFORCEMENT

- .1 Protection of the environment is considered to be of prime importance during any works on federal properties.
- .2 Progress payments will not be made to the Contractor while any requirements for Environmental Protection are outstanding.
- .3 Directions given by the Departmental Representative with respect to action to be taken to correct environmental deficiencies must be acted upon immediately.
- .4 In the event that deficiencies in work are not corrected, then the Departmental Representative will take the necessary action for correction purposes and will deduct the cost thereof from any monies due to the Contractor.

END OF SECTION 01 56 10

1.0 GENERAL

- .1 Use new material and equipment unless otherwise specified.
- .2 Within 7 days of written request by the Departmental Representative, submit following information for materials and equipment proposed for supply:
 - .1 name and address of manufacturer,
 - .2 trade name, model and catalogue number,
 - .3 performance, descriptive and test data,
 - .4 manufacturer's installation or application instructions,
 - .5 evidence of arrangements to procure.
- .3 Use products of one manufacturer for material and equipment of same type or classification unless otherwise specified.
- .4 All Airport equipment shall be certified to be compliant with applicable Transport Canada standards including but not limited to TP312 5th Edition.
- .5 All equipment shall be CSA approved. Where CSA approval is unavailable, contractor to arrange and pay for "Special Inspection" by the Local Authority having jurisdiction.

2.0 MANUFACTURERS INSTRUCTION

- .1 Unless otherwise specified, comply with manufacturer's latest printed instructions for materials and installation methods.
- .2 Notify the Departmental Representative in writing of any conflict between these specifications and manufacturer's instructions. The Departmental Representative will designate which document is to be followed.

3.0 FASTENINGS - GENERAL

- .1 Provide metal fastenings and accessories in same texture, colour and finish as base metal in which they occur. Prevent electrolytic action between dissimilar metals. Use non-corrosive fasteners, anchors and spacers for securing exterior work.
- .2 Space anchors within limits of load bearing or shear capacity and ensure that they provide positive permanent anchorage. Wood plugs not acceptable.
- .3 Conceal fasteners where indicated. Space evenly and lay out neatly.
- .4 Fastenings which cause spalling or cracking are not acceptable.
- .5 Obtain the Departmental Representative's approval before using explosive actuated fastening devices. If approval is obtained comply with CSA Z166 1975.

4.0 FASTENINGS - EQUIPMENT

- .1 Use fastenings of standard commercial sizes and patterns with material and finish suitable for service.
- .2 Use heavy hexagon heads, semi finished unless otherwise specified. Use No. 304 stainless steel for

exterior areas.

- .3 Bolts may not project more than one diameter beyond nuts.
- .4 Use plain type washers on equipment, sheet metal and soft gasket lock type washers where vibrations occur. Use resilient washers with stainless steel.

5.0 DELIVERY AND STORAGE

- .1 Deliver, store and maintain packaged material and equipment with manufacturer's seals and labels intact.
- .2 Prevent damage, adulteration and soiling of material and equipment during delivery, handling and storage. Immediately remove rejected material and equipment from site.
- .3 Store material and equipment in accordance with suppliers' instructions.

6.0 CONFORMANCE

- .1 Materials specified by referenced standard, select any material that meets or exceeds the specified standard.
- .2 Where materials are required to be listed on the "Canadian General Standards Board, Qualified Products List" select any manufacturer so listed.
- .3 Materials specified by "Prescriptive" or "Performance" specification, select any material meeting or exceeding specification.
- .4 Materials specified by naming one or more materials, select any material named. For the purpose of these specifications, the term "Acceptable Material" is deemed to be a complete and working commodity as described by a manufacturer's name, catalogue number, trade name or any combination thereof.
- .5 When materials are specified by a Standard, Prescriptive or Performance specifications, upon request of the Departmental Representative, obtain from manufacturer an independent testing laboratory reporting, showing that the material or equipment meets or exceeds the specified requirements.

7.0 CONSTRUCTION EQUIPMENT AND PLANT

- .1 On request, prove to the satisfaction of the Departmental Representative that the construction equipment and plant are adequate to manufacture, transport, place and finish work to quality and production rates specified. If inadequate, replace or provide additional equipment or plant as directed.
- .2 Maintain construction equipment and plant in good operating order.

8.0 METRIC SIZED MATERIALS

- .1 SI metric units of measurement are used exclusively on the drawings and in the specifications for this project.
- .2 The Contractor is required to provide metric products in the sizes called for in the Contract Documents except where a valid claim can be made that a particular product is not available on the Canadian market.

- .3 Claims for exemptions from use of metric sized products shall be in writing and fully substantiated with supportive documentation. Promptly submit application to Departmental Representative for consideration and ruling. Non-metric sized products may not be used unless Contractor's application has been approved in writing by the Departmental Representative.
- .4 Difficulties caused by the Contractor's lack of planning and effort to obtain modular metric sized products which are available on the Canadian market will not be considered sufficient reasons for claiming that they cannot be provided.

9.0 SUBSTITUTION

- .1 No substitutions will be permitted without prior written approval of the Departmental Representative.
- .2 Proposals will be considered by Departmental Representative if:
 - .1 materials specified are not available.
 - .2 delivery date of materials specified would unduly delay completion of contract, or
 - .3 substitute material which are brought to the attention of and considered by Departmental Representative as equivalent to the material specified and will result in a credit to the Contract amount.
- 3. Should proposed substitution be accepted either in part or in whole, assume full responsibility and costs when substitution affects other work on project. Pay for design or drawing changes required as result of substitution.

END OF SECTION 01 60 00

1.0 CLEANUP

- .1 Maintain the working area in a clean and orderly manner as The Work progresses, and upon completion of construction, remove all waste materials, and all temporary facilities from the site.
- .2 Haul surplus or salvage materials that are the property of the Departmental Representative to the Departmental Representative's storage site.
- .3 Remove surplus or salvaged materials belonging to the Contractor from the site.
- .4 Clean haul routes and restore to pre-construction condition.
- .5 Remove grease, dust, dirt, stains, labels, finger prints and other foreign materials from sight on exposed finished surfaces, including glass and other polished surfaces.
- .6 Clean lighting reflectors, lenses and other lighting surfaces.
- .7 Broom clean paved surfaces, rake clean other surfaces of ground.
- .8 Remove debris and surplus materials from roof areas and accessible concealed spaces.

2.0 OPERATION MANUALS

- .1 Prepare operation and maintenance manuals and submit four copies to the Departmental Representative before the Completion Date including digital copy on a USB key.
- .2 Operation and maintenance manuals are specified in general in this section, with regard to numbers of binders, preparation, marking, general arrangement, format and general contents. Requirements for mechanical, process equipment, electrical work and other items may be specified in other sections of the specifications, however the general format shall be in accordance with this section.
- .3 Prepare sets of manuals for various divisions using identical bindings, and the same indexing system and format for all manuals.
- .4 Provide 8 ½ x 11 inch, commercial quality, 3-ring binders.
- .5 Letter each binder as follows:
 - .1 Front Face
 - .1 Full identification of title of project
 - .2 Departmental Representative full identification title
 - .3 CONTRACTOR full identification title
 - .4 Sub contractors full identification title
 - .2 Spine
 - .1 full identification of title of project
 - .2 copy number
- .6 Arrange each individual binder as follows, using coloured divider tabs which shall be laminated mylar plastic and which shall be coloured according to section of the manual.
 - .1 Each division of the manual i.e. mechanical, electrical, process equipment etc. shall be a complete manual and shall in general be in the following format with the divider tabs as noted:

- .2 Tab 1.0
 - .1 Title Page
 - .2 job name & Owner's name
 - .3 address, telephone number and complete name of:
 - .4 Departmental Representative
 - .5 General Contractor
 - .6 Subcontractor
 - .7 index of all divider tabs
- .3 Tab 1.1 List of drawings
- .4 Tab 1.2 Description of Systems
- .5 Tab 1.3 Operation of Systems
- .6 Tab 1.4 Maintenance & Lubrication
- .7 Tab 1.5 List of suppliers and addresses of same
- .8 Tab 2.0, 2.1 etc. Certifications
- .9 Tab 3.0, 3.1 etc. Manufacturers data, Shop drawings, Bulletins
- .7 Provide preventive maintenance program if specified in applicable sections.
- .8 Provide, in addition to mechanical and electrical equipment details:
 - .1 maintenance data for finished surfaces
 - .2 copies of all megger test results
 - .3 guarantees, warranties and bonds showing names and addresses of manufacturer and guarantee commencement and expiry date
 - .4 Electrical Safety Authority's Certificate of Final Acceptance.
 - .5 Certificates and inspection reports by the manufacturers and their representatives
- .9 Provide electronic format of OM manual

END OF SECTION 01 70 00

1.0 GENERAL

- .1 Conduct cleaning and disposal operations to comply with local ordinances and applicable laws.
- .2 Store volatile waste in covered metal containers and remove from premises at end of each working day.
- .3 Provide adequate ventilation during use of volatile or noxious substances. Use of building ventilation systems is not permitted for this purpose.
- .4 Prevent accumulation of waste which creates hazardous conditions.

2.0 MATERIALS

- .1 Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.

3.0 CLEANING DURING CONSTRUCTION

- .1 Provide on site containers for collection of waste materials, and debris.
- .2 Dispose of waste materials, and debris off site.
- .3 Schedule cleaning operations so that resulting dust, debris and other contaminants will not fall on wet, newly painted surfaces nor contaminate building systems.
- .4 Dust control is a critical factor of this contract. Dust can create hazardous conditions at the airport such as reduced visibility for control tower and aircraft, dust accumulation on aircraft movement areas, etc. The Contractor shall ensure that adequate dust control is provided at all times during the contract to avoid any hazardous situations and shall immediately implement any measures as directed by the Departmental Representative to control dust problems. Any damages or costs incurred as a result of excessive dust shall be paid for by the contractor.
- .5 Check continuously that no piece of concrete, gravel or any object has been dropped on a runway or taxiway by equipment during travelling to and from the site or during construction activities.
- .6 In the event of an open section of a runway, taxiway or apron fouled by truck spillage or debris, Contractor must
 - .1 Immediately notify the Departmental Representative that area is temporarily unserviceable.
 - .2 Without delay arrange for clean-up by Contractor's own personnel.
 - .3 Notify Departmental Representative when area is clear.
 - .4 In the event that due action is not carried out to ensure that area is made serviceable, then this will subject the Contractor to liquidated damages for every hour the runway or taxiway is unserviceable.
 - .5 Clean lighting reflectors, lenses and other lighting surfaces, as directed by the Departmental Representative.

4.0 FINAL CLEANING

- .1 Clean lighting reflectors, lenses, and other lighting surfaces to the satisfaction of the Departmental Representative.

- .2 Broom clean paved surfaces; rake clean other surfaces of grounds.

END OF SECTION 01 71 00

1.0 RECORD DRAWINGS

- .1 Maintain project record drawings and accurately record any deviations from contract documents.
- .2 On the Worksite set of Contract Documents, the Contractor shall record any changes that are made during the actual construction of The Work. The purpose of recording these changes is to provide drawings of record at the end of The Work. The Contractor shall be responsible for the adequacy and the reliability of the information recorded on the drawings of record.
- .3 Record changes in red. Mark one set of paper prints and at completion of project and prior to final inspection, neatly transfer notations to second set of drawings, label "As Built", sign and date both sets of drawings and submit both sets to Departmental Representative.
- .4 On completion of work, provide final survey and record the following information:
 - .1 Horizontal location, accurate to +/- 0.1 m, of new underground cables, services, new surface features and equipment referenced to permanent surface features, legal survey markers or control survey monuments. Locate changes in trench direction, and crossovers with other new or existing cable runs.
 - .2 On completion of Work, perform an "as-built" site survey to confirm final elevations and record the exact locations for all equipment installed under this contract. This as-built survey information shall include but shall not be limited to;
 - .1 Installation location and elevation of each elevated edge light (top of lens)
 - .2 Installed pull pit locations (center of pull pit)
 - .3 Offset from pavement edge for all airfield series lighting cabling installations
 - .4 Installation location and elevation of each PAPI light unit (center of lens).
 - .5 Installation location and elevation of each wind cone – (center of mast).
 - .6 Installation location and elevation of each illuminated guidance sign (near corner of sign box)
 - .7 As-built survey data to be accurate to within 1 cm
 - .8 Datum to be NAD 83.
 - .9 Make horizontal measurements immediately after backfilling trench.
 - .10 Field changes of dimension and detail.
 - .11 Changes made by Change Order or Field Order.
 - .3 If project is completed without significant deviations from contract documents, declare this in writing and submit to Departmental Representative in lieu of record drawings.

END OF SECTION 01 72 00

1.0 GENERAL

- .1 Specific requirements for maintenance materials, tools and spare parts are specified in Section 01 70 00.
- .2 Deliver maintenance materials, special tools and spare parts to Departmental Representative and store in designated area as directed by Departmental Representative.
- .3 Prepare lists of maintenance materials special tools and spare parts for inclusion in the Operations Manual.

2.0 MAINTENANCE MATERIALS

- .1 Deliver specified items packaged to prevent damage.
- .2 Identify, on carton or package, colour, room No., system or area as applicable where item is used.

3.0 SPECIAL TOOLS

- .1 Assemble special tools as specified.
- .2 Include following:
 - .1 Identification tag reference.
 - .2 Identification of equipment or system for which tools are applicable.
 - .3 Instruction on intended use of tool.
- .3 Identify special tools to indicate equipment or system for which tools are intended.

4.0 SPARE PARTS

- .1 Assemble spare parts as specified.
- .2 Include the following:
 - .1 Part number.
 - .2 Identification of equipment or system for which parts are applicable.
 - .3 Installation instructions as applicable.
 - .4 Name and address of nearest supplier.

END OF SECTION 01 73 10

1.0 GENERAL PROTECTION

- .1 Do not disrupt airport business except as permitted by the Departmental Representative.
- .2 Provide temporary protection for safe handling of public, personnel, pedestrians and vehicular traffic.
- .3 Provide barricades and lights where directed for the safe movement of aircraft and for the protection of the Contractor's workforce.
- .4 Refer to the Plan of Construction Operations appended to this document for additional details related to how construction will take place at the airport.

2.0 MOVEMENT OF EQUIPMENT AND PERSONNEL

- .1 In areas of airport not closed to aircraft traffic:
 - .1 Obtain the Departmental Representative's approval on scheduling of work. The Departmental Representative reserves the right to revise the work schedule as required by Airport Operations. Allow 24 hours' notice to get approval to work in these areas.
 - .2 Control movements of equipment and personnel as directed by the Departmental Representative and Airside Security Escorts.
 - .3 Signals from the Departmental Representative and Airside Security Escorts to be obeyed instantly.

3.0 OPERATIONAL RESTRICTIONS AND CONSTRAINTS

- .1 Comply with Operational, Safety and Security and other applicable requirements in the execution of the work and working in close proximity of live runways and taxiways, including but not limited to the following:
 - .1 The integrity of all electronic and visual navigational aids associated with live aviation activities on airside must be maintained for aircraft operations, which take precedence over construction operations.
 - .2 Buried power, communication and control cables and other underground structures and services in the vicinity of the construction areas are to be identified and protected.
 - .3 Emergency Rescue Services mobility must be preserved at all times. Operating routes must be reviewed by Departmental Representative on a bi-weekly basis to ensure that access is maintained at all times. Alternative and approved routes are to be established if new construction is anticipated to interfere with such access.

4.0 UNSERVICEABLE AREAS

- .1 The Contractor will be responsible for the supply, installation and maintenance and removal of all runway, taxiway and apron unserviceability barricades, closure markers, temporary daytime marker boards and unserviceability lighting as shown on the plans, described in the Plan of Construction Operations and as directed by the Departmental Representative.
- .2 Parking of equipment and stockpiling shall only be permitted within the Contractor's yard.
- .3 Equipment is to be stored in designated equipment storage areas or as directed by Departmental Representative.
- .4 Contractor is advised due to possibility of jet blast or any turbulence from aircraft, all markers must

be rigidly fixed and tied and delineators must be adequately weighed down with sand bags or bolted to pavement.

5.0 TRENCHING

- .1 On or adjacent to pavements open to aircraft traffic, obtain Departmental Representative's written permission to undertake trenching which cannot be completed, backfilled and sealed within one working day.

6.0 AIRPORT FACILITIES

- .1 The Departmental Representative will coordinate with security and the airport to allow the contractor to stake or inform the location of underground facilities such as cables, pipes and ducts. Notify the Departmental Representative of work areas sufficiently in advance of operations so that co-ordination can take place with security and the airport so underground facilities can be located by the contractor.

7.0 GENERAL PROVISIONS FOR AIRPORT ACTIVITIES

- .1 Refer to the Plan of Construction Operations and the Contract Documents for details related to construction at the airport.
- .2 Access to the site by the Contractor's vehicles and equipment shall be restricted to the secured entrances which will be detailed on the construction drawings. These access points will require security personnel at all times during active periods, which will be provided by the CONTRACTOR.
- .3 No construction related vehicles or traffic shall travel on paved surfaces which are not part of the project limits without authorized security escort services.
- .4 Construction equipment and stockpiled materials shall be restricted to construction areas or areas indicated by the Departmental Representative.
- .5 The Contractor shall designate one (1) person who will be responsible to ensure all aspects of security and operational safety requirements are adhered to and have authority to rectify the situation. Such a person shall be available at all times during construction and referred to as the "Contractor Safety Superintendent". The Departmental Representative shall be advised of this person at the Pre Construction Meeting. The "Contractor Safety Superintendent" shall be accompanied by an airport security escort at all times to provide radio contact with Air Traffic Control (ATC) and provide necessary escort services adjacent to and on active airside areas.
- .6 Construction Mobilization shall be closely co-ordinated with the Departmental Representative to ensure all airport safety precautions are implemented properly. Direction will be provided at the Pre Construction Meeting.
- .7 All airside areas, i.e. Runways, taxiways, aprons, etc., are considered NO SMOKING zones. The Contractor Safety Superintendent shall ensure all construction personnel are briefed and adhere to these restrictions.

8.0 DUST CONTROL, PAVEMENT CONDITIONS FOREIGN OBJECT DAMAGE (FOD) CONTROL

- .1 Dust control shall be achieved through the application of water within the project limits during periods of construction or as indicated by the Departmental Representative. Calcium chloride shall not be used anywhere within the project limits.
- .2 The Contractor shall ensure pavement surfaces abutting the project limits are kept clean and free of

loose debris at all times. This work shall be completed as indicated by the Departmental Representative.

- .3 For reference, the following outlines the current "FOD" Foreign Object Damage Prevention Program in place at the Airport:

Applications: All construction sites.

Guidelines:

1. The contractor is responsible to ensure that each contractor on site is responsible for all debris caused by their forces and must clean up the job site on a continuous basis and must maintain the site in good order.
2. Any materials likely to be wind swept must be tied down or made secure.
3. All food stuff waste must not be scattered about the site and must be placed in a closed container if outside the site trailers. (This will not only limit wind swept debris but will also provide some wildlife (bird) control Measures.)
4. All materials stored on site must be kept in an orderly fashion while not in use.
5. The general contractor must take immediate action if materials are wind swept from the site location to prevent possible aircraft accident or damage.
6. All the above precautions must be followed to minimize the possibility of aircraft accident or damage. Failure to follow the above precautions may result in closing of work site until FOD materials are cleaned up. If the contractor does not remedy the problem immediately, other forces may be retained to remedy the problem at the contractor's expense.
7. These guidelines are established with reference to Section 49 of the Airport Traffic Regulations, Department of Transport Act.
8. Should the Contractor fail to control dust and debris (FOD), the Departmental Representative reserves the right to order the Contractor to cease all operations until adequate measures have been taken. No claims for delay of contract can be made by the Contractor on this item.

END OF SECTION 01 80 00

1.0 GENERAL

1.1 RELATED WORK

- .1 Section 03 20 00 - Concrete Reinforcement.
- .2 Section 03 30 00 - Cast-in-Place Concrete.
- .3 Div 16 related airfield works

1.2 REFERENCES

- .1 CSA A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
- .2 CSA O86S1, Supplement #1 to CAN/CSA-O86-01, Engineering Design in Wood.
- .3 CSA O121, Douglas Fir Plywood.
- .4 CSA O151, Canadian Softwood Plywood.
- .5 CSA O153, Poplar Plywood.
- .6 CAN3 O188.0, Standard Test Methods for Mat-Formed Wood Particleboard and Waferboard.
- .7 CSA S269.1, Falsework for Construction Purposes.
- .8 CAN/CSA S269.3, Concrete Formwork, National Standard of Canada.
- .9 CAN/ULC S701, Standard for Thermal Insulation, Polystyrene, Boards, and Pipe Covering.

1.3 SHOP DRAWINGS

- .1 The Contractor shall be responsible for the following:
 - .1 Submit shop drawings for formwork and falsework in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Indicate method and schedule of construction, shoring, stripping and re-shoring procedures, materials, arrangement of joints, special architectural exposed finishes, ties, liners, and locations of temporary embedded parts. Comply with CSA S269.1 for falsework drawings and CAN/CSA S269.3 for formwork drawings.
 - .3 Indicate sequence of erection and removal of formwork/falsework as directed by the Departmental Representative.
 - .4 Each shop drawing submission shall bear stamp and signature of qualified professional engineer registered or licensed in Province of Manitoba, Canada.
 - .5 When slip forming are used, submit details of equipment and procedures for review by the Departmental Representative.

2.0 PRODUCTS

2.1 MATERIALS

- .1 The Contractor shall provide materials to the following requirements:
 - .1 Formwork materials:
 - .1 Plywood and wood formwork materials to CSA O121.
 - .2 For concrete with special architectural features, use formwork materials to CSA-A23.1/A23.2.

- .2 Form ties: Removable or snap-off metal ties, fixed or adjustable length, free of devices leaving holes larger than 25 mm dia. in concrete surface.
- .3 Form liner:
 - .1 Plywood: Douglas Fir to CSA O121 square edge, 19 mm thick.
 - .2 Waferboard: to CAN3 O188.0, 19 mm thick.
- .4 Tubular column forms: round, spirally wound laminated fibre forms internally treated with release material.
- .5 Form release agent: non-toxic, biodegradable, low VOC active release agents containing compounds that react with free lime in concrete to provide water insoluble soaps, preventing concrete from sticking to forms.
- .6 Form stripping agent: colorless mineral oil, non-toxic, biodegradable, low VOC, free of kerosene, with viscosity between 70 and 110 s Saybolt Universal 15 to 24 mm²/s at 40°C, flashpoint minimum 150°C, open cup.
- .7 Falsework materials: to CSA S269.1.

3.0 EXECUTION

3.1 FABRICATION AND ERECTION

- .1 The Contractor shall be responsible for the following:
 - .1 Verify lines, levels and centers before proceeding with formwork/falsework and ensure dimensions agree with drawings.
 - .2 Fabricate and erect falsework in accordance with CSA S269.1.
 - .3 Fabricate and erect formwork in accordance with CAN/CSA-S269.3 to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CSA-A23.1/A23.2.
 - .4 Align form joints and make watertight. Keep form joints to a minimum.
 - .5 Use 25 mm chamfer strips on external corners of concrete members, joints, unless specified otherwise.
 - .6 Form chases, slots, openings, drips, recesses, expansion and control joints as indicated.
 - .7 Construct forms for architectural concrete, and place ties as indicated and as directed.
 - .8 Joint pattern not necessarily based on using standard size panels or maximum permissible spacing of ties.
 - .9 Build in anchors, sleeves, and other inserts required to accommodate Work specified in other sections.
 - .1 Ensure that anchors and inserts will not protrude beyond surfaces designated to receive applied finishes, including painting.
 - .10 When slip forming and flying forms are used, submit details as indicated in PART 1 - SUBMITTALS.
 - .11 Line forms for exterior exposed surfaces such as bridges and girders.
 - .12 Clean formwork in accordance with CSA A23.1/A23.2, before placing concrete.

3.2 REMOVAL AND RESHORING

- .1 The Contractor shall be responsible for the following:
 - .1 Leave formwork in place for a minimum of 3 days after placing concrete; longer if

concrete has not reached 70% of its specified strength.

- .2 Provide necessary reshoring of members where early removal of forms may be required or where members may be subjected to additional loads during construction as required.
- .3 Re-use formwork and falsework subject to requirements of CSA-A23.1/A23.2.

END OF SECTION 03 10 00

1.0 GENERAL

1.1 RELATED WORK

- .1 Section 03 10 00 - Concrete Forms and Accessories.
- .2 Section 03 30 00 - Cast-in-Place Concrete.
- .3 Div 16 related airfield works

1.2 REFERENCES

- .1 ACI 315, American Concrete Institute, Details and Detailing of Concrete Reinforcement.
- .2 ACI 315R, American Concrete Institute, Manual of Engineering and Placing Drawings for Reinforced Concrete Structures.
- .3 ASTM A775/A775M, Standard Specification for Epoxy-Coated Steel Reinforcing Bars.
- .4 CSA A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
- .5 CSA A23.3, Design of Concrete Structures.
- .6 CSA G30.5, Welded Steel Wire Fabric for Concrete Reinforcement.
- .7 CAN/CSA G30.18, Billet-Steel Bars for Concrete Reinforcement.
- .8 CSA G40.2/G40.21, General Requirements for Rolled or Welded Structural Quality Steel/ Structural Quality Steel
- .9 CAN/CSA G164, Hot Dip Galvanizing of Irregularly Shaped Articles, A National Standard of Canada.
- .10 CSA W186, Welding of Reinforcing Bars in Reinforced Concrete Construction.

1.3 SHOP DRAWINGS

- .1 The Contractor shall be responsible for the following:
 - .1 Submit shop drawings including placing of reinforcement in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Prepare reinforcing drawings in accordance with ACI 315.
 - .3 Submit shop drawings including placing of reinforcement and indicate:
 - .1 Bar bending details.
 - .2 Lists.
 - .3 Quantities of reinforcement.
 - .4 Sizes, spacings, locations of reinforcement and mechanical splices if approved by the Departmental Representative with identifying code marks to permit correct placement without reference to structural drawings.

2.0 PRODUCTS

2.1 MATERIALS

- .1 Contractor shall provide materials to the following requirements:

- .1 Reinforcing steel: billet steel, grade 400, deformed bars to CAN/CSA G30.18, unless indicated otherwise.
- .2 Welded steel wire fabric: to CSA G30.5. Provide in flat sheet only.
- .3 Chairs, bolsters, bar supports, spacers: to CSA-A23.1.
- .4 Cold-drawn annealed steel wire ties: to CSA G30.3.
- .5 Substitute different size bars only if permitted in writing by the Departmental Representative.
- .6 Epoxy Coating of non-prestressed reinforcement: to ASTM A775/A775M.
- .7 Galvanizing of non-prestressed reinforcement: to CAN/CSA G164, minimum zinc coating 610 g/m².
 - .1 Protect galvanized reinforcing steel with chromate treatment to prevent reaction with Portland cement paste.
 - .2 If chromate treatment is carried out immediately after galvanizing, soak steel in aqueous solution containing minimum 0.2% by weight sodium dichromate or 0.2% chromic acid.
 - .1 Temperature of solution equal to or greater than 32 degrees and galvanized steels immersed for minimum 20 seconds.
 - .3 If galvanized steels are at ambient temperature, add sulphuric acid as bonding agent at concentration of 0.5% to 1%.
 - .1 In this case, no restriction applies to temperature of solution.
 - .4 Chromate solution sold for this purpose may replace solution described above, provided it is of equivalent effectiveness.
 - .1 Provide product description as described in PART 1 - SUBMITTALS.

2.2 FABRICATION

- .1 The Contractor shall be responsible for the following:
 - .1 Fabricate reinforcing steel in accordance with CSA-A23.1/A23.2, and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Ontario.
 - .2 Welded steel wire fabric: to CSA G30.5. Provide in flat sheets only.
 - .3 Obtain the Departmental Representative's approval for locations of reinforcement splices other than those shown on placing drawings.
 - .4 Upon approval of the Departmental Representative, weld reinforcement in accordance with CSA W186.
 - .5 Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and lists.

2.3 SOURCE QUALITY CONTROL

- .1 The Contractor shall be responsible for the following:
 - .1 Ship epoxy coated bars in accordance with ASTM A775A/A775M. Provide the Departmental Representative with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis, minimum 4 weeks prior to commencing reinforcing Work.
 - .2 Upon request inform the Departmental Representative of proposed source of material to be supplied.

3.0 EXECUTION

3.1 PREPARATION

- .1 The Contractor shall be responsible for the following:
 - .1 Do not field bend or field weld reinforcement except where indicated or authorized by the Departmental Representative.
 - .2 When field bending is authorized, bend without heat, applying a slow and steady pressure.
 - .3 Replace bars which develop cracks or splits.

3.2 PLACING REINFORCEMENT

- .1 The Contractor shall be responsible for the following:
 - .1 Place reinforcing steel as indicated on reviewed placing drawings and in accordance with CSA-A23.1/A23.2. Ensure that all mismatched concrete panels are reinforced as shown.
 - .2 Use plain round bars as slip dowel in concrete.
 - .3 Prior to placing concrete, obtain the Departmental Representative's approval of reinforcing material and placement.
 - .4 Ensure cover to reinforcement is maintained during concrete pour.
 - .5 Protect epoxy coated bars with covering during transportation and handling.

3.3 FIELD TOUCH-UP

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

END OF SECTION 03 20 00

1.0 GENERAL

1.1 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 40 00 – Quality Control
- .3 Section 03 10 00 - Concrete Forms and Accessories.
- .4 Section 03 20 00 - Concrete Reinforcement.
- .5 Section 31 05 17 - Aggregates: General.

1.2 MEASUREMENT PROCEDURES

- .1 Plain concrete haunching will not be measured, but considered incidental to Work.
- .2 Reinforced concrete bases approach lighting footings if required will be measured in unit of each complete with excavation, dewatering, granular base foundation, concrete forming and reinforcement, cast-in-place conduits, anchor bolts, backfill and compaction.
- .3 Reinforced concrete bases for PAPI, wind cone footings, illuminated guidance signs and other structures will not be measured, but considered incidental to Work.
- .4 Grout and cap existing pipe will not be measured, but considered incidental to Work.
- .5 Supply and installation of anchor bolts, nuts, washers, and grouting will not be measured, but considered incidental to Work.
- .6 All other concrete Work is incidental to the Work in which it is incorporated and considered to be part of the Work.

1.3 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM C 150, Standard Specification for Portland Cement.
 - .2 ASTM C 260, Standard Specification for Air-Entraining Admixtures for Concrete.
 - .3 ASTM C 309, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
 - .4 ASTM C 494, Standard Specification for Chemical Admixtures for Concrete.
 - .5 ASTM C 1017, Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
 - .6 ASTM C1202, Standard Test Method for Electrical Indication of Concrete's Ability to Resist Chloride Ion Penetration.
 - .7 ASTM D 412, Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension.
 - .8 ASTM D 624, Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers.
 - .9 ASTM D 1751, Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
 - .10 ASTM D 1752, Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.

- .11 ASTM D 3405, Standard Specification for Joint Sealants, Hot-Applied, for Concrete and Asphalt Pavements.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-37.2, Emulsified Asphalt, Mineral Colloid-Type, Unfilled, for Damp proofing and Waterproofing and for Roof Coatings.
 - .2 CAN/CGSB-51.34, Vapour Barrier, Polyethylene Sheet for Use in Building Construction.
- .3 Canadian Standards Association (CSA International)
 - .1 CSA A23.1-14/A23.2-14, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
 - .2 CAN3-A266.1, Air-Entraining Admixtures for Concrete.
 - .3 CAN3-A266.2, Chemical Admixtures for Concrete.
 - .4 CSA A283-06 (R2016), Qualification Code for Concrete Testing Laboratories.
 - .5 CSA A3000-18, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
 - .1 CSA A3001, Cementitious Materials for Use in Concrete.

1.4 ACRONYMS AND TYPES

- .1 Refer to CSA A3001 for complete list of Definitions. Cement: hydraulic cement, blended hydraulic cement or limestone cement (XXb - where b denotes blended, and XXL - where L denotes limestone cement).
 - .1 Type GU, GUb or GUL - General use cement (ASTM Type I).
 - .2 Type MS or MSb - Moderate sulphate-resistant cement (ASTM Type II).
 - .3 Type MH, MHb or MHL - Moderate heat of hydration cement (ASTM Type II).
 - .4 Type HE, HEb or HEL - High early-strength cement (ASTM Type III).
 - .5 Type LH, LHb or LHL - Low heat of hydration cement (ASTM Type IV).
 - .6 Type HS or HSb - High sulphate-resistant cement (ASTM Type V).
- .2 Fly ash:
 - .1 Type F - with CaO content less than 8%.
 - .2 Type CI - with CaO content ranging from 8 to 20%.
 - .3 Type CH - with CaO greater than 20%.
- .3 GGBFS - Ground, granulated blast-furnace slag.

1.5 DESIGN REQUIREMENTS

- .1 Alternative 1 - Performance: in accordance with CSA-A23.1/A23.2, and as described in MIXES of 2.0 - PRODUCTS.

1.6 SUBMITTALS

- .1 The Contractor shall be responsible for the following:
 - .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 At least 2 weeks prior to beginning Work, submit to the Departmental Representative

samples of following materials proposed for use:

- .1 2 L of curing compound.
- .2 1 m length of each type of joint filler.
- .3 Type and chemical composition of each type of supplementary cementing material.
- .4 Type and chemical composition of each type of blended hydraulic cement.
- .5 Type and chemical composition of each admixture.
- .6 Source of aggregates gradation and test results that aggregates meet the requirements of durable concrete.

1.7 CERTIFICATES

- .1 Minimum 2 weeks prior to starting concrete Work, the Contractor shall submit manufacturer's test data and certification to the Engineer by qualified independent inspection and testing laboratory that following materials will meet specified requirements:
 - .1 Portland cement.
 - .2 Grout.
 - .3 Admixtures.
 - .4 Aggregates.
 - .5 Water.
 - .6 Joint filler.
- .2 The Contractor shall provide certification that plant, equipment and materials to be used in concrete comply with requirements of CSA A23.1/A23.2, and ready mixed concrete plants supplying concrete to the project shall submit a currently valid "Certificate of Ready Mixed Concrete Production Facilities" certificate from the Atlantic Provinces Ready Mixed Concrete Association.
- .3 The Contractor shall demonstrate no alkali aggregate reactivity exist in accordance with CSA A23.2-25A for Detection of Alkali-Silica Reactive Aggregate and CSA A23.2-27A for Identifying Degree of Alkali-Reactivity of Aggregates.

1.8 QUALITY ASSURANCE

- .1 The Contractor shall be responsible for the following:
 - .1 Quality Control and Assurance: in accordance with Section 01 40 00 - Quality Control.
 - .2 Ensure site supervisor, Departmental Representative, specialty contractor - finishing, forming and testing laboratories attend.
 - .3 Verify project requirements.
 - .4 Submit to the Departmental Representative minimum 4 weeks prior to starting concrete work, valid and recognized certificate from certified plant delivering concrete.
 - .5 Minimum 4 weeks prior to starting concrete work, submit proposed quality control procedures for review by the Departmental Representative on following items:
 - .1 Falsework erection.
 - .2 Hot weather concrete.
 - .3 Cold weather concrete.
 - .4 Curing.

- .5 Finishes.
- .6 Formwork removal.
- .7 Joints.
- .8 Waterproofing/damp proofing.
- .2 Quality Control Plan: Contractor shall submit written report, as described in 3.0 VERIFICATION, to the Departmental Representative verifying compliance that concrete in place meets performance requirements of concrete as established in 2.0 PRODUCTS.
- .3 Health and Safety Requirements: Contractor shall undertake construction occupational health and safety in accordance with Section 01 54 50 – Safety Requirements and applicable regulations.

1.9 DELIVERY, STORAGE AND HANDLING

- .1 The Contractor shall be responsible for the following:
 - .1 Concrete hauling time: maximum allowable time for concrete to be delivered to site of Work and discharged not to exceed 120 minutes after batching.
 - .1 Any increase to the maximum 120-minute hauling time limit must be requested in advance by the Contractor and must be agreed to by both the Departmental Representative and the concrete producer as described in CSA A23.1/A23.2 in writing.
 - .2 Any deviations to these delivery, storing and handling requirements must be formally requested by the Contractor for review by the Departmental Representative.
 - .2 Concrete delivery: ensure continuous concrete delivery from plant meets CSA A23.1/A23.2.
 - .3 Contractor shall ensure that the following Waste Management and Disposal practices are followed:
 - .1 Separate waste materials for recycling.
 - .2 Dispose unused concrete materials, admixtures and additive materials (pigments, fibres) off airport property.
 - .3 Unused admixtures and additive materials must not be disposed of into sewer systems, into lakes, streams, onto ground or in other location where it will pose health or environmental hazard.
 - .4 Prevent admixtures and additive materials from entering drinking water supplies or streams. Using appropriate safety precautions, collect liquid or solidify liquid with inert, noncombustible material and remove for disposal. Dispose of waste in accordance with applicable local, Provincial and National regulations.

2.0 PRODUCTS

2.1 SUSTAINABLE REQUIREMENTS

- .1 The Contractor shall use new materials for all new installations as indicated on the drawings and in the specifications. Removed aggregates that meet specifications for surface restorations can be used.
- .2 The Contractor shall use the least toxic sealants, fillers, compounds, adhesives, sealers and finishes necessary to comply with the requirements of the project.

2.2 MATERIALS

- .1 Materials provided by Contractor to the following requirements:

- .1 Cement: to CSA-A3001, Type GU.
- .2 Supplementary cementing materials: maximum 25% by mass of total cementitious materials (GGBFS and/or fly ash) to CSA-A3001.
- .3 Water: to CSA-A23.1.
- .4 Aggregates: to CSA-A23.1/A23.2 and ASTM C 330.
- .5 Admixtures:
 - .1 Air entraining admixture: to ASTM C 260.
 - .2 Chemical admixture: to ASTM C 494, ASTM C 1017, and CAN3-A266.2. The Engineer to approve accelerating or set retarding admixtures during cold and hot weather placing.
- .6 Shrinkage compensating grout: premixed compound consisting of non-metallic aggregate, Portland cement, water reducing and plasticizing agents to CSA-A23.1/A23.2.
 - .1 Compressive strength: minimum 35 MPa at 28 days.
 - .2 Net shrinkage at 28 days: maximum 0.5 %.
- .7 Grout filler for abandoned utilities: mixture consisting of one part Portland cement, three parts sand and water.
 - .1 Compressive strength: 5 MPa at 28 days.
- .8 Premoulded joint fillers:
 - .1 Bituminous impregnated fiber board: to ASTM D 1751.
 - .2 Sponge rubber: to ASTM D 1752, Type I, flexible grade.
 - .3 Standard cork: to ASTM D 1752, Type II.
- .9 Weep hole tubes: plastic as indicated.
- .10 Polyethylene film: 0.75 mm thickness to CAN/CGSB-51.34.

2.3 MIXES

- .1 The Contractor shall be responsible for the following mix requirements:
 - .1 Mix to comply with Alternative 1 - Performance Method for specifying concrete: to meet the Departmental Representative performance criteria in accordance with CSA-A23.1/A23.2.
 - .1 Ensure concrete supplier meets performance criteria as established below and provide verification of compliance as described in PART 3 - VERIFICATION.
 - .2 Provide concrete uniform mixes:
 - .1 Free of surface blemishes and segregation.
 - .3 Provide concrete mix to meet following hard state requirements:
 - .1 Durability and class of exposure: C-1 as appropriate.
 - .2 Minimum compressive strength at 28 days to: 25MPa unless otherwise indicated on the drawings.
 - .3 Nominal maximum size of coarse aggregate 28-5: CSA-A23.1, table 11.
 - .4 Slump at point of discharge shall be: 75mm +/- 25mm
 - .5 Surface texture: non-skid finish.
 - .6 Pre-Qualification: Contractor shall arrange for all Suppliers to submit manufacturer's test data and certification to the Departmental Representative indicating that the selected materials meet requirements of this section prior to commencing concrete work.
 - .4 Provide quality management plan to ensure verification of concrete quality to

specified performance.

- .5 Furnish a copy of the concrete supplier's certification.
- .6 Contractor shall arrange for the submission of mix designs and test results by a CSA Certified Category I Laboratory to confirm that durability and other performance requirements can be achieved in the field.

3.0 EXECUTION

3.1 PREPARATION

- .1 The Contractor shall be responsible for the following:
 - .1 Obtain the Departmental Representative's approval before placing concrete.
 - .1 Provide 24 hours' notice prior to placing of concrete.
 - .2 Place concrete reinforcing in accordance with Section 03 20 00 - Concrete Reinforcement.
 - .3 During concreting operations:
 - .1 Development of cold joints not allowed.
 - .2 Ensure concrete delivery and handling facilitates placing with minimum of re-handling, and without damage to existing structure or Work.
 - .4 Pumping of concrete is permitted only after approval of equipment and mix.
 - .5 Ensure reinforcement and inserts are not disturbed during concrete placement.
 - .6 Prior to placing of concrete obtain the Departmental Representative's approval of proposed method for protection of concrete during placing and curing in adverse weather conditions.
 - .7 Protect previous Work from staining.
 - .8 Clean and remove stains prior to application for concrete finishes.
 - .9 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature, concrete temperature, test samples taken and field test results (slump and air content).
 - .10 In locations where new concrete is dowelled to existing work, drill holes in existing concrete.
 - .1 Place steel dowels and/or tie bars and pack solidly with shrinkage compensating grout or epoxy grout to anchor and hold dowels in positions as indicated.
 - .11 Do not place load upon new concrete until authorized by the Departmental Representative.
 - .12 Do formwork in accordance with Section 03 10 00 – Concrete Forming and Accessories.

3.2 CONSTRUCTION

- .1 The Contractor shall be responsible for the following:
 - .1 Do cast-in-place concrete work in accordance with CSA-A23.1/A23.2.
 - .2 Sleeves and inserts:
 - .1 Do not permit penetrations, sleeves, ducts, pipes or other openings, except where indicated or approved by the Departmental Representative.
 - .2 Where approved by the Engineer set sleeves, ties, pipe hangers and other inserts and openings as indicated or specified elsewhere.

- .3 Sleeves and openings greater than 100 x 100 mm not indicated, must be reviewed by the Engineer.
- .4 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain approval of modifications from the Departmental Representative before placing of concrete.
- .5 Check locations and sizes of sleeves and openings shown on drawings.
- .6 Set special inserts for strength testing as indicated and as required by non-destructive method of testing concrete.
- .3 Anchor bolts:
 - .1 Set anchor bolts to templates under supervision of appropriate trade prior to placing concrete.
 - .2 With approval of the Departmental Representative, grout anchor bolts in preformed holes or holes drilled after concrete has set. Drilled holes to be minimum 25 mm larger in diameter than bolts used and to manufacturers' recommendations.
 - .3 Protect anchor bolt holes from water accumulations, snow and ice build-ups.
 - .4 Set bolts and fill holes with shrinkage compensating grout or epoxy grout.
 - .5 Locate anchor bolts used in connection with expansion shoes, rollers and rockers with due regard to ambient temperature at time of erection.
- .4 Finishing and curing:
 - .1 Finish concrete in accordance with CSA-A23.1/A23.2 by trowelling exterior surfaces.
 - .2 Rub exposed sharp edges of concrete with carborundum to produce 3 mm radius edges unless otherwise indicated.
 - .3 Use procedures as reviewed by the Departmental Representative to remove excess bleed water. Ensure surface is not damaged.
 - .4 Use curing compounds compatible with applied finish on concrete surfaces. Provide written declaration that compounds used are compatible. Otherwise, remove curing compound by shot blasting or high-pressure water where paint is to be applied.
- .5 Grouting of steel casing under existing runway and taxiway:
 - .1 Prepare steel casing for grouting after establishment, with the Departmental Representative, the extent of the Work.
 - .2 Ensure grout selected to be of low heat of hydration and compatible with ducts to be used and that it will not cause any deterioration of said ducts.
 - .3 Ensure suitable staging of grout process to ensure filling of steel casing.
 - .4 Pump grout inside the steel casing from one end of the casing. Ensure the quantity of grout is adequate to fill all voids in steel casing.
 - .5 Ensure integrity of fiberglass epoxy ducts in steel casing is maintained during grouting process.
- .6 Joint fillers:
 - .1 Furnish filler for each joint in single piece for depth and width required for joint, unless otherwise authorized by the Departmental Representative.
 - .2 When more than one piece is required for joint, fasten abutting ends and hold securely to shape by stapling or other positive fastening.
 - .3 Locate and form isolation, construction, and expansion joints as indicated.
 - .4 Install 12 mm thick joint filler unless otherwise shown or directed.

3.3 SURFACE TOLERANCE

- .1 Contractor to ensure that concrete tolerance is in accordance with CSA-A23.1/A23.2 straightedge method.

3.4 FIELD QUALITY CONTROL

- .1 The Contractor shall be responsible for the following:
 - .1 Site tests: conduct following test in accordance with Section 01 40 00 - Quality Control Submit report as described in PART 1 - SUBMITTALS.
 - .1 Concrete pours, dates and location.
 - .2 Slump tests.
 - .3 Air content.
 - .4 Temperature.
 - .5 Concrete cylinders/specimens taken.
 - .2 Perform ASTM C1202, Standard Test Method for Electrical Indication of Concrete's Ability to Resist Chloride Ion Penetration, for concrete use in bridges, storage tanks and parking garages.
 - .3 Inspection and testing of concrete and concrete materials in accordance with CSA-A23.1/A23.2.
 - .4 Three concrete test cylinders and one slump test shall be taken for every 100.0 m³ of each of class of concrete placed; or for each day of concrete placement if the latter is less than 100.0 m³. Testing shall be performed in accordance with CSA-A23.2 (Latest Edition)
 - .5 Ensure testing laboratory is certified in accordance with CSA A283.
 - .6 Ensure test results are distributed for discussion at project meetings.
 - .7 Non-Destructive Methods for Testing Concrete: in accordance with CSA-A23.1/A23.2.
 - .8 Inspection or testing by the Departmental Representative will not augment or replace Contractor quality control nor relieve Contractor of his contractual responsibility.

3.5 VERIFICATION

- .1 Quality Control Plan: The Contractor shall ensure concrete supplier meets performance criteria as specified and provide verification of compliance as described herein.

END OF SECTION 03 30 00

1.0 GENERAL

1.1 GENERAL

- .1 This Section covers items common to Sections of Division 16 and all other applicable specified works.
- .2 Refer the Plan of Construction Operations included with the Construction Tender for additional details related to the project scheduling.

1.3 CODES AND STANDARDS

- .1 Execute the complete installation in accordance with the following codes and standards, current editions. This list may not be fully inclusive. The installation shall be done in accordance with all applicable codes and standards in the Province of Manitoba to the satisfaction of the local Electrical Authority and Inspection Departments having jurisdiction. The Contractor shall inform the Departmental Representative immediately of any discrepancies between the Contract Documents and any code enforced in the local jurisdiction.
 - .1 Latest edition of CSA C22.1, the Canadian Electrical Code, territorial electrical code and all supplemental or superseding electrical codes in the Province of Manitoba, including all active bulletins.
 - .2 Transport Canada - TP312E, Aerodrome Standards and Recommended Practices, 5th Ed.
 - .3 National Building Code and all applicable Municipal and Territorial Codes and regulations.
 - .4 Latest edition of CSA C22.3 No.1. for underground systems
 - .5 CSA C22.2 No.179-[09(R2014)], Airport Series Lighting Cables.
 - .6 CSA C22.2 No.180-[13] , Series Isolating Transformers for Airport Lighting.
 - .7 CSA C22.2 No.198.2-[M1986] – Underground Cable Splicing Kits.
 - .8 CAN3-C235-83.- Operating Voltages
 - .9 The lighting shall be installed in accordance with IES Lighting Handbook 2011 (10th Ed.);
- .2 In all cases of conflict / discrepancy, the more stringent requirements shall apply.
- .3 All electrical work shall be completed to the satisfaction of the local electrical safety authority.

1.4 PERMITS, FEES AND INSPECTION

- .1 Obtain all permits required for the execution and inspection of the electrical work as required in the local jurisdiction.
- .2 Submit a Certificate of Final Acceptance from the local Electrical Safety Authority Inspection Department on completion of the Work.

1.5 PRE-CONSTRUCTION SITE INVESTIGATION

- .1 Prior to the start of any excavation, perform a complete site investigation to accurately determine the exact locations of all existing buried cables, wiring and ducts which could be affected or disturbed during the work.

- .2 Mark locations of existing buried cables, wiring and ducts on site and transfer locations to record drawings.
- .3 Prior to construction, conduct a detailed condition survey of every electrical system and component within the project limits that is not to be impacted by construction and identify / record any equipment that is cracked, broken, deficient or not working. Any subsequent equipment damage that may occur after this inspection shall be repaired or the equipment replaced at the Contractor's expense and at no cost to the Departmental Representative.

1.6 WORK SCHEDULING AND PHASING

- .1 All existing buried cables/utilities which could be damaged by any construction operation (i.e. trenching, grading, excavating, etc.) must be accurately located and marked on site by the Contractor prior to construction. Ensure markers placed do not damage cables/utilities. Replace any markers that become lost or obscured during and throughout construction. Record all cable/utility locations c/w dimensions to permanent physical site conditions on a set of project record drawings. Include sufficient allowance in tendered price to hand excavate or hydro vac over or near existing buried cables where necessary to install the new cables/utilities. Locate and mark all existing circuits within construction zone.
- .2 Schedule and plan the work in a way that minimizes disruption to all existing circuits which are present in the construction area.
- .3 Confirm with Departmental Representative and gain approval regarding any existing wiring thought to be obsolete and proposed for removal / disruption.
- .4 Obtain Departmental Representative approval for de-energization of all existing electrical circuits prior to de-activation. Lock out circuits as required by Electrical Code and Departmental Representative/ jurisdictional procedures. Lock out circuits in all cases.
- .5 All final connections and testing are to be performed only during daylight hours and in VFR conditions.
- .6 Where work involves breaking into or connecting to existing services, carry out work at times directed by Departmental Representative with minimum disturbance to airport operations.
- .7 Submit schedule to and obtain approval from Departmental Representative for any shut-down or closure of active service or facility. Adhere to approved schedule and provide notice to affected parties.
- .8 Schedule the work in accordance with the project milestone dates.
- .9 Schedule Constraints:
 - .1 Submit a detailed work plan describing the proposed approach, schedule and proposed project implementation details. This plan shall adhere to the constraints detailed in the construction sequencing drawings and Plan of Construction Operations (PCO).and is to be reviewed and approved by the Departmental Representative.
 - .2 The Contractor shall obtain approval from the Departmental Representative for any work within the critical area of any active airfield surface.
 - .3 In accordance with the plan of construction operations (PCO), the Contractor shall be required to be able to remove all men, equipment and loose material from the critical area as necessary as detailed in the PCO. Inform Departmental Representative of any issues adhering to this requirement.

1.7 SURVEYING AND LAYOUT OF THE WORK

- .1 The Contractor shall be responsible for survey layout for the work in accordance with the Contract Drawings.
- .2 The Contractor shall be responsible for verification of the accuracy of the electrical base plans prior to construction and shall confirm the BM table data elevations and if there is any discrepancy immediately bring to the attention of the departmental representative.
- .3 The positioning of all airfield lighting equipment shall be determined using the Contract drawings and CAD files supplied prior to construction. Coordinates are to be determined for critical items such as light fixture locations however the drawings shall be used for locations of many of the materials. Dimensions shown on the drawing details shall supersede layout drawing locations and coordinates provided shall supersede the layout drawings and detail drawings. The Contractor is to request clarification from the Departmental Representative if any information pertaining to the exact location of an object is not apparent to them on the Drawings or provided coordinates. The Contractor is to submit a list of coordinates to the Departmental Representative for review and approval prior to layout in the field. Do not scale from symbols on the Drawings since they may be shown diagrammatically for clarity.
- .4 Consult the Departmental Representative and gain approval of layout locations onsite prior to construction layout. Do not scale or obtain co-ordinates from symbols in the CAD file without consultation with the Departmental Representative and subsequent confirmation that the coordinates represent the correct locations.
- .5 Confirm trench and pull pit locations onsite and with Departmental Representative prior to excavations.
- .6 On completion of Work, perform an “as-built” site survey to confirm final elevations and record the exact locations for all equipment installed under this contract. This as-built survey information shall include but shall not be limited to;
 - .1 Installation location and elevation of each elevated edge light (top of lens)
 - .2 Installed pull pit locations (center of pull pit)
 - .3 Offset from Runway and Taxiway centerlines for all airfield series lighting cabling installations
 - .4 Installation location and elevation of each PAPI light unit (center of lens).
 - .5 Installation location and elevation of each wind cone – (center of mast).
 - .6 Installation location and elevation of each RTIL fixture (center of fixture)
 - .7 Installation location of RTIL mini power center
 - .8 Installation location and elevation of each illuminated guidance sign (near corner of sign box)
 - .9 As-built survey data to be accurate to within 1cm
 - .10 Datum to be NAD83
- .7 Provide confirming survey data in AutoCAD format at conclusion of work to Departmental Representative.
- .8 Contractor to remedy errors in location, alignment and elevation as directed by the Departmental Representative.

1.9 ELECTRONIC LICENSE AGREEMENT

- .1 Prior to the distribution of electronic drawing files in AutoCAD format for the purposes of Contractor layout, the Contractor shall enter into an agreement with the Departmental Representative regarding the use of such electronic drawing files.

1.10 EXISTING CABLES AND SERVICES

- .1 This project involves work in areas with existing buried cables and services.
- .2 Before commencing work, establish location and clearly mark existing underground cables and services in area of excavation:
 - .1 Use an electronic cable detector.
 - .2 Notify applicable utilities to locate their respective cables and services.
 - .3 Locate Airport owned cables and services. Departmental Representative may provide site drawings indicating known underground cables and services; however, no guarantee of their accuracy or completeness is given.
- .3 Where work involves breaking into or connecting to existing services, carry out work at times directed by Departmental Representative with minimum disturbance to airport operations.
- .4 Submit schedule to and obtain approval from Departmental Representative for any shut-down or closure of active service or facility. Adhere to approved schedule and provide notice to affected parties.
- .5 Verify locations of existing service lines by hydraulic vacuum excavation or careful hand digging prior to machine excavation.
- .6 Maintain and protect existing underground cables and services in area of work.
- .7 Where unknown services are encountered, immediately advise Departmental Representative and confirm findings in writing.
- .8 Record locations of maintained, re-routed and abandoned service lines.
- .9 Make good for damage to existing underground cables and services.

1.11 MAINTENANCE OF EXISTING ELECTRICAL CIRCUITS

- .10 Maintain existing airfield electrical circuits to current operational standards during work in accordance with the PCO and construction sequencing drawings.
- .11 Arrange for and gain approval for de-energization and lockout of all circuits impacted by the work.
- .12 Minimize outage time when making connections to existing electrical systems.
- .13 Obtain Departmental Representative's approval prior to the de-activation of any system.
- .14 Reconnect electrical circuits and make operational prior to scheduled flights, sunset or inclement weather.
- .15 Provide temporary cabling and connections as required to maintain the operation of airfield lighting circuits as indicated.

1.12 CARE, OPERATION AND STARTUP

- .1 Instruct the Departmental Representative with respect to the operation, care, recommended safety precautions and maintenance of all equipment used in the

construction zone for the duration of the project. Ensure that operating personnel are conversant with all aspects of its care and operation.

1.13 SAFETY REQUIREMENTS

.1 Construction Safety Measures

- .1 Adhere to standards of the latest editions of the National Building Code, Territorial Government, Workers'/Workmen's Compensation Board and local authority with respect to construction safety measures. In all cases of conflict or discrepancy, the more stringent requirements shall apply.

.2 WHMIS

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

1.14 CO-ORDINATION

- .1 Ensure cooperation of workers with the Departmental Representative's personnel and other trades in laying out Work. Maintain efficient and continuous supervision.

1.15 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. Perform work in a manner to neither damage nor put at risk any portion of Work or other existing facilities.

1.17 PROTECTION OF WORK IN PROGRESS

- .1 Adequately protect Work completed or in progress and ensure no damage occurs.
- .2 Work damaged or defaced due to failure in providing such protection is to be removed and replaced, or repaired, as directed by Departmental Representative, such that the condition of the finished product is in accordance with the Contract Documents.

1.18 WARRANTY

Provide written warranty certificate, signed, sealed and issued to the Departmental Representative, stating that all work covered under this contract is guaranteed against defects in material and workmanship for a period of one (1) year starting from the date of the Final Certificate of Completion.

1.19 REMOVALS / SALVAGING

- .1 Where existing materials are to be removed and disposed of offsite as described in these Specifications or the Contract Drawings, the Contractor shall have ownership of these materials and shall be responsible for disposal off-site.
- .2 Where existing materials are to be salvaged and retained / reinstalled as described in these Specifications or the Contract Drawings, the Contractor shall store the materials on site where directed by the Departmental Representative.

1.20 ELECTRICAL SUBMITTAL PROCEDURES

.1 Administrative

- .1 Provide submittals for all new products. Submit shop drawings within 2 weeks of tender award and in orderly sequence with priority to long lead items materials so as to not cause delay in the Work.

- .2 Work affected by submittal shall not proceed 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. The Contractor's review shall represent that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and coordinated with requirements of the Work and Contract Documents. Submittals not stamped, signed, dated and identified as to specific project may be returned without being examined and may be considered rejected.
- .6 Verify field measurements and affected adjacent Work are coordinated.
- .7 Contractor's responsibility for errors and omissions in submission is not relieved by Departmental Representative's review of submittals.
- .8 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Departmental Representative's review.
- .9 Keep one reviewed copy of each submission on site.
- .2 Shop Drawings and Product Data
 - .1 Product data sheets or brochures are acceptable in place of shop drawings due to standardized manufacture of product.
 - .2 Delete information not applicable to project.
 - .3 Make changes in shop drawings as Departmental Representative may require, consistent with Contract Documents. When resubmitting, notify Departmental Representative in writing of any revisions other than those requested.
 - .4 Accompany submissions with transmittal letter, in duplicate, containing:
 - .1 Date.
 - .2 Project title and number.
 - .3 Contractor's name and address.
 - .4 Identification and quantity of each shop drawing, product data and sample.
 - .5 Submissions shall include:
 - .1 Date and revision dates.
 - .2 Project title and number.
 - .3 Name and address of:
 - .1 Subcontractor.
 - .2 Supplier.
 - .3 Manufacturer.
 - .4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.
 - .4 Details of appropriate portions of Work as applicable:
 - .1 Fabrication.

- .2 Layout, showing dimensions, including identified field dimensions, and clearances.
 - .3 Setting or erection details.
 - .4 Capacities.
 - .5 Performance characteristics.
 - .6 Standards.
 - .7 Operating weight.
 - .8 Wiring diagrams.
 - .9 Single line and schematic diagrams.
 - .10 Relationship to adjacent work.
- .6 If shop drawings are rejected, noted copy will be returned and resubmission of corrected shop drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.
- .7 The review of shop drawings by the Departmental Representative is for sole purpose of ascertaining conformance with general design. This review shall not mean that Departmental Representative approves detail design inherent in shop drawings, responsibility for which shall remain with Contractor submitting same, and such review shall not relieve Contractor of responsibility for errors or omissions in shop drawings or of responsibility for meeting all requirements of construction and Contract Documents. Without restricting generality of foregoing, Contractor is responsible for dimensions to be confirmed and correlated at job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for co-ordination of Work of all sub-trades.

1.21 FIELD QUALITY CONTROL

- .1 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project as detailed in the Contract Documents.
- .2 Submit test and commissioning reports during and at conclusion of project as detailed in the Contract Documents.
- .2 Perform tests in the presence of the Departmental Representative.

1.22 GENERAL ACCEPTANCE TESTING AND COMMISSIONING

- .1 Refer to Section 16 30 00 for airfield lighting testing and commissioning requirements.
- .2 The general acceptance testing and commissioning shall include, but not be limited to, the following:
 - .1 Check and inspect all the equipment, wiring, cables and connectors.
 - .2 Perform load tests on each phase of all impacted panelboards. Report loads on each phase to Departmental Representative. Ensure that panelboards are not overloaded. Report any issues with panelboard loading immediately to Departmental Representative,
 - .3 Submit a copy of the Final Inspection Certificate from the local Electrical Safety Inspection Authority.
 - .4 Perform tests using qualified personnel. Provide necessary instruments and equipment to demonstrate that:
 - a) Circuits are continuous and free from short circuits and grounds.

- b) All circuits are connected according to applicable wiring diagrams.
 - c) All circuits perform the designated functions in the sequence and manner intended.
- .5 Check all other impacted electrical systems for proper operation.

END OF SECTION 16 10 00

1.1 GENERAL

- .1 This Section covers items common to Sections of Division 16 and all other application specified electrical works.

1.2 PRODUCT REQUIREMENTS

- .1 Quality
 - .1 Products and materials shall be new, not damaged or defective, and meeting specifications for purpose intended. If requested, furnish evidence as to type, source and quality of products provided.
 - .2 Defective products will be rejected. Any shop drawing review and inspection prior to the identification of defection does not relieve the Contractor of responsibility for repair. Remove and replace defective products at no extra cost and be responsible for delays and expenses caused by rejection.
 - .3 Maintain uniformity of manufacture for any particular or like item throughout Work unless the Contract Documents indicate otherwise.
- .2 Availability
 - .1 Review product delivery requirements and anticipate foreseeable supply delays for any items. Inform Departmental Representative of expected delivery times. If delays in supply of products are foreseeable, notify Departmental Representative of such
- .3 Transportation, Delivery, Storage, Handling and Protection
 - .1 Arrange for delivery to the site with Departmental Representative, providing minimum 24 hours' notice. Provide all labor, personnel and equipment required for safe delivery and unloading of materials to the site.
 - .2 Handle and store products in a way that prevents all forms of avoidable damage to the products and the storage environment,
 - .3 Handle and store products in accordance with manufacturer's instructions
 - .4 Store products in original packaging until required in Work.
 - .5 Replace damaged products to satisfaction of Departmental Representative.
 - .6 Rehabilitate damaged factory finished surfaces to original state and to Departmental Representative's satisfaction. Use touch-up materials that match original. Do not paint over identifying information.
- .4 Manufacturer's Instructions
 - .1 Unless otherwise indicated in the Contract Documents, install products in strict accordance with manufacturer's instructions.
 - .2 Notify Departmental Representative in writing, of all discrepancies and conflicts between the Contract Documents and the manufacturer's instructions such that the Departmental Representative may establish a course of action.

1.4 MATERIAL AND EQUIPMENT

- .1 Provide all material and equipment as specified including all miscellaneous accessories and details not specifically mentioned or fully detailed, but which are necessary, or which are reasonably required to make a complete installation in accordance with code requirements and industry standards.
- .2 Material and equipment to be CSA certified. Where there is no alternative to supplying equipment, which is not CSA certified, special approval from Electrical Inspection

Department shall be obtained. Any third-party inspection required for this shall be arranged by the Contractor with all associated fees paid at no extra cost to the Contract.

- .3 Factory assemble control panels and component assemblies.

1.5 MANUFACTURER'S AND CSA LABELS

- .1 Must be visible and legible after equipment is installed.
- .2 To meet requirements of Electrical Inspection Department.

1.6 FASTENINGS AND SUPPORTS

- .1 Provide permanent fastenings, anchors and accessories and adhesives required for performance of the work.
- .2 Do not use impact driven (explosive, hammer, etc.) fastening devices unless written request for approval is reviewed and approved, in writing, by Departmental Representative
- .3 Exposed metal fastenings and accessories of same texture, colour and finish as base metal in which they occur.
- .4 Do not use organic plugs in concrete or masonry.
- .5 Prevent electrolytic action between dissimilar metals.
- .6 All Unistrut type support channels and associated fittings shall be hot dipped galvanized steel.

1.7 LABELS AND SIGNS

- .1 Provide warning signs, as specified or to meet requirements of applicable codes and Electrical Safety Inspection Department
- .2 Manufacturers nameplates and CSA labels to be visible and legible after equipment is installed.

1.8 GROUNDING EQUIPMENT

- .1 Provide all equipment grounding as required by Code, regardless of whether it has been shown on the drawings or called for in the specifications.
- .2 Clamps for grounding of conductor: size as required to electrically connect to building's existing main grounding conductor.
- .3 Grounding conductors: bare stranded copper, soft annealed, sized as required by Code.
- .4 Insulated grounding conductors: green, same type as the uninsulated grounding conductors
- .5 Ground bus: copper, size as indicated, complete with insulated supports, fastenings, connectors.
- .6 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:
 - .1 Grounding and bonding bushings.
 - .2 Protective type clamps.
 - .3 Bolted type conductor connectors.
 - .4 Thermite welded type conductor connectors.
 - .5 Bonding jumpers, straps.
 - .6 Pressure wire connectors.
- .7 Copper compression or mechanical grounding connectors as required sized for conductors. Approved manufacturer: Burndy or approved equal.

1.9 SPARE PARTS LIST

Turn over supplied spare parts to Departmental Representative as follows.

- .1 Four (4) medium intensity runway edge lights with clear/clear lenses - complete assembly c/w housing, lens, cord and breakable coupling.
- .2 Four (4) medium intensity runway edge lights with clear/yellow lenses - complete assembly c/w housing, lens, cord and breakable coupling.
- .3 One (1) apron junction edge light (yellow) - complete assembly c/w housing, lens, cord and breakable coupling.
- .4 One (1) wind direction indicator LED power supply
- .5 One (1) wind direction indicator LED lamp
- .6 Two (2) illuminated guidance sign LED driver power supplies.
- .7 PAPI spares
 - .1 1 - SC PAPI Inclinator MT ASSY FOAM INSULATION (ADB P/N 44A7290 or approved equal)
 - .2 3 - Frangible couplings 2" EMT to 2" NPT (ADB P/N 44B0180 or approved equal).
 - .3 1 – LED PAPI light engine replacement kit (ADB P/N 94A0665 or approved equal)
 - .4 1 – LED PAPI control board replacement kit (ADB P/N 94A0666 or approved equal).
 - .5 1 – LED PAPI front heated glass replacement kit (ADB P/N 94A0674 or approved equal).
 - .6 1 – LED PAPI input power board current driven (ADB P/N 44A7392 or approved equal)
- .8 One (1) isolation transformer of each size required for illuminated guidance signs.
- .9 Four (4) isolation transformers of size required for runway edge lights.
- .9 Two (2) isolation transformers of size required for threshold/end lights.
- .9 Two (2) isolation transformers of size required for taxiway edge lights.
- .10 Two (2) isolation transformers of size required for PAPI light units
- .11 One (1) isolation transformers of size required for wind cone lights

2.0 EXECUTION

2.1 FASTENINGS INSTALLATION

- .1 Secure equipment to solid masonry, tile and plaster surfaces with lead anchors or nylon shields.
- .2 Secure equipment to poured concrete with expandable inserts.
- .3 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.
- .4 Fasten exposed conduit or cables to building construction or support system using straps:
 - .1 One-hole steel straps to secure surface conduits and cables 50mm and smaller.
 - .2 Two-hole steel straps for conduits and cables larger than 50mm.
 - .3 Beam clamps to secure conduit to exposed steel work.
- .5 Suspended support systems:
 - .1 Support individual cable or conduit runs with 6mm diameter threaded rods and spring clips.
 - .2 Support two or more cables or conduits on channels supported by 6mm diameter threaded rod hangers where direct fastening to building construction is impractical.
- .6 For surface mounting of two or more conduits use channels at 1500mm OC spacing.
- .7 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.
- .8 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.
- .9 Do not use wire lashing or perforated strap to support or secure raceways or cables.
- .10 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Departmental Representative.
- .11 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

2.2 GROUNDING INSTALLATION

- .1 Install complete permanent, continuous grounding system including electrodes, conductors, connectors, accessories. Run a separate bonding conductor in all conduits.
- .2 Install connectors in accordance with manufacturer's instructions.
- .3 Protect exposed grounding conductors from mechanical injury.
- .4 Use mechanical connectors for grounding connections to equipment provided with lugs.
- .5 Soldered joints not permitted.
- .6 Install 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.
- .7 Bond single conductor, metallic armoured cables to cabinet at supply end, and provide non-metallic entry plate at load end.
- .8 Install system and circuit grounding connections as per code based on actual site conditions.
- .9 Install grounding connections to typical equipment included in, but not necessarily limited to following list. Service equipment, transformers, switchgear, duct systems, frames of motors, motor control centres, starters, control panels, generators, and distribution panels.

END OF SECTION 16 20 00

1.0 GENERAL

- 1.1 This Section covers items common to Sections of Division 16 and all other applicable specified electrical works.
- 1.2 Refer the Plan of Construction Operations for additional details related to the project scheduling.
- 1.3 Refer to all other sections of the Specification for applicable supplemental requirements.

2.0 PRODUCTS

2.1 RACEWAYS

- .1 Rigid PVC Conduit (RPVC)
 - .1 Identified as RPVC or Rigid PVC Conduit or Rigid PVC Conduit (Schedule 40) on drawings
 - .2 Rigid PVC conduit, CAN/CSA-211.2 complete with CSA approved couplings, fittings, expansion joints above grade and all applicable accessories.
 - .3 Use manufacturer recommended solvent welds / glue for connection of raceway materials.
- .2 High Density Polyethylene Tubing (HDPE)
 - .1 Identified as HDPE, polytubing or poly on drawings.
 - .2 Flexible high-density polyethylene tubing, DR-11.
 - .3 Made from polyethylene resin compound in accordance with the latest edition of ASTM F2160 Standard Specification for Solid Wall High Density Polyethylene (HDPE) Conduit Based on Controlled Outside Diameter (OD).
 - .4 Black in colour.
 - .5 Diameter, as indicated.
 - .6 HDPE tubing to be complete with markings at intervals not exceeding 5 feet which indicate:
 - .1 Nominal pipe size.
 - .2 Pressure rating or Dimension Ratio (D/R).
 - .3 The manufacturing standard reference, ASTM D 3350.
 - .7 Butt fusion fittings as required to make complete installation as indicated.
 - .8 10 mm stranded polypropylene pull rope tensile strength 5 kN. Breakable.
- .3 Electrical Metallic Tubing (EMT)
 - .1 to CSA C22.2 No.83, with couplings. All indoor conduit to be EMT unless otherwise specified
- .4 Fibreglass Reinforced Epoxy (FRE) Conduit
 - .1 Identified as FRE on drawings.
 - .2 Manufactured with continuous glass roving encapsulated in thermosetting epoxy resin.
 - .3 Suitable for both encased burial (EB) and direct burial (DB) applications.
 - .4 FRE conduit to be complete with markings indicating:
 - .1 Nominal pipe (trade) size.

- .2 Applicable temperature range.
- .3 Manufacturer's name.
- .4 Date of manufacture.
- .5 Testing laboratory approval.
- .5 Manufactured and approved in accordance with C22.2 NO. 2420-09 (R2014) *Belowground reinforced thermosetting resin conduit (RTRC) and fittings (Bi-national standard, with UL 2420).*

2.2 RACEWAY FASTENINGS

- .1 One hole steel straps to secure surface conduits 2" (50 mm) and smaller. Two hole steel straps for conduits larger than 2" (50 mm).
- .2 Beam clamps to secure conduits to exposed steel work.
- .3 Channel type support for two or more conduits at 4' oc.
- .4 Threaded rods, 6 mm dia., to support suspended channels.

2.3 RACEWAY FITTINGS

- .1 Fittings: manufactured for use with the raceway specified. Coating: same as conduit.
- .2 Where alternatives are proposed they must be submitted as a shop drawing for review and approval.
- .3 Where 90° bends are required submit proposed fittings as shop drawings for review and approval. Factory "ells" where 90° bends are required for 1" (25 mm) and larger conduits.
- .4 All couplings and connectors for EMT raceways system shall be steel set-screw style.
- .5 Fitting between dissimilar raceway materials must be submitted for approval.

2.4 FILL MATERIALS

- .1 Sand fill: clean, natural sand and gravel material, free from silt, clay, loam, friable or soluble materials and vegetable matter and in graded within following limits when tested to ASTM C136 and ASTM C117 and giving a smooth curve without sharp breaks when plotted on a semilog chart:

<u>Sieve Size (Tyler)</u>	<u>% Passing</u>
25 mm	100
4.75 mm	20 - 100
1.40 mm	10 - 100
0.300 mm	5 - 90
0.150 mm	5 - 30
0.075 mm	3 - 10

- .2 Backfill Material: Selected material from excavation or other sources, approved by Engineer, unfrozen and free from rocks larger than 50 mm, cinders, ashes, sods, refuse or other deleterious materials.

2.5 PULL PITS

- .1 Rigid polyethylene construction, conical, meeting Transport Canada Specification K-303, sized at a minimum diameter of 450 mm and a minimum depth of 450 mm with tabs for locking type, steel covers.

- .2 Hot-dipped galvanized steel locking type covers, 6 mm thick with tabs, 1/4" countersink holes for locking bolts, a notch cut into the edge for a shovel to push and a 1/4"-20 or 3/8"-16 tapped hole for ground lug.
- .3 Pull pit lids intended for edge light mounting on pull pit lid to be equipped with specially designed hub that the edge light breakable coupling is installed in.
- .4 The Contractor is to supply and install Burndy type KC servit posts the ground lugs for the pullpit lids.
- .5 Approved manufacturers: Kevrick Electrical Products, Sceptre, Canron, Century Plastics, PolyRama, ADB-Safegate

3.0 EXECUTION

3.1 SITE PREPARATION AND STOCKPILING

- .1 Remove obstructions, ice and snow, from surfaces to be excavated.
- .2 Stockpile fill materials in areas designated by Departmental Representative.
- .3 Protect fill materials from contamination.
- .4 Runs shown on drawings are schematic and diagrammatic only. Stake proposed routing and review on site with Departmental Representative.

3.2 TRENCHING

- .1 Advise Engineer in advance of excavation operations.
- .2 Confirm trench locations with Departmental Representative prior to excavation.
- .3 Excavate to dimensions indicated.
- .4 Do not leave open trenching beyond that specified in PCO when operating on pull back basis.
- .5 Do not leave any open trenches at end of day's operation.
- .6 Dispose of surplus and unsuitable excavated material in location approved by Departmental Representative.
- .7 Earth bottom of trench to be undisturbed soil, level, free from loose, soft or organic matter. Earth bottom to be free of all air voids and level.
- .8 Notify Departmental Representative when soil at bottom of trench appears unsuitable and proceed as directed by Departmental Representative.
- .9 Obtain Departmental Representative's approval of completed trench.
- .10 Remove unsuitable material from trench bottom to extent and depth directed by Departmental Representative.

3.3 DIRECT BURIAL OF RACEWAYS

- .1 Unless indicated otherwise on drawings, install at the following depths:
 - .1 1000mm under vehicular areas.
 - .2 450mm below grade on airside property in areas with no vehicle traffic.
 - .3 Ensure that the depth of burial from finished grade in all cases is compliant with the applicable local Electrical Code and to the satisfaction of the local Electrical Safety Authority Inspector.

- .2 Maintain a minimum of 1000mm clearance from adjacent existing buried cables as well as new adjacent raceways installed in separate trenches.
- .3 For runs along edges of runways and taxiways, install parallel to runway or taxiway edge with distance from edge as indicated. Maintain +/- 50mm tolerance along length of run.
- .4 For runs away from edges of runways and taxiways, follow surveyed stake lines set by Contractor. Follow stake line to +/- 100mm tolerance. Confirm trench locations with Departmental Representative prior to excavation.
- .5 Install using open trench.
- .6 Layout and temporarily secure to ensure duct run is straight to +/- 50mm tolerance before backfilling.
- .7 During construction, cap ends of ducts to prevent entrance of foreign materials.
- .8 Install a 9mm stranded polypropylene pull rope with 3m spare rope at each end in all raceways.

3.4 FILL TYPES AND COMPACTION

- .1 Use fill of types as indicated Compact in layers to specified density using mechanical vibratory compaction equipment.

3.5 BACKFILLING

- .1 Do not proceed with backfilling operations until Departmental Representative has inspected and approved installations.
- .2 Areas to be backfilled to be free from debris, snow, ice, water or frozen ground.
- .3 Dimensions indicated are minimum dimensions of fill after compaction.
- .4 Place and compact fill materials.
- .5 Backfilling around direct buried raceway:
 - .1 Place 75 mm depth of sand bedding across full width of trench.
 - .2 Lay raceway on top of bedding. Ensure that raceway is level along length of trench with no significant elevation changes.
 - .3 Cover raceway with 75mm layer of sand.
 - .4 Add SDBC counterpoise.
 - .5 Fill trench with backfill material in 150mm layers, compacting each layer to required density.
 - .6 Place plastic warning tape at indicated depth.
- .6 If during progress of work fills do not meet specified requirements, remove defective fills, replace and retest at no extra cost.

3.6 PULLPIT INSTALLATION

- .1 Install the pullpits as detailed on the drawings.
- .2 Excavate to size and depth indicated.
- .3 Cover bottom of excavation as detailed on the drawings.
- .4 Place pullpit so that lid is slightly below adjacent ground as detailed on Drawings.
- .5 Make holes in pullpit wall suitable for entry of raceways. Ensure that placement of raceways into pull pit are in a consistent location for all pull pits

- .6 Install incoming and outgoing conduit complete with seal to pull pit.
- .7 Backfill with native material around pullpit and compact to same level and density as adjacent ground.
- .8 Install isolating transformer(s) of proper rating inside as detailed on the drawings.
- .9 Make connections to primary and secondary cables, ground counterpoise and pullpit lid ground lug.
- .10 Place lid on pulpit with plastic inserts in turning holes

3.7 SURFACE CONDUITS

- .1 Run parallel or perpendicular to building lines.
- .2 Run conduits in flanged portion of structural steel.
- .3 Group conduits wherever possible on suspended/surface channels.
- .4 Do not pass conduits through structural members except as indicated.
- .5 Do not locate conduits less than 74 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.
- .6 Ensure all PVC conduit mounted above grade includes expansion joints.

3.8 RESTORATION

- .1 Upon completion of work, remove surplus materials and debris, and correct defects noted by Departmental Representative.
- .2 Clean and reinstate areas affected by work as directed by Departmental Representative.
- .3 Install previously preserved topsoil over trenched area. If the topsoil has deteriorated, replace it by topsoil of a quality equal to that removed.

END OF SECTION 16 21 00

1.0 GENERAL

- 1.1 This Section covers items common to Sections of Division 16 and all other applicable specified electrical works
- 1.2 Refer the Plan of Construction Operations for additional details related to the project scheduling.
- 1.3 Refer to all other sections of the Specification for applicable supplemental requirements.

1.2 WIRING IDENTIFICATION

- .1 Identify ASLC wiring with engraved lamacoid tags, or other approved alternative, secured to cables with ty-wraps indicating circuit number and/or circuit function. Submit proposed tags for review and approval as shop drawing.
- .2 Identify wiring with permanent indelible identifying markings, either numbered or coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.
- .3 Maintain phase sequence and colour coding throughout.
- .4 Colour code: in accordance with Electrical Code

1.3 WIRING TERMINATIONS

- .1 Lugs, terminals, screws used for termination of wiring to be suitable for specified conductors.
- .2 All terminations to be compliant with electrical code and industry standards
- .3 Primary ASLC connector kits as specified.
- .4 Ground counterpoise sections within pull pits shall be crimped together with use of split bolt connector.
- .5 Airfield series lighting cabling splices that are not within pull pits containing isolation transformers shall be permanent splices in accordance with the Contract Documents.

2.0 PRODUCTS

2.1 SLEEVES, INSERTS

- .1 This Contractor is responsible for supplying and setting of all sleeves for wiring.

2.2 BUILDING WIRE

- .1 Copper conductors: size as indicated, with 600/1000V insulation of chemically cross-linked thermosetting polyethylene material rated R90 (sizes #8 AWG and larger to be rated 1000V).
- .2 All wiring shall be stranded conductors.
- .3 Terminations and splices shall be kit type and approved by Departmental Representative.

2.3 OTHER MATERIAL

- .1 Circuit markers:
 - .1 Lamacoid reading: "CCT #", where # indicates circuit number as indicated.
- .2 Ty-wraps: black, weather-resistant, 0.3" wide x length to suit to fasten:
 - .1 Secondary cables.
 - .2 Lamacoid cable markers to cables.
 - .3 Acceptable Material: Thomas & Betts Cat. No. TY37MX (No substitution).
- .3 Tape: PVC type:
 - .1 Acceptable material (No substitution)
 - .1 PVC type: 3M Scotch Super 88
 - .2 Rubber type: 3M Scotch 130C

3.0 EXECUTION

3.1 USE OF RACEWAYS

- .1 All cables are to be installed in raceways unless otherwise indicated.

3.2 WIRE AND CABLE INSTALLATION

- .1 Install wiring to all devices shown on the drawings.
- .2 All branch wiring shall be sized and installed so that at full load, the voltage drop shall not exceed 2% from the panels to the farthest outlet. Circuits sharing a common neutral shall not be connected to the same main phase.
- .3 Install wiring in conduit systems.
- .4 Install wiring to vibrating equipment in flexible conduit.
- .5 No splices shall be pulled into a conduit or be so placed as to be inaccessible.
- .6 All wiring for systems, controls, and other such items shall be identified on each end and at all joints by a circuit or wire number.
- .7 Support vertical runs of cables every 1800 mm.
- .8 Support horizontal runs of cables every 1200 mm.
- .9 As far as is practicable, all feeder wiring shall be continuous from origin to panel termination without running splices in intermediate pull boxes or splicing chambers. Sufficient slack shall be left at the termination point to make proper connections to the equipment.
- .10 All wiring and the routing of wiring is to be code compliant in terms of the type of wiring installed and the specifics with respect to the routing of the wiring (mix of voltages in common raceways, conduit fill etc). The Contactor shall ensure an Electrical Code compliant installation regardless of any discrepancies with the local electrical code contained within the Contract documentation.

3.3 CABLE INSTALLATION IN RACEWAYS

- .1 Swab ducts immediately prior to installing cables.
- .2 Cables must be handled and reeled off in such a manner as to prevent kinking or bending beyond minimum radius.
- .3 Cables shall be turned into raceways in smooth bends. Ensure that the cable insulation/jacket is not damaged during installation.

- .4 Install cables as indicated.
- .5 Do not pull spliced cables inside raceways.
- .6 Install multiple cables simultaneously.
- .7 Use CSA approved lubricants of type compatible with cable jacket to reduce pulling tension.
- .8 Before pulling cable into raceways and until cables are properly terminated, seal ends of cables with moisture seal tape.
- .9 New cable installation must be executed by hand or with the use of a specially designed pulling machine.
 - a) When installing new cables into an existing empty raceway do not exceed 80% of the manufacturer specified maximum pulling tension. Ensure this manufacturer specified pulling tension information is included on the cable shop drawing submittal and ensure it can be measured and verified onsite during execution of the works.
 - b) When installing new cabling into a raceway that contains existing cables that are to remain do not exceed 50% of the manufacturer specified maximum pulling tension – Inform Engineer of any issues executing at this tension.
- .10 Caution must be taken to ensure that existing cables are not damaged. In the presence of the Departmental Representative, megger test the existing section of cable before removal of obsolete cables and after to ensure that the resistance to ground of the existing cables that are to remain has not increased. Report findings to Departmental Representative. Excessive damage to existing cables may cause them to require replacement at the Contractor's expense.
- .11 When removing cables from existing raceways that contain existing cables do not exceed 50% of the manufacturer specified maximum pulling tension. Caution must be taken to ensure that existing cables are not damaged. In the presence of the Departmental Representative, megger test the existing section of cable before removal of obsolete cables and after to ensure that the resistance to ground of the existing cables that are to remain has not increased. Report findings to Departmental Representative. Excessive damage to existing cables may cause them to require replacement at the Contractor's expense

END OF SECTION 16 22 00

1.0 GENERAL

- 1.1 This Section covers items common to Sections of Division 16 and all other applicable specified electrical works
- 1.2 Refer the Plan of Construction Operations for additional details related to the project scheduling.
- 1.3 Refer to all other sections of the Specification for applicable supplemental requirements.

1.1 SHOP DRAWINGS

- .1 Submit shop drawings of all airport equipment to the Departmental Representative for review prior to installation in accordance with Specifications. Shop drawings are to indicate photometric output of lights and certifications for conformance with applicable TP312, ICAO and FAA standards (current Editions) for each type of light and color of light.

1.3 ACCEPTANCE TESTING AND COMMISSIONING

- .1 Refer to Section 16 10 00 for general testing and commissioning requirements.
- .2 Perform final system adjustments and setup to ensure systems operate to factory specifications.
- .3 Provide instruments required for testing and adjusting.
- .4 Provide report indicating installation deficiencies of the system that are to be corrected prior to putting system into operation.
- .5 Provide final report indicating system performance as compared to factory specifications.
- .6 Submit test results on standard forms to Departmental Representative for approval.
- .7 Provide necessary instruments and equipment to demonstrate that:
 - a) Circuits are continuous and free from short circuits and grounds.
 - b) All circuits are connected according to applicable wiring diagrams.
 - c) All circuits perform the designated functions in the sequence and manner intended.
 - d) All circuits are operating correctly by:
 - .1 Energizing and operating each circuit at each brightness not less than 10 times.
 - .2 Energizing and operating each circuit at full load for a continuous period of not less than eight hours.
- .8 ASLC Megger Testing
 - .1 Provide instruments, meters, equipment and personnel required to conduct tests

at the beginning, during and at conclusion of project. Instruments, meters and equipment used in the work to be calibrated. Provide proof of calibration for Departmental Representative's review.

- .2 Execute all megger testing in the presence of the Departmental Representative and submit written results.
- .3 Prior to start of work, measure and record resistance to ground of existing airfield series circuits which will be affected by this work but will remain either fully or partially at the conclusion of the project. Ensure results are submitted in written form within 1 week of testing.
- .4 At conclusion of work, measure and record resistance to ground on existing airfield series circuits which are affected by this work.
- .5 For entirely new airfield series lighting circuits the Megger results using a 5kV tester must indicate a resistance to ground of the new installation not less than 1GOhm.
- .6 For partially replaced airfield series lighting circuits (where only one section of cabling is replaced with new), isolate the new section of cabling and megger test. The Megger results using a 5kV tester must indicate a resistance to ground of the new installation not less than 1GOhm.
- .7 Note the ambient temperature, weather conditions and soil conditions at the time of test.

.9 EDGE LIGHTING SYSTEMS

- .1 Check all pull pits, isolating transformers, primary, secondary, counter poise and ground connections.
- .2 Confirm all light fixtures are functioning and ensure that all are properly aimed and aligned.
- .3 Ensure that the runway edge light circuit components are interleaved between the two circuits as shown on the drawings.
- .4 Provide services of factory authorized technician to perform final testing and commissioning of the edge lighting system complete with verification of aiming, alignment and control.

.10 PAPI SYSTEMS

- .1 Provide services of factory authorized technician to perform final testing and commissioning of the PAPI system. The PAPI systems must be commissioned by manufacturer authorized technicians with the proper knowledge and experience to commission the systems.
- .2 Confirm the anti-frost protection system correct operation.

Confirm the correct operation and configuration of the integrated anti-frost heater system. Recommission / recalibrate existing constant current regulator as required. Temporarily activate the anti-frost configuration to demonstrate correct operation then de-activate. Ensure Departmental Representative is trained in how to activate the anti-frost configuration. Provide instructions in commissioning report and attach instructions to the PAPI constant current regulators.

- .3 Perform ground survey check in accordance with Transport Canada Advisory Circular AC 300-006 to verify aiming and document results in commissioning report.
- .4 Demonstrate the automatic shutoff feature that activates when one of the PAPI units goes too far out of alignment by adjusting the aiming of one of the units outside of tolerance. Ensure that the other units turn off. Re-aim the adjusted unit correctly and verify that the PAPI light units turn back on.
- .5 Submit report from factory authorized technical which declares that the PAPI system is installed according to the manufacturer's instructions and is suitable for operational use.
- .11 **CONSTANT CURRENT REGULATORS**
 - .1 Retain the services of the original equipment manufacturer authorized technician to commission the constant current regulators and/or recalibrate existing constant current regulators to suit the load of the new circuits.
 - .2 Submit commissioning report from manufacturer authorized technician declaring that the regulators are properly commissioned as suitable for use in operation
 - .3 Calibrate and adjust the settings of constant current regulators including adjusting the output transformer taps as necessary/applicable and as applicable to suit the loading of the lighting system.
 - .4 Ensure the supply voltage corresponds to the input tap. Check that the open circuit protector de-energizes the circuit within 2 or 3 seconds when load is disconnected.
 - .5 Recommission / recalibrate existing constant current regulator as required to implement the LED integrated anti-frost heating
 - .6 If the Contractor does not have sufficient demonstratable experience and knowledge to calibrate and commission the constant current regulator the Contract shall require that the device is commissioned by a manufacturer technician.
- .12 **AIRFIELD LIGHTING CONTROL SYSTEM**
 - .1 Verify the functionality of all manual switches and ARCAL control.
 - .2 Ensure all new systems operate as intended and as the previous systems were operating
 - .3 Retain the edge lighting and/or PAPI supplier to provide verification commissioning of the control system to ensure that all lighting systems are operated as required. Submit commissioning report documenting the tests performed to verify functionality prior to activation of the lighting
 - .4 Ensure all wind cones and illuminated guidance signs illuminate when their respective circuit is energized. Ensure that the illumination remains at a constant brightness when circuit currents are varied.
- .13 Ensure all wind cones and illuminated guidance signs illuminate when their respective circuit is energized. Ensure that the illumination remains at a constant brightness when circuit currents are varied.
- .14 **RTIL**
 - .1 Ensure that the RTIL units operate and are controlled correctly.
 - .2 Ensure that the RTIL units are properly aimed.

END OF SECTION 16 30 00

1.0 GENERAL

- 1.1 This Section covers items common to Sections of Division 16 and all other applicable specified electrical works

2.0 PRODUCTS

2.1 AIRFIELD SERIES LIGHTING CABLE (ASLC)

- .1 Referred to as ASLC or primary cabling on drawings
- .2 To CSA C22.2 No.179.
- .3 Single conductor stranded soft drawn copper, #8 AWG, 5000Volt, cross linked polyethylene insulation and jacket.
- .4 Ozone and discharge resistant insulation / jacket
- .5 Shop drawing to indicate recommended maximum pulling tension.

2.2 AIRFIELD GROUND COUNTERPOISE WIRE

- .1 Single conductor #8 AWG, soft drawn copper wire:
 - .1 Solid bare for direct burial as counterpoise above raceways for airfield lighting circuits.

2.3 AIRFIELD ISOLATING TRANSFORMERS AND CONNECTORS

- .1 Transformers and primary connectors to be insulated for 5000V.
- .2 Transformers and all connections to be completely waterproof and suitable for mounting in any type of pullpit.
- .3 Transformers must be designed to allow continuous operation with the secondary open circuited, short circuited or with a lamp in place.
- .4 Transformers to be epoxy encapsulated complete with factory installed primary and secondary leads and shall conform to CSA spec. C22.2 180-M. Ensure secondary lead is equipped with a FAA L-823 receptacle.
- .5 Connections shall conform to Transport Canada spec. K-255 and shall be suitable for 5kV non-screened cable and shall match the transformer manufacturer.
- .6 Transformer rating: as indicated, 6.6A primary, 6.6A secondary, 60Hz.
 - .1 Taxiway and apron junction edge lights = 10/15W

Confirm all transformer sizes are rated as recommended by load equipment manufacturer.
- .7 Acceptable manufacturer: Amerace or approved equal.

2.5 AIRFIELD PRIMARY PLUG AND RECEPTACLE CONNECTORS

- .1 Primary plug and receptacle connector kit, straight type, one male plug, one female plug, for use with isolating transformer or use for separable straight splice of #8 AWG primary cable.
- .2 Rated 25 A continuous, 5000V to ground/earth.

- .3 Molded from compounded EPDM rubber resistant to sunlight and ozone.
- .4 To connect primary cable to isolating transformers use Amerace #54 Super connecting kits. Consult the connector manufacturer to obtain connectors specifically sized for the type of series cable used to ensure a snug, watertight fit.
- .5 Cover all separable primary connectors with a heat shrink kit specifically designed for airfield lighting primary connectors.
- .6 Acceptable Manufacturer: Amerace (54 Super kits).

2.6 AIRFIELD SECONDARY PLUG AND RECEPTACLE CONNECTORS

- .1 Secondary male plug connector kit to field assemble secondary extension using 2 conductor #12 AWG type SOW secondary cable, length to suit.
- .2 Secondary female receptacle connector kit to field assemble secondary extension using 2 conductor #12 AWG type SOW secondary cable, length to suit.
- .3 Ensure connector is sized correctly to cable diameter to ensure watertight seal.
- .4 Factory assembled secondary extensions to be minimum 1.2m long #12 AWG type SOW, two conductor cable terminated with male connector on one end and female connector on the other end. Exact length to suit distances between light fixtures and pullpits.
- .5 Acceptable Manufacturer: Amerace Ltd.

2.7 OTHER MATERIAL

- .1 Circuit markers:
 - .1 Lamacoid reading: "CCT #", where # indicates circuit number as indicated.
- .2 Ty-wraps: black, weather-resistant, 0.3" wide x length to suit to fasten:
 - .1 Secondary cables.
 - .2 Lamacoid cable markers to cables.
 - .3 Acceptable Material: Thomas & Betts Cat. No. TY37MX (No substitution).
- .3 Tape: PVC type:
 - .1 Acceptable material (No substitution)
 - .1 PVC type: 3M Scotch Super 88
 - .2 Rubber type: 3M Scotch 130C

3 EXECUTION

3.1 INSTALLATION OF AIRFIELD PRIMARY ASLC CABLES

- .1 Install the primary cables in accordance with applicable sections of this specification and along the routes shown on the layouts. Refer to the drawings for trench configuration details.

- .2 Install all primary cable in raceways as shown on Contract drawings. Ensure that an ample amount of cable pulling lubrication is used and that cable maximum pulling tension is not exceeded. Ensure that cable insulation is not damaged during installation.
- .3 Make all connections using approved connectors as indicated in specifications. Ensure that all splices and connections are accessible and not located within raceways.
- .4 Leave a 600 mm loop of loose cable at each connection so as to avoid mechanical tension on the connector. Make a 600mm loop of any ASLC going straight through pulpit and leave neatly coiled inside pull pit.
- .5 Carefully install connector according to manufacturer's instructions. Ensure that the mating surfaces between plugs and receptacles are kept dry and clean. Take specific care to ensure that the connector elements are completely mated and inserted until all air has escaped.
- .6 Install a cable circuit marker on each cable end and on all cables running through pulpits or manholes. All cables to be labeled wherever they are visible.
- .7 Install a ground counterpoise wire above raceway for all runs of airport lighting series circuits including primary and secondary cabling.

3.2 AIRFIELD ISOLATING TRANSFORMER INSTALLATION

- .1 Install isolating transformer(s) of proper rating inside as detailed on the drawings and/or recommended by the secondary load manufacturer.
- .2 Make connections to primary and secondary cables and ground counterpoise.

3.3 INSTALLATION OF AIRFIELD GROUND COUNTERPOISE

- .1 Install the 1/C #8 ground counterpoise wire with all runs of primary series lighting and secondary cables in or above raceway as indicated on the drawings.
- .2 An acceptable alternative to running a ground counterpoise above each ASLC raceway is to run counterpoise wire in a zig-zag pattern crossing cables at 300mm intervals when outer cables in trench are more than 150mm apart.
- .3 Use 1/C #8 solid SDBC wire above series cables in raceway and above spare ASLC raceways.
- .4 Use 1/C #8 TWU green with series cable pulled in duct banks.
- .5 Use appropriate ground connector and connect the counterpoise wire to:
 - .1 the power supply system common ground. Ensure electrical code requirements are met for bonding of the counterpoise to the source ground.
 - .2 Each light unit anchor / mounting hardware
 - .3 Each isolating transformer
 - .4 Each ground rod
 - .5 All other ground wires in the same trench
 - .6 Each pulpit lid

- .7 All other locations indicated in the drawings
- .6 Counterpoises to be connected to separate crimps rather than all terminated to the ground stud of the isolation transformer.

3.4 INSTALLATION OF AIRFIELD SECONDARY CABLES

- .1 Make connections using approved connectors as indicated in specifications.
- .2 Connect to isolating transformer secondary outlet.
- .3 Leave a 600 mm loop of loose cable at connection to transformer.
- .4 Install secondary cables through edge light fixture support columns such that they are not exposed above grade

END OF SECTION 16 31 00

1.0 GENERAL

- 1.1 This Section covers items common to Sections of Division 16 and all other applicable specified electrical works

2.0 PRODUCTS

2.1 ANGLE IRON ANCHOR STAKES

- .1 Hot-dipped galvanized steel, size 50mm x 50mm x 6.4mm thick, length as shown on the drawings. Complete with cast aluminum stake head to secure the end of the secondary fixture cable and allow it to pass through the breakable coupling and into the light fixture without the use of clips, clamps or screws.
- .2 Acceptable manufacturer: ADB-Safegate, Eaton/Crouse Hinds or approved equal.

2.2 BREAKABLE COUPLINGS

- .1 All breakable couplings are to be installed and supplied as new.
- .2 Aluminum, Transport Canada type, length to suit as shown on Contract drawings, 60.3mm outside diameter c/w 2" NPT thread for mounting of elevated edge lighting fixtures on pull pit lids and/or anchor stakes.
- .3 Acceptable manufacturer: ADB-Safegate, Eaton/Crouse Hinds or approved equal.

2.3 TAXIWAY AND APRON EDGE LIGHTS

- .1 Light unit shall be LED based, suitable for angle iron stake mounting, complete with center-exit connecting cord and male plug connector, support column, stainless steel hardware, 50mm diameter frangible coupling, and retroreflective tape on support column.
- .2 Fixture shall be supplied complete with an optical assembly producing the required photometric distribution to Transport Canada TP312, 5th Edition specifications for medium intensity taxiway edge lighting. Fixture height to be as detailed on the drawings.
- .3 The LED edge light fixtures shall conform to the requirements of FAA Advisory Circular 150/5345-46 (current edition) "Specification for Runway and Taxiway Light Fixtures" and "FAA Engineering Brief No. 67 "Light Sources other than Incandescent and Xenon for Airport Lighting and Obstruction Lighting Fixtures." The LED fixture shall be ETL (or equivalent) certified to comply with TP 312 5th Edition and ICAO Annex 14
- .4 The light source shall be an electroluminescent diode assembly. To ensure reliability, a single LED type shall be used in the light source. The lifetime of the LED shall be a minimum of 56,000 hours at full intensity and more than 150,000 hours in actual operating conditions. To ensure optimum daytime visibility, the optical emitting lens shall use aviation glass.
- .5 The light fixture, without heater, shall operate on a 6.6A circuit at 60Hz using an appropriately-sized isolation transformer. The fixture shall be designed to operate with up to a 30/45W, 6.6A (secondary) isolation transformer. For increased efficiency, the fixture shall alternatively operate with a 10/15W, 6.6A (secondary) isolation transformer that meets all applicable requirements of AC 150/5345-47. The fixture load shall be no more than 12VA. The CCR load (which includes isolation transformer losses) shall be no more than 19VA.
- .6 The fixture shall have an adjustment mechanism that allows $\pm 4.5^\circ$ vertical adjustment in the field. It shall be possible to install the lights on existing circuits in addition to, or in replacement of, conventional incandescent or halogen lights without having to change any other element (CCR, primary and secondary cabling, series isolation transformer,

etc.). The fixture light output shall match quartz-incandescent fixtures at all brightness levels on a 3-step or 5-step regulator. The required beam color shall be obtained without the use of a color filter.

- .7 It shall be possible to easily remove the top optical assembly without the use of tools. Exterior, hard to remove, rubber type elements (that are subject to UV degradation; attack by rodents, fire ants, birds, etc.) shall not be used to hold the top optical assembly on.
- .8 The fixture electronics shall be mounted inside the LED chamber to provide optimum protection from water and ice. The fixture shall use robust, solid-state internal devices that withstand damage if the fixture is knocked over.
- .9 The fixture shall have a low-profile design with a maximum O.D. of 3.75 inches to reduce the risk of damage due to jet blast. The overall fixture height shall be as detailed on the drawings.
- .10 Taxiway and apron edge light fixture colour to be blue, symmetrical and in accordance with TP312 5th Edition requirements.
- .11 All electronics shall be housed within IP67 rated enclosure.
- .12 Apron junction light fixture colour to be yellow, symmetrical and in accordance with TP312 5th Edition requirements.
- .13 Fixtures to maintain a high power factor over their entire brightness range.
- .14 Installation of fixtures shall include aiming, leveling and testing of all fixtures.
- .15 Acceptable manufacturer: Eaton/Crouse Hinds or approved equal.

2.4 ELEVATED MEDIUM INTENSITY LED RUNWAY EDGE LIGHTS

- .1 Light unit shall be LED based, angle iron stake mounting, complete with center-exit connecting cord, male plug connector, support column, stainless steel hardware, 50mm diameter frangible coupling and retroreflective tape on support column.
- .2 Fixture shall be supplied complete with an optical assembly producing the required photometric distribution to Transport Canada TP312, 5th Edition specifications for medium intensity runway edge lighting. Fixture height to be as detailed on the drawings.
- .3 The LED edge light fixtures shall conform to the requirements of FAA Advisory Circular 150/5345-46 (current edition) "Specification for Runway and Taxiway Light Fixtures" and "FAA Engineering Brief No. 67 "Light Sources other than Incandescent and Xenon for Airport Lighting and Obstruction Lighting Fixtures." The LED fixture shall be ETL (or equivalent) certified to comply with TP 312 and ICAO Annex 14, Vol. 1, para. 5.3.17.
- .4 The light source shall be an electroluminescent diode assembly. To ensure reliability, a single LED shall be used in the light source. The lifetime of the LED shall be a minimum of 56,000 hours at full intensity and more than 150,000 hours in actual operating conditions. To ensure optimum daytime visibility, the optical emitting lens shall use aviation glass.
- .5 The light fixture, shall operate on a 6.6A circuit at 60Hz using an appropriately-sized isolation transformer. The fixture shall be designed to operate with up to a 30/45W, 6.6A (secondary) isolation transformer.

For increased efficiency, the fixture shall alternatively operate with a 10/15W, 6.6A (secondary) isolation transformer that meets all applicable requirements of AC 150/5345-47. The fixture load shall be no more than 20VA. The CCR load (which includes isolation transformer losses) shall be no more than 27VA.

- .6 The fixture shall have an adjustment mechanism that allows $\pm 4.5^\circ$ vertical adjustment in the field. It shall be possible to install the lights on existing circuits in addition to, or in replacement of, conventional incandescent or halogen lights without having to change any other element (CCR, primary and secondary cabling, series isolation transformer, etc.). The fixture light output shall match quartz-incandescent fixtures at all brightness levels on a 3-step or 5-step regulator. The required beam color shall be obtained without the use of a color filter.
- .7 It shall be possible to easily remove the top optical assembly without the use of tools. Exterior, hard to remove, rubber type elements (that are subject to UV degradation; attack by rodents, fire ants, birds, etc.) shall not be used to hold the top optical assembly on.
- .8 The fixture electronics shall be mounted inside the LED chamber to provide optimum protection from water and ice. The fixture shall use robust, solid-state internal devices that withstand damage if the fixture is knocked over.
- .9 The fixture shall have a low-profile design with a maximum O.D. of 3.75 inches to reduce the risk of damage due to jet blast. The overall fixture height shall be as detailed on the drawings.'
- .10 Edge light fixture colour to be white or white/yellow as detailed on the drawings.
- .11 Fixtures to maintain a high power factor over their entire brightness range.
- .12 Include the supply of one (1) aiming/levelling device for the edge lights.
- .13 Installation of fixtures shall include aiming, leveling and testing of all fixtures.
- .14 Approved manufacturer: ADB-Safegate, Eaton/Crouse Hinds or approved equal.

2.5 ELEVATED MEDIUM INTENSITY LED THRESHOLD / END LIGHTS

- .1 Light unit shall be LED based, pullpit lid mounted complete with center-exit connecting cord, male plug connector, support column, stainless steel hardware, 50 mm diameter frangible coupling retroreflective tape on support column. Fixture height to be as detailed on the drawings.
- .2 Fixture photometric output, colour and pattern shall meet the requirements of Transport Canada Standard TP312, 5th Edition for a medium intensity threshold light.
- .3 The LED edge light fixtures shall conform to the requirements of FAA Advisory Circular 150/5345-46 (current edition) "Specification for Runway and Taxiway Light Fixtures" and "FAA Engineering Brief No. 67 "Light Sources other than Incandescent and Xenon for Airport Lighting and Obstruction Lighting Fixtures." The LED fixture shall be ETL (or equivalent) certified to comply with TP 312, 5th Edition for a medium intensity threshold light.
- .4 The light source shall be an electroluminescent diode assembly. To ensure reliability, a single LED shall be used in the light source. The lifetime of the LED shall be a minimum of 56,000 hours at full intensity and more than 100,000 hours in actual operating conditions.
- .5 The light fixture, shall operate on a 6.6A circuit at 60Hz using an appropriately-sized isolation transformer. The fixture shall be designed to operate with up to a 30/45W, 6.6A (secondary) isolation transformer. For increased efficiency, the fixture shall alternatively operate with a 10/15W, 6.6A (secondary) isolation transformer that meets all applicable requirements of AC 150/5345-47. The fixture load shall be no more than 15VA. The CCR load (which includes isolation transformer losses) shall be no more than 27VA.

- .6 The fixture shall have an adjustment mechanism that allows $\pm 4.0^\circ$ vertical adjustment in the field. It shall be possible to install the lights on existing circuits in addition to, or in replacement of, conventional incandescent or halogen lights without having to change any other element (CCR, primary and secondary cabling, series isolation transformer, etc.). The fixture light output shall match quartz-incandescent fixtures at all brightness levels on a 3-step or 5-step regulator.
- .7 It shall be possible to easily disassemble the fixture without the use of tools. Exterior, hard to remove, rubber type elements (that are subject to UV degradation; attack by rodents, fire ants, birds, etc.) shall not be used.
- .8 The fixture electronics shall be mounted inside the LED chamber to provide optimum protection from water and ice. The fixture shall use robust, solid-state internal devices that withstand damage if the fixture is knocked over.
- .9 The fixture shall have a low-profile design with a maximum O.D. of 6.55 inches to reduce the risk of damage due to jet blast. The overall fixture height shall be as detailed on the drawings.
- .10 Threshold/end light fixture colour to be red/green bi-directional.
- .11 Fixtures to maintain a high power factor over their entire brightness range.
- .12 Include the supply of one (1) aiming/levelling device for the lights.
- .13 Installation of fixtures shall include aiming, levelling and testing of all fixtures.
- .14 Approved Manufacturers: ADB Safegate EMIS model or approved equal.

2.6 LED PRECISION APPROACH PATH INDICATORS (PAPI)

- .1 PAPI system to meet Transport Canada Aerodrome Safety Circular ACS 2002-014 dated 2002.03.26, "Operation and Modification Options for Precision Approach Path Indicator (PAPI) Units". The LED PAPI shall conform to the requirements FAA Advisory Circular 150/ 5345-28 (latest revision), "Precision Approach Path Indicator Systems." The LED PAPI shall be ETL certified. PAPI system photometric output to meet TP312, 5th Edition.
- .2 To ensure reduced energy consumption and reduced maintenance requirements, each PAPI Light Unit shall use a Light Emitting Diode (LED) assembly. To maximize optical efficiency, the optical system shall consist of a sealed optical chamber. The LED assembly and front glass shall be easily replaceable without requiring Light Unit re-calibration.
- .3 The optical chamber shall be protected from sandblasting by a separate, hardened front glass which is digitally controlled and is designed to ensure that the outer glass is clear of frost/dew within 3 minutes over a temperature range of -21°C to $+55^\circ\text{C}$ (-6°F to -40°F), 4 minutes over a temperature range of -39°C to -22°C (-38°F to -8°F), and 5 minutes over a temperature range of -55°C to -40°C (-31°F to -40°F). There shall be a setting which allows the units to heat the front glass on CCR Steps 1 & 2 without the PAPI lights being on to allow for assurance that the outer glass is clear of frost/dew at all times.
- .4 PAPI system to include:
 - .1 Four PAPI light units per PAPI bar.

- .2 Input power required by the PAPI shall be 550VA maximum.
- .3 The light units shall be powered via a 3 step (6.6A) or 5 step (6.6A) airfield series circuit. Each LED PAPI Light Unit shall require only one [6.6A/6.6A] 200W (maximum) isolation transformer.
- .4 Each light unit shall include a control board with associated tilt sensor electronics. The Light Unit shall have a visual display on the exterior that shows the actual light unit angle. The visual display shall also have the capability to display the horizontal (zero) setting of the light unit. Tilt sensors containing mercury shall not be used.
- .5 Each light unit shall be constructed as follows:
The light unit shall be made from folded aluminum sheet fully protected against corrosion. It shall be fully weatherproof. For ease of alignment, the PAPI Light Unit shall be mounted using only three mounting legs. Precision elevation adjustment shall be possible in less than 10 minutes per unit, making use of the visual display incorporated into each light unit.
- .6 The system shall include an interconnection cable kit and one hard-copy instruction manual (per system). The manufacturer shall also have a downloadable electronic version of the manual available on their web site.
- .7 PAPI light units rated for operation in a temperature range of -55°C to +55°C .
- .8 Secondary connectors connected to lamps.
- .9 PAPI lens protective cover.
- .10 Breakable couplings and floor flange fittings to attach PAPI light unit to transition plate.
- .11 Transition plate to fasten PAPI light unit to anchor bolts. Transition plate to include for the following:
 - .1 Lateral adjustment of the PAPI unit.
 - .2 2° azimuthal adjustment.
- .12 Mounting legs:
 - .1 Use 2" galvanized EMT, length as required for PAPI mounting height as indicated on drawings.
- .5 Accessories:
 - .1 One can of enamel touch up paint, CGSB colour No. 508-101, international orange.
- .6 Other Materials:
 - .1 2" galvanized EMT
 - .2 Airfield series lighting cable:

- .3 Secondary cable: two conductor #12 AWG type SOW.
- .4 Ground counterpoise wire
- .5 Ground rod.
- .6 Isolating transformer: 200 W, 6.6A/6.6A
- .7 Polyethylene pullpit:
- .8 Primary connector.
- .9 Secondary connector
- .10 Cable ties: to
- .11 Concrete footings.
- .7 Approved Manufacturers: ADB Safegate or approved equal.

2.8 PAPI HELICAL ANCHOR

- .1 To be designed by Professional Structural Engineer licensed in Manitoba and stamped that it meets the requirements to support the structure and prevent frost heaving. Submit shop drawing for approval complete with stamp prior to ordering / installation.
- .2 Welding per CSA W59-13
- .3 Steel shall be Grade B ASTM A36 or equivalent hot rolled carbon steel.
- .4 Hot dip galvanized after welding per CSA G164.M1981.
- .5 Designed for top plate compatibility for of manufacturer supplied transition plate.
- .6 The Contractor will be required to conduct bore holes and soil geotechnical investigation to assist in determining soil conditions for designing the screw anchors.
- .7 If local existing condition do not allow for the installation of helical anchors then the use of an alternative concrete caisson will be required. Final design of alternative foundation to be determined based on local conditions determined on site and approved by Departmental Representative.
- .8 Acceptable Product: Valmont West Coast Engineering or approved equal

2.8 OTHER MATERIAL

- .1 Anti-seize compound:
 - .1 Acceptable material: Bostik Never-Seize No. NSBT-16 or Loctite No. 767.

3 EXECUTION

3.1 STAKE MOUNT EDGE LIGHT INSTALLATION

- .1 Install new edge lights, as indicated on the drawings.

- .2 At approximate positions indicated and at exact locations as measured on site, install light unit anchor stake set plumb and vertical with the groove of the breakable coupling at same elevation as adjacent ground surface. Do not obstruct the break-off groove with pavement or soil. Auger out a hole to accommodate installation of stake.
- .3 Ensure stakes are exactly plumb and true. Ensure stake heads do not protrude above surrounding finished grade.
- .4 Assemble in accordance with the manufacturer's instructions. Use ample amounts of anti-seize compound when assembling fixture. When threading frangible coupling into stake head do not use a wrench or pliers – hand tighten only. Frangible coupling must be removable from stake head but must be secure and tight.
- .5 For hard wired light connect isolating transformer secondary lead to light unit cord assembly by means of disconnecting plug and receptacle.
- .6 Level and align the light unit as recommended by manufacturer.
- .7 Install lamp of proper rating as indicated.
- .8 Install lens as indicated and aim as instructed by manufacturer.

3.3 PAPI INSTALLATION

- .1 Install ASLC cables as loop circuits for power supply to isolating transformers along the route indicated.
- .2 Pull in FRE conduit as indicated.
- .3 Install isolating transformers, 200 W (or as otherwise recommended and supplied by the manufacturer) 6.6A /6.6A at locations indicated on drawings.
- .4 Place in pull pits as indicated.
- .5 Assemble PAPI light units following manufacturer's instructions.
- .6 Install helical anchor or concrete foundation
- .7 Install PAPI units on concrete base or helical anchor using transition plate as indicated
- .8 Install and cut legs from 2" galvanized EMT, length as required, to provide PAPI light beam elevation as indicated in the electrical details section of the drawings. To be verified by the Departmental Representative during construction.
- .9 Install 2C#12 SOW secondary cables from the isolating transformers as indicated. Fasten SOW cables to inside of rear leg assembly of each unit, using black nylon ties.
- .10 Install ground rods as indicated. Make connections to ground rods and equipment housings using 1/C #8 SDBC wire and suitable ground connector.
- .11 Identify "A", "B", "C" and "D" PAPI units with lamacoid tags (black face with white core) with indicated angular setting angles.
- .12 Touch up paint finish with enamel, CGSB colour No. 508-101, international orange.

- .13 Set the dip switch setting which allows for permanent frost prevention. Ensure that the constant current regulator powering the PAPI system output low voltage (step 1 or 2) to the PAPIs at all times.
- .14 Install the PAPI junction box and communication wires as indicated in the Drawings. PAPI communication cables to be routed in dedicated raceway between individual light unit pull pits and connected to junction boxes within pull pits. Ensure that the PAPI units automatically shut off should one of them go too far out of alignment.

END OF SECTION 16 32 00

1.0 GENERAL

- 1.1 This Section covers items common to Sections of Division 16 and all other applicable specified electrical works
- 1.2 Refer the Plan of Construction Operations for additional details related to the project scheduling.
- 1.3 Refer to all other sections of the Specification for applicable supplemental requirements.

2.0 PRODUCTS

2.1 INTERNALLY ILLUMINATED AIRFIELD GUIDANCE SIGNS

- .1 The LED signs shall conform to the requirements of Transport Canada Aerodrome Standards and Recommended Practices specification TP 312E 5th Ed. A Letter of Attestation from an independent testing authority shall be available for the LED signs and must be submitted upon request.
- .2 The LED sign shall have a visible Face Height of 600mm with a Legend Height of 400mm. To ensure compliance with legend spacing requirements, the LED sign shall be available in visible panel widths from 700mm to 3700mm. To minimize acquisition and installation costs, each LED sign shall be available as either single face or double face. Use of two separate signs for double-sided messages is not allowed.
- .3 The sign light source shall utilize individual Light Emitting Diode (LED) assemblies. To ensure long LED life and high lumen maintenance, individual LEDs shall be mounted directly on a heatsink panel and be widely spaced.
- .4 The LED sign must maintain constant brightness at all Constant Current Regulator (CCR) step settings. To minimize spare parts needs, the same LED DC power supply circuit shall properly operate when powered from either a 4.8A – 6.6A (3-step), a 2.8A – 6.6A (5-step) or a 5.5A (1-step) 50 or 60Hz series circuit.
- .5 The LED sign shall be designed to operate in an ambient temperature range of -55°C to +55°C (-55°F to +131°F).
- .6 Isolation transformer secondary power wiring shall be routed out the bottom of the sign or bottom of externally mounted power supply enclosure.
- .7 The sign shall include an On/Off switch that bypasses the isolation transformer secondary current during maintenance activities.
- .8 To ensure maximum pilot visibility, the sign shall have a flat, vertical face and shall have illumination uniformity exceeding TP 312E 5th Ed luminance requirements. The sign face shall be a translucent color (white, yellow or red) according to the sign application type. The sign shall not use panel dividers on continuous messages. However, the sign shall have the capability of including panel dividers between different types of messages in order to minimize replacement cost if a panel needs to be changed.
- .9 The sign shall use a bolted structure to provide for easy field repair/refurbishment and to reduce repair costs. The LED signs shall be able to withstand wind loads of 322 kph (200 mph) minimum and the sign frangible couplings shall break before the wind loading reaches 480 km/h (300 mph).

- .10 The LED signs shall be available in taller overall heights of [48" (1219mm)] [60" (1524mm)] [72" (1829mm)].
- .11 For each sign, include required frangible mounting legs, length as indicated in drawings, to the underside of the sign, number determined by sign length and manufacturer's design.
- .12 Cast aluminum mounting flanges to attach mounting legs to concrete pad footing or transition plate. Include necessary anchor bolts, stainless steel nuts, bolts and washers.
- .13 To maximize maintenance personnel safety, there shall be no more than 240Vdc at any point inside the sign. In addition, the LED power supply circuit shall output a regulated DC current.
- .14 Individual sign LEDs shall be wired in a series/parallel combination that allows for redundancy in case of one or two consecutive LED failures.
- .15 The LED DC power supply circuit shall impose a low load (VA) on the CCR and shall be mounted internally on the upper portion of the sign or externally in a separate enclosure. The LED power supply unit shall meet or exceed an IP66 rating for moisture and debris ingress protection.
- .16 Each sign shall consume a maximum of 250VA and require no more than one isolation transformer with a maximum rating of 200W while operating on 3 or 5 step circuits at any brightness step. For each sign, include the required isolating transformers determined by the manufacturer's design.
- .17 The LED power supply circuit shall not require field calibration. The LED sign shall have an input Power Factor >0.98 as measured on the secondary side of the L-830 or L-831 isolation transformer. Both the input maximum VA load and the maximum load imposed on the CCR shall be shown on the catalog sheet included with the submittal documents.
- .18 The sign box enclosure shall meet or exceed IP54 rating for moisture and debris ingress protection.
- .19 The LED power supply units shall have a warranty of 4 years minimum.
- .20 Approved manufacturers: Eaton/Crouse Hinds PRO APF AGS LED model or approved equal

3 EXECUTION

3.1 INSTALLATION OF ILLUMINATED GUIDANCE SIGNS

- .1 Locate new sign as detailed on the Site Plan drawings. Ensure indicated guidance sign location dimensions are met to +/- 25mm and are not less than that indicated
- .2 Install concrete pad footings at locations to suit guidance sign dimensioned locations as indicated.
- .3 Install granular apron as indicated.
- .4 Install support flanges, support legs and sign box on concrete pad.
- .5 Supply and install pulpit c/w 50mm rigid PVC conduit for secondary cabling as indicated. Install weatherhead at surface.

- .6 Install ground rod. Install ground connector at ground rod and ground cable. Make ground connections to new sign using ground connections supplied with sign.
- .7 Supply and install on site fabricated 2C#12 AWG secondary extension leads complete with secondary connectors, approximate length of 1500mm, one for each isolating transformer.
- .8 Make secondary connections to secondary cable leads supplied with new guidance sign.
- .9 Supply and install new primary connectors at pulpit end of new ASLC cabling and terminate to isolating transformers.
- .10 Supply and install new primary connectors at supply end of new ASLC cabling and terminate to existing ASLC cabling and isolating transformer at taxi edge.
- .11 Once the guidance sign is energized, adjust tap settings on the CVT in accordance with manufacturer's instructions if applicable. Ensure constant brightness when primary circuit current changes.
- .12 Complete backfill work and restore grades to match existing.

END OF SECTION 16 33 00

1.0 GENERAL

- 1.1 This Section covers items common to Sections of Division 16 and all other applicable specified electrical works
- 1.2 Refer the Plan of Construction Operations for additional details related to the project scheduling.
- 1.3 Refer to all other sections of the Specification for applicable supplemental requirements.

2.0 PRODUCTS

2.1 WIND DIRECTION INDICATOR

- .1 Windssocks to be internally lit meeting the frangibility requirements of ICAO Standard Part 6, Doc 9157, AN/901, and TP312, 5th Edition.
- .2 Windssock fabric to be 900mm diameter x 3.6 m long, nylon, treated with water repellent and equipped with drainage grommets. Color coding to be aviation orange and white in alternating colour bands meeting Transport Canada and CAR621 requirements. Fabric support cage to be lightweight aluminum frame, 750mm long.
- .3 Rotary swivel mechanism shall incorporate ball bearings sealed against dust and moisture penetration. The swivel assembly must permit full 360° rotation with precision vaning for wind direction indication.
- .4 Windssocks to be internally illuminated using a LED light element with constant brightness power supply and isolation transformer, powered by a 6.6A series circuit and providing the illumination levels specified in TP312, 5th Edition.
- .5 Windssock support towers to be 4.9m high, aluminum mast, center hinged with counterweight, complete with winch mechanism to allow lamp to be lowered to ground level for servicing or replacement. Painted finish to be powder coated aviation orange with a 5-year warranty.
- .6 The towers shall be suitable for concrete base mounting complete with base flange. The windssocks are to be frangibly mounted using fuse bolts.
- .7 The windssocks shall be equipped with a weatherproof isolation switch to disconnect lamp power for servicing and a constant brightness transformer.
- .8 Provide one (1) removable winch per site.
- .9 Approved manufacturers: Millard Towers Ltd., ADB-Safegate or approved equal.

3 EXECUTION

3.1 WIND DIRECTION INDICATOR INSTALLATION

- .1 Assemble windssock and windssock tower in accordance with manufacturer's instruction and install on base complete with frangible fuse bolts. Ensure concrete footing and windssock tower base bolt spacing is matched. Fuse bolts must be vertically plumb and may not be horizontally stressed upon installation.
- .2 Install all cables and perform electrical connections as detailed on the drawings.
- .3 Drive in ground rod and bond to windssock mast using #6 ground wire as shown.
- .4 Install lamp and confirm correct operation of illuminated windssock.
- .5 Train the airport personnel on raising and lowering the windssock.

END OF SECTION 16 34 00

1.0 GENERAL

- .1 This Section covers items common to Sections of Division 16 and all other applicable specified electrical works.
- .2 Refer the Plan of Construction Operations for additional details related to the project scheduling.
- .3 Refer to all other sections of the Specification for applicable supplemental requirements.

2.0 PRODUCTS

2.1 VOLTAGE POWERED RUNWAY THRESHOLD IDENTIFICATION LIGHTS (RTIL)

- .1 Provide a new RTIL system for Runway 25. The RTIL system shall be FAA type L-849V, style A and consist of two (2) high-intensity, unidirectional, white, flashing LED light units. One (1) unit shall serve as the primary (master) and one (1) as the secondary (slave). System performance and operation shall comply with Transport Canada TP312 – 5th Edition specifications.
- .2 The light units shall operate at a single intensity (15,000 cd) and be voltage powered from a mini-substation as detailed on the drawings.
- .3 The two (2) LED light units shall be flashed simultaneously with no more than a 20ms separation and at a rate of 90 ±30 flashes per minute.
- .4 Each control cabinet shall include a door interlock that deactivates incoming power when the door is opened.
- .5 Operating conditions: Temperature range of -45° to +55°C, wind velocity to 100 knots, all weather.
- .6 Provide a new mini power center for the RTILs comprised of a primary isolating disconnect switch, step-down transformer, and panelboard, complete with a new support structure.
- .7 Acceptable manufacturer: ADB-Safegate. Acceptable alternative: Strobe Approach Lighting Technology (SALT).
- .8 Equipment supply shall include set up, calibration and certification on site by a factory trained technician.

2.2 ISOLATING DISCONNECT SWITCH

- .1 Unit to be a 30A. 600VAC, 2 pole, single throw manual starting switch.
- .2 Unit to be labelled with lamacoid nameplate to read "RUNWAY 25 RTIL DISCONNECT SWITCH", permanently fastened to the switch enclosure with rivets or screws.
- .3 Enclosure to be weatherproof, CSA 3S/3SX type, stainless steel, aluminum, or non-metallic.
- .4 Ability for installation of pad lock for lock out procedure when power is disconnected.
- .5 Acceptable manufacturer Square D, Cutler-Hammer, Siemens, Bryant or approved equal.

2.3 STEP-DOWN TRANSFORMER

- 1. Step-down transformer to be single-phase, 600V primary, 120/240V secondary, 60Hz, and be 3kVA power rated.

2. Enclosure to be weatherproof, CSA 4X type, stainless steel.
3. Transformer must be CSA certified and meet or exceed CSA C802.2 minimum standard level efficiency values.
4. Acceptable manufacturer: Rex Power Magnetics, Part No. SC3J-K/EP/E4X. Acceptable alternatives: Hammond, Marcus, or approved equal.

2.4 PANELBOARD

1. Panelboard is to have a 30A, 120/240V minimum rating, a 15A-2P main breaker, and have a minimum capacity of 4-2P branch circuits.
2. Enclosure to be weatherproof, CSA 4X type, stainless steel or non-metallic.
3. Panelboard must be CSA listed and certified.
4. Acceptable manufacturers: Eaton, Square D/Schneider Electric, Siemens, or approved equal.

2.5 RTIL HELICAL ANCHOR

- .1 To be designed by Professional Structural Engineer licensed in Manitoba and stamped that it meets the requirements to support the structure and prevent frost heaving. Submit shop drawing for approval complete with stamp prior to ordering / installation.
- .2 Welding per CSA W59-13
- .3 Steel shall be Grade B ASTM A36 or equivalent hot rolled carbon steel.
- .4 Hot dip galvanized after welding per CSA G164.M1981.
- .5 Designed for top plate compatibility for of manufacturer supplied transition plate.
- .6 The Contractor will be required to conduct bore holes and soil geotechnical investigation, to assist in determining soil conditions for designing the screw anchors.
- .7 Acceptable Product: Valmont West Coast Engineering or approved equal

3 EXECUTION

3.1 VOLTAGE POWERED RUNWAY THRESHOLD IDENTIFICATION LIGHTS (RTIL) INSTALLATION

- .1 At approximate locations shown and at exact locations as measured on site, install the RTIL units complete with their helical anchor foundations and transition plates as detailed on the drawings.
- .2 Construct the new support structure as detailed on the drawings for the mini substation and mount the equipment.
- .3 Ensure that both flash heads are installed at the same elevation above the threshold.
- .4 Provide all cables, conduits and connectors as detailed on the drawings and as per manufacturer's instructions. Install all cables, conduits and connectors in accordance with other specification sections.
- .5 Aim the RTIL's in accordance with Transport Canada TP312 – 5th Edition requirements and confirm correct operation.

- .6 Restore the surface to match surrounding grade.

END OF SECTION 16 35 00

1.0 GENERAL

1.1 SECTION INCLUDES

- .1 Removal of abandoned cables, conduits and ducts.
- .2 Removal of abandoned electrical pull pits.
- .3 Removal of existing concrete foundations.
- .4 Removal of electrical light fixtures, support structures and associated cabling.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 54 50 – Safety Requirements
- .3 Section 01 56 10 - Environmental Protection.
- .4 Section 01 80 00 - Airports in Use.
- .5 Section 31 23 10 - Excavating, Trenching and Backfilling.

1.3 SUBMITTALS

- .1 The Contractor shall comply with requirements of Section 01 33 00 - Submittal Procedures, unless otherwise directed.

1.4 STORAGE AND PROTECTION

- .1 The Contractor shall be responsible for the following:
 - .1 Protect in accordance with Section 31 22 14 - Airfield Grading, and Section 31 23 10 - Excavating, Trenching and Backfilling.
 - .2 Protect existing items designated to remain and items designated for salvage. In event of damage to such items, immediately replace or make repairs to approval of the Departmental Representative

1.5 QUALITY CONTROL

- .1 General: Unless otherwise directed, the Contractor shall comply with applicable regulatory, security, safety, environmental and other Airport requirements in carrying out the Work.

2.0 PRODUCTS Not Used.

3.0 EXECUTION

3.1 PREPARATION

- .1 The Contractor shall:
 - .1 Inspect Site with the Departmental Representative and verify extent and location of items designated for removal, disposal, alternative disposal, recycling, salvage and items to remain prior to commencement of construction Work.
 - .2 Locate and protect utilities. Preserve active utilities traversing site in operating condition. Comply with Section 01 80 00 – Airport in Use, with respect to notification of the

Departmental Representative and daylighting of existing utilities.

- .3 Notify and obtain approval of utility companies before starting demolition.
- .4 Prior to start of Work, examine existing conditions and provide adequate means for carrying out the Work and ensure compliance with airport operations requirements, security and safety requirements, environmental protection, sequence of operation, access, etc.

3.2 MISCELLANEOUS REMOVALS

- .1 The Contractor shall be responsible for the following:
 - .1 Removals:
 - .1 Remove items as indicated.
 - .2 Do not disturb items designated to remain in place.
 - .3 In removal of pavements, curbs and gutters:
 - .1 Square up adjacent surfaces to remain in place by saw cutting or other method approved by the Departmental Representative.
 - .2 Protect adjacent joints and load transfer devices.
 - .3 Protect underlying and adjacent granular materials where appropriate.
 - .4 In removal of fences and gates, provide substitute fencing for security, if required, prior to removal and as per plans and specifications. Salvage fence fabric, gate posts, gates and hardware as per plans and specifications.
 - .5 When removing pipes i.e. storm drains, subdrains, pipe culverts etc. under existing or future pavement and other areas, excavate at least 300 mm below pipe invert. Trench excavation width subject to the Departmental Representative's approval.
 - .6 In partial or total removal of manholes, catch basins, inlets, electrical utility vaults, etc. excavate to such extent as to ensure safe demolition and removal of structures. Neatly remove and clean cover/gratings and frames for salvage or dispose offsite as specified.
 - .7 In removal of pavement markings, provide sandblasting, shot-blasting or high-pressure water blasting equipment to remove painted surfaces as specified or directed. Method of removal is subject to the Departmental Representative's approval.
 - .8 Where Contractor encounters abandoned cables, in areas of excavation, ensure that cable(s) are not energized and obtain the Departmental Representative's direction prior to removal. Contractor to record location of removed cable.

3.3 MILLING / GRINDING PAVEMENT

- .1 The Contractor shall be responsible for the following:
 - .1 Provide a power operated, self-propelled milling machine to:
 - .1 Remove asphalt pavement to the required depth, profile, cross slope, and surface.
 - .2 Accurately establish profile grades by referencing from either the existing pavement on from an independent grade control;
 - .3 Control cross slope;
 - .4 Apply sufficient down-pressure to plane the milled surface; and
 - .5 Effective remove cutting from the pavement and preventing dust from escaping into the air.

- .2 Provide a mechanical sweeper and, as deemed necessary, water truck to control dust.
- .3 Provide supplemental equipment as necessary to remove material adjacent to curbs, railroad crossings, and other areas that cannot be removed by the milling machine.
- .4 Saw cut perimeter area to be milled/grinded as shown on drawings.
- .5 Mill/grind existing asphalt and concrete pavements as required and dispose of resulting material off or on Airport property, as directed.
- .6 Ensure milling/grinding down 5mm to 10mm into lower surface/layer and create a rough surface.
- .7 Use light jackhammers for partial depth removal of concrete pavement.
- .8 Prior to paving over milled/grinded areas, clean pavement surface by power broom, flush and vacuum surface to remove fine debris and dust particles. Pavement must be cleaned to the satisfaction of the Departmental Representative prior to proceeding with tacking and paving operations.

3.4 SALVAGE

- .1 The Contractor shall be responsible for the following:
 - .1 Salvage:
 - .1 Items to be salvaged;
 - .1 Chain link fence fabric, vinyl fence fabric, gates and gate posts and hardware.
 - .2 Cast iron/ductile iron manhole cover/grating and frames as indicated.
 - .3 Electrical and other items shown on drawings, or as directed.
 - .2 Carefully dismantle items containing materials for salvage, clean and stockpile salvaged materials at suitable locations on airport property and hand over to the Departmental Representative.
 - .3 Dispose of or stockpile milled and grinded material as specified or directed by the Departmental Representative.

3.5 SEALING

- .1 The Contractor shall be responsible for the following:
 - .1 Sealing:
 - .1 Seal pipe ends and walls of manholes or catch basins as indicated or required. Securely plug to form watertight seal. Advise the Departmental Representative and allow time for inspection and approval prior to backfilling.
 - .2 Seal all saw cuts and joints.

3.6 DISPOSAL

- .1 The Contractor shall be responsible for the following:
 - .1 Disposal:
 - .1 Dispose of materials not designated for salvage or re-use in Work off airport property, unless otherwise directed.
 - .2 Dispose to approved dumping areas and pay for dumping fees.

3.7 BACKFILL

- .1 The Contractor shall be responsible for the following:
 - .1 Backfill and compact trenches, holes, pits and low areas resulting from demolition and removal work in accordance with Section 31 22 14 - Airfield Grading and Section 31 23

10 - Excavating, Trenching and Backfilling.

3.8 RESTORATION

- .1 The Contractor shall be responsible for the following:
 - .1 Restore areas and existing works outside areas of demolition to match condition of adjacent undisturbed areas
 - .2 Reinststate all disturbed topsoil and grassed areas outside the limits of new pavements and as a result of demolition and removal.

3.9 CLEANUP

- .1 Upon completion of Work, the Contractor shall remove debris, trim surfaces and leave work site clean.

END OF SECTION 31 02 10

1.0 GENERAL

1.1 SUMMARY

- .1 This section defines correction to maximum dry density and takes into account aggregate particles larger than 4.75 mm.

1.2 REFERENCES

- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM C127 Standard Test Method for Specific Gravity and Absorption of Coarse Aggregate.
 - .2 ASTM D698 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (600 kN-m/m³)).
 - .3 ASTM D1557, Test Method for moisture-Density relation of soils and soil aggregate Mixture Using 4.54 kg Hammer and 457 mm drop.
 - .4 ASTM D4253, Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.

1.3 DEFINITIONS

- .1 Corrected maximum dry density is defined as:
 - .1 $D = (F1 \times D1) + (0.9 \times D2 \times F2)$
 - .2 Where: D = corrected maximum dry density kg/m³.
 - F1 = fraction (decimal) of total field sample passing 4.75 mm sieve.
 - F2 = fraction (decimal) of total field sample retained on 4.75 sieve. (equal to 1.00 - F1)
 - D1 = maximum dry density, kg/m³ of material passing 4.75 mm sieve determined in accordance with Method D of ASTM D1557.
 - D2 = bulk density, kg/m³, of material retained on 4.75 mm sieve, equal to 1000 G where G is bulk specific gravity (dry basis) of material when tested to ASTM C127.

END OF SECTION 31 05 10

1.0 GENERAL

1.1 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures.
- .2 Section 03 30 00 – Cast-in-Place Concrete.
- .3 Section 31 23 10 – Excavating, Trenching and Backfilling.

1.2 REFERENCES

- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM D 4318, Standard Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils.
 - .2 ASTM D 4791, Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate.

1.3 SAMPLES

- .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Allow continual sampling by Departmental Representative during production.
- .3 Provide Departmental Representative with access to source and processed material for sampling.
- .4 Pay cost of sampling and testing of aggregates which fail to meet specified requirements.

2.0 PRODUCTS

2.1 MATERIALS

- .1 All materials shall be supplied by the Contractor.
- .2 Aggregate quality: sound, hard, durable material free from soft, thin, elongated or laminated particles, organic material, clay lumps or minerals, or other substances that would act in deleterious manner for use intended.
- .3 Flat and elongated particles of coarse aggregate: to ASTM D 4791.
 - .1 Greatest dimension to exceed four times least dimension.
- .4 Plasticity Index: to ASTM D4318.
- .5 Fine aggregates satisfying requirements of applicable section to be one, or blend of following:
 - .1 Natural sand.
 - .2 Manufactured sand.
 - .3 Screenings produced in crushing of quarried rock, boulders, gravel or slag.
- .6 Coarse aggregates satisfying requirements of applicable section to be one of or blend of following:
 - .1 Crushed rock.

2.2 SOURCE QUALITY CONTROL

- .1 Inform Departmental Representative of proposed source of aggregates and provide access for sampling at least 4 weeks prior to commencing production.

- .2 If, in opinion of Departmental Representative, materials from proposed source do not meet, or cannot reasonably be processed to meet, specified requirements, locate an alternative source or demonstrate that material from source in question can be processed to meet specified requirements.
- .3 Advise Departmental Representative 4 weeks in advance of proposed change of material source sampling and testing. Cost of sampling and testing associated with a change in source during the Work shall be borne by the Contractor.
- .4 Acceptance of material at source does not preclude future rejection if it fails to conform to requirements specified, lacks uniformity, or if its field performance is found to be unsatisfactory.

3.0 EXECUTION

3.1 PREPARATION

- .1 Processing
 - .1 Process aggregate uniformly using methods that prevent contamination, segregation and degradation.
 - .2 Blend aggregates, if required, to obtain gradation requirements, percentage of crushed particles, or particle shapes, as specified.
 - .3 Wash aggregates, if required to meet specifications. Use only equipment approved by Departmental Representative.
 - .4 When operating in stratified deposits use excavation equipment and methods that produce uniform, homogeneous aggregate.
- .2 Handling
 - .1 Handle and transport aggregates to avoid segregation, contamination and degradation.
- .3 Stockpiling
 - .1 Stockpile aggregates on site in locations as indicated unless directed otherwise by Departmental Representative. Do not stockpile on completed pavement surfaces.
 - .2 Stockpile aggregates in sufficient quantities to meet Project schedules.
 - .3 Stockpiling sites to be level, well drained, and of adequate bearing capacity and stability to support stockpiled materials and handling equipment.
 - .4 Separate different aggregates by strong, full depth bulkheads, or stockpile far enough apart to prevent intermixing.
 - .5 Do not use intermixed or contaminated materials. Remove and dispose of rejected materials as directed by Departmental Representative within 48 hours of rejection.
 - .6 Stockpile materials in uniform layers of thickness as follows:
 - .1 Max 1.0 m for coarse aggregate and base course materials.
 - .2 Max 1.5 m for fine aggregate and sub-base materials.
 - .3 Max 1.5 m for other materials.
 - .7 Uniformly spot-dump aggregates delivered to stockpile in trucks and build up stockpile as specified.
 - .8 Do not cone piles or spill material over edges of piles.
 - .9 Do not use conveying stackers.

- .10 During winter operations, prevent ice and snow from becoming mixed into stockpile or in material being removed from stockpile.

3.2 CLEANING

- .1 Leave aggregate stockpile site in tidy, well drained condition, free of standing surface water.
- .2 Leave any unused aggregates in neat compact stockpiles as directed by Departmental Representative.

3.3 WEIGHING OF AGGREGATES

- .1 Weigh aggregates as required for measurement and payment. Include the cost of weigh scales, including installation, operation, issuance of weigh tickets, and removal, in the unit price for items measured by weight.

END OF SECTION 31 05 17

1.0 GENERAL

1.1 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 56 10 - Environmental Protection
- .3 Section 03 30 00 – Cast-in-Place Concrete.
- .4 Section 31 02 10 - Sitework Demolition and Removal
- .5 Section 31 05 10 - Corrected Maximum Dry Density for Fill.
- .6 Section 31 05 17 – Aggregates: General.

1.2 REFERENCES

- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM C117, Standard Test Method for Material Finer Than 0.075 mm (No.200) Sieve in Mineral Aggregates by Washing.
 - .2 ASTM C136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .3 ASTM D422, Standard Test Method for Particle-Size Analysis of Soils.
 - .4 ASTM D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³) (600 kN-m/m³).
 - .5 ASTM D1557, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³) (2,700 kN-m/m³).
 - .6 ASTM D4318, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
- .2 Canadian General Standards Board (CGSB).
 - .1 CAN/CGSB-8.2, Sieves, Testing, Woven Wire, Metric.
- .3 Canadian Standards Association (CSA)
 - .1 CAN/CSA-A3000, Cementitious Materials Compendium.
 - .2 CAN/CSA-A23.1, Concrete Materials and Methods of Concrete Construction.

1.3 DEFINITIONS

- .1 Excavation classes: Two classes of excavation will be recognized; Common Excavation and Rock Excavation.
 - .1 Common Excavation: excavation of all materials whatever the nature, including topsoil, borrow, granular base, granular subbase, shale, sandstone, dense tills, hardpan, frozen materials and partially cemented materials that can be ripped and excavated with heavy construction equipment.
 - .2 Rock Excavation: Excavation of material from solid masses of igneous, sedimentary or metamorphic rock which, prior to its removal, was integral with its parent mass, cannot be removed by excavation and/or ripping and requires blasting or pneumatic hammer, and includes boulders or rock fragments having individual size in excess of 1 metre.
- .2 Topsoil: material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping and seeding.
- .3 Waste material: excavated material unsuitable for use in work or surplus to requirements.

- .4 Borrow material: material obtained from locations outside area to be graded and required for construction of fill areas or for other portions of work.
- .5 Native material: Existing sand and silt subgrade material including sand and silt with some/trace gravel and sandstone cobbles, as encountered in the borehole logs enclosed as Appendix A.
- .6 Pavement structure: combination of layers of unbound or stabilized granular subbase, base, and asphalt or concrete surfacing.
- .7 Subgrade elevation: elevation immediately below pavement structure.
- .8 Unsuitable materials:
 - .1 Weak and compressible materials under pavement areas.
 - .2 Frost susceptible materials within 750 mm of finished grade under pavement areas.
 - .3 Frost susceptible materials:
 - .1 Fine grained soils with plasticity index less than 10 when tested to ASTM D4318, and gradation within limits specified when tested to ASTM D422-63 and ASTM C136: Sieve sizes to CAN/CGSB-8.1.

<u>Sieve Designation % passing</u>	
2.00 mm	100
0.10 mm	45-100
0.02 mm	10-80
0.005 mm	0-45
 - .2 Coarse grained soils containing more than 20 % by mass passing 0.075 mm sieve.

1.4 SUBMITTALS

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

1.5 QUALITY ASSURANCE

- .1 Submit design and supporting data for unshrinkable fill and other imported materials at least 2 weeks prior to commencing Work.
- .2 Keep design and supporting data on site.

1.6 PROTECTION OF EXISTING FEATURES

- .1 Protect existing features in accordance with Section 31 02 10 Sitework Demolition and Removal.
- .2 Existing buried utilities and structures:
 - .1 Size, depth and location of existing utilities and structures as indicated are for guidance only. Completeness and accuracy are not guaranteed.
 - .2 Prior to commencing excavation Work, notify Departmental Representative, establish location and state of use of buried utilities and structures. Contractor or authorities having jurisdiction to clearly mark such locations to prevent disturbance during Work.
 - .3 Confirm locations of buried utilities by careful test excavations.
 - .4 Maintain and protect from damage, water, sewer, gas, electric, telephone and other utilities and structures encountered.
 - .5 Where utility lines or structures exist in area of excavation, obtain direction of Departmental Representative before removing re-routing.
 - .6 Record location of maintained, re-routed and abandoned underground lines.
 - .7 Confirm locations of recent excavations adjacent to area of excavation.

- .3 Existing buildings and surface features:
 - .1 Conduct, with Departmental Representative, condition survey of existing buildings, trees and other plants, lawns, fencing, service poles, wires, rail tracks, pavement, survey bench marks and monuments which may be affected by Work.
 - .2 Protect existing buildings and surface features from damage while Work is in progress. In event of damage, immediately make repair to approval of Departmental Representative.

2.0 PRODUCTS

2.1 MATERIALS

- .1 Granular Subbase and Granular Base: Unless otherwise specified, comply with applicable requirements of Sections 32 11 19 – Granular Subbase and 32 11 21 – Granular Base, respectively, and Section 31 05 17 – Aggregates.
- .2 Borrow: Material resulting from excavation on site and which is suitable for use as pavement embankment fill and capping of graded areas. Selected material from excavations which do not contain weak or compressible materials, and free of rocks larger than 75 mm, topsoil, cinders, ashes, sods, refuse or other deleterious materials.
- .3 Native Material: Material resulting from excavation on site including sand and silt, gravel and sandstone cobbles.
- .4 Unshrinkable fill: proportioned and mixed to provide.
 - .1 Minimum compressive strength of 0.4 MPa at 28 days.
 - .2 Minimum Portland cement content of 25 Kg/m³.
 - .3 Minimum strength of 0.07 MPa at 24 hours.
 - .4 Concrete aggregates: to CAN/CSA-A23.1
 - .5 Portland cement: Type GU.
 - .6 Slump: 160-200 mm, +- 20 mm.
 - .7 Comply with applicable requirements of Section 03 30 00 - Cast-in-Place Concrete.
- .5 Concrete bedding: to the requirements of Section 03 30 00 – Cast-in-Place Concrete.
- .6 Bedding Sand: Concrete Bedding Sand to Section 33 46 17 – Subgrade Drainage Network.
- .7 Clearstone: Clearstone shall comply with Section 31 05 17 – Aggregates – General and the following requirements:
 - .1 Clearstone shall be free from flat, elongated or other objectionable particles and shall be approved by the Departmental Representative prior to construction.
 - .2 Gradation:

Sieve Size (mm)	Percent Passing
26.5	100
19	90 – 100
12.5	
9.5	0-55
4.75	0-10
0.075	0-2.0

- .3 Physical Properties:
 - .1 Absorption: to ASTM C 127, 1.75% max

- .2 Plasticity Index: to ASTM D 4318, 0
- .3 Micro-Deval: to ASTM D 6928, 25% max

3.0 EXECUTION

3.1 SITE PREPARATION

- .1 Remove obstructions, ice and snow, from surfaces to be excavated within limits indicated.
- .2 Cut pavement or sidewalk neatly along limits of proposed excavation in order that surface may break evenly and cleanly in accordance with Section 31 02 10 Sitework Demolition and Removals.

3.2 TOPSOIL STRIPPING

- .1 Strip topsoil to depths as directed by Departmental Representative. Do not mix topsoil with subsoil.
- .2 Stockpile in locations as directed by Departmental Representative.
- .3 Dispose of unused topsoil in the stockpiles identified on the drawings. Departmental Representative may authorize thicker topsoil layers than specified on the drawings outside of RESA and runway graded areas.

3.3 STOCKPILING

- .1 Stockpile fill materials in areas designated by Departmental Representative. Stockpile granular materials in manner to prevent segregation.
- .2 Protect fill materials from contamination.

3.4 COFFERDAMS, SHORING, BRACING AND UNDERPINNING

- .1 Obtain permit from authority having jurisdiction for temporary diversion of water course.
- .2 Construct temporary Works to depths, heights and locations as indicated or approved by Departmental Representative.
- .3 During backfill operation:
 - .1 Unless otherwise as indicated or as directed by Departmental Representative, remove sheeting and shoring from excavations.
 - .2 Do not remove bracing until backfilling has reached respective levels of such bracing.
 - .3 Pull sheeting in increments that will ensure compacted backfill is maintained at an elevation at least 500 mm above toe of sheeting.
- .4 When sheeting is required to remain in place, cut off tops at elevations as indicated.
- .5 Upon completion of substructure construction:
 - .1 Remove cofferdams, shoring and bracing.
 - .2 Remove excess materials from site and restore water courses as indicated and as directed by Departmental Representative.

3.5 DEWATERING AND HEAVE PREVENTION

- .1 Keep excavations free of water while Work is in progress.
- .2 Submit for Departmental Representative's approval details of proposed dewatering or heave prevention methods, such as dikes, well points, and sheet pile cut-offs.

- .3 Avoid excavation below groundwater table if quick condition or heave is likely to occur. Prevent piping or bottom heave of excavations by groundwater lowering, sheet pile cut-offs, or other means.
- .4 Protect open excavations against flooding and damage due to surface run-off.
- .5 Dispose of water in accordance local environmental regulations and in manner not detrimental to public and private property, or any portion of Work completed or under construction.

3.6 EXCAVATION

- .1 Excavate to lines, grades, elevations and dimensions as indicated.
- .2 Remove concrete masonry paving walks demolished foundations and rubble and other obstructions encountered during excavation in accordance with Section 31 02 10 – Sitework Demolition and Removals.
- .3 Excavation must not interfere with bearing capacity of adjacent foundations.
- .4 For trench excavation, unless otherwise authorized by Departmental Representative in writing, do not excavate more than 30 m of trench in advance of installation operations and do not leave open more than 15 m at end of day's operation.
- .5 Keep excavated and stockpiled materials a safe distance away from edge of trench.
- .6 Restrict vehicle operations directly adjacent to open trenches.
- .7 Dispose of surplus and unsuitable excavated material in approved location on site or off site.
- .8 Do not obstruct flow of surface drainage or natural watercourses.
- .9 Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft or organic matter.
- .10 Notify Departmental Representative when bottom of excavation is reached.
- .11 Obtain Departmental Representative approval of completed excavation.
- .12 Remove unsuitable material from trench bottom to extent and depth as directed by Departmental Representative.
- .13 Correct unauthorized over-excavation as follows:
- .14 Fill with Native Material compacted to not less than 95% MPmdd.
- .15 Trim, make firm and remove loose material and debris from excavations. Where material at bottom of excavation is disturbed, compact foundation soil to density at least equal to undisturbed soil.
- .16 Excavation adjacent to existing runways and taxiways shall be carried out without undermining the existing pavements or other facilities. Protect existing pavements and facilities and repair any damage to the satisfaction of the Departmental Representative. Any disturbed areas adjacent to open aprons, taxiways and runways (42.5 m from a taxiway centerline and 47.5 m taxiway centerline and 90.0 m from runway centerline) to be stabilized as directed by the Departmental Representative until areas are restored or completed

3.7 BEDDING AND SURROUND OF UNDERGROUND SERVICES

- .1 Place and compact sand or granular base for bedding and surround of underground services as indicated.
- .2 Place bedding and surround material in unfrozen condition.
- .3 Place concrete encasement as indicated under airfield pavements.

3.8 BACKFILLING

- .1 Do not proceed with backfilling operations until Departmental Representative has inspected and approved installations.
- .2 Areas to be backfilled to be free from debris, snow, ice, water and frozen ground.
- .3 Do not use backfill material which is frozen or contains ice, snow or debris.
- .4 Place backfill material in uniform layers not exceeding 150 mm compacted thickness up to grades indicated. Compact each layer before placing succeeding layer. For compaction requirements see Section 31 22 14 - Airfield Grading.
- .5 Backfill around installations.
 - .1 Do not backfill around or over cast-in-place concrete within 24 h after placing of concrete.
 - .2 Place layers simultaneously on both sides of installed work to equalize loading. Difference not to exceed 0.5 m.
 - .3 Where temporary unbalanced earth pressures are liable to develop on walls or other structures:
 - .1 Permit concrete to cure for minimum 14 days or until it has sufficient strength to withstand earth, compaction pressure and approval obtained from Departmental Representative or:
 - .2 If approved by Departmental Representative, erect bracing or shoring to counteract imbalance, and leave in place until removal is approved by Departmental Representative.
- .6 Place unshrinkable fill in locations as indicated.

3.9 RESTORATION

- .1 Upon completion of Work, remove waste materials and debris and trim slopes, correct defects as directed by Departmental Representative.
- .2 Replace topsoil in accordance with Section 32 91 21 – Topsoil and Finish Grading.
- .3 Replace pavements in accordance with Sections 32 11 21 – Granular Base, Section 32 11 19 – Granular Subbase, and Section 32 12 16 – Asphalt Paving.
- .4 Clean and reinstate areas affected by Work as directed by Departmental Representative.

END OF SECTION 31 23 10

1.0 GENERAL

1.1 RELATED SECTIONS

- .1 Section 31 05 10 - Corrected Maximum Dry Density for Fill.
- .2 Section 31 05 17 - Aggregate General.
- .3 Section 31 23 10 – Excavating, Trenching and Backfilling.

1.2 REFERENCES

- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM C117, Standard Test Methods for Material Finer Than 0.075 mm Sieve in Mineral Aggregates by Washing.
 - .2 ASTM C131, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
 - .3 ASTM C136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .4 ASTM D1557, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000ft-lbf/ft³) (2,700kN-m/m³).
 - .5 ASTM D1883, Standard Test Method for CBR (California Bearing Ratio) of Laboratory Compacted Soils.
 - .6 ASTM D4318, Standard Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils.
- .1 Ministry of Transportation – Ontario (MTO) Laboratory Testing Manual
 - .1 LS-608 Percent Flat and Elongated Particles in Coarse Aggregate
 - .2 LS-614 Freezing and Thawing of Coarse Aggregate
 - .3 LS-618 The Resistance of Coarse Aggregate to Degradation by Abrasion in the Micro-Deval Apparatus

1.3 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, handle and stockpile aggregates in accordance with Section 31 05 17 - Aggregate General.

2.0 PRODUCTS

2.1 MATERIALS

- .1 Granular base: material in accordance with Section 31 05 17 - Aggregate General and following requirements:
 - .1 Crushed rock.
 - .2 Gradations to be within limits specified when tested to ASTM C 136 and ASTM C 117.
 - .3 Gradation:

Sieve	% Passing	Designation
31.5 mm	100	25.0 mm 95 – 100
12.5 mm	56 – 82	4.75 mm 31 – 59

2.36mm	21 – 46	1.18 mm	13 – 34
0.300 mm	5 – 18	0.075 mm	0 – 8

- .4 Other Properties as follows:
 - .1 Micro-Deval Abrasion to MTO LS-618: Max. loss 25%.
 - .2 Freeze Thaw Loss to MTO LS-614: Max. loss 15%.
 - .3 Crushed particles, Min. 100%
 - .4 Flat and Elongated (4:1), Max 20%.
 - .5 Plasticity Index, Max. 3.

2.2 SAMPLES

- .1 Submit samples of granular base materials in required quantities for testing prior to construction.

3.0 EXECUTION

3.1 INSPECTION OF UNDERLYING SUB-BASE

- .1 Place granular base after subbase surface is inspected and approved by Departmental Representative.

3.2 PLACING

- .1 Construct granular base to depth and grade in areas indicated.
- .2 Ensure no frozen material is placed. Hauling and placing material cannot take place in conditions below 0 degrees Celsius.
- .3 Place material only on clean unfrozen surface, free from snow and ice.
- .4 Begin spreading base material on crown line or on high side of one-way slope.
- .5 Place material using methods which do not lead to segregation or degradation of aggregate.
- .6 Place material to full width in uniform layers not exceeding 150 mm compacted thickness. Departmental Representative may authorize thicker lifts (layers) if specified compaction can be achieved.
- .7 Shape each layer to smooth contour and compact to specified density before succeeding layer is placed.
- .8 Remove and replace that portion of layer in which material becomes segregated during spreading.
- .9 Spray and stabilize exposed granular base adjacent to runways and taxiways with asphalt tack coat or alternative liquid dust control coat as directed by the Departmental Representative prior to reopening adjacent runways and taxiways.

3.3 COMPACTION EQUIPMENT

- .1 Compact to density not less than 100% MPmdd.
- .2 Shape and roll alternately to obtain smooth, even and uniformly compacted base.
- .3 Apply water in a controlled manner to maintain the material within +/- 2% of optimum soil moisture content for compaction.
- .4 In areas not accessible to rolling equipment, compact to specified density with mechanical tampers approved by Departmental Representative.
- .5 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.

- .6 Compaction equipment to be capable of obtaining required material densities.

3.4 SITE TOLERANCES

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

3.5 PROTECTION

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

END OF SECTION 32 11 21

APPENDIX A:

GEOTECHNICAL REPORT

Submitted to:

AVIA NG CONSULTANTS

SOIL INVESTIGATION AND FOUNDATION DESIGN

CHURCHILL, MANITOBA



OCTOBER 2018

FILE NO. 18-166-81

DRAFT



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ATTACHMENTS

Figure 1 – Site and Test Pit Location Plan

Modified Unified Classification System for Soils

Stratigraphic Test Pit Logs (17)

Particle Size Analysis (5)

1.0 INTRODUCTION

ENG-TECH Consulting Limited (ENG-TECH) completed the requested geotechnical investigation for the proposed approach lighting towers and floodlighting at the Churchill Airport in Churchill, Manitoba. The purpose of the investigation was to assess the soil conditions within the proposed lighting tower and floodlighting areas in order to provide recommendations for foundation, drainage and concrete durability.

1.1 Scope of Work

ENG-TECH completed the following scope of work:

- A test pit and soil sampling program.
- A laboratory testing program.
- An assessment and engineering report outlining the investigation.

2.0 TEST HOLE DRILLING, SOIL SAMPLING AND LABORATORY TESTING

ENG-TECH supervised the excavation of a total of seventeen (17) test pits (TP1 to TP17) on October 1, 2018 at the locations shown on Figure 1. The test pits were excavated using a Doosan DX 190W excavator, owned and operated by Merv's Excavating. All the test pits were dug to refusal (suspected frost) or to a depth of 3.0 m below grade. All test pits were backfilled using the excavated soil materials upon the completion of digging.

The soil stratigraphy was visually classified at the time of drilling using the modified Unified Soil Classification System (USCS). Soil samples were collected off the excavator bucket and retained for testing in ENG-TECH's Winnipeg laboratory.

Moisture contents were determined on all soil samples collected (50), while three (5) hydrometer tests were completed on select samples. The moisture content results are shown on the test pit summary logs, while the hydrometer results are shown on separate report.

3.0 STRATIGRAPHY

Overall, the stratigraphy at the site from TP1 to TP15 consists of sand followed by a layer of low plastic silt till. The sand was brown, moist to wet, medium dense, poorly graded and contained some to-with gravel. The silt till was grey, damp to moist, firm, low plastic and contained trace to-some sand, gravel and clay. TP16 and TP17 consist of a thick layer of sand followed by silt. The sand layer was consistent with the remaining test pits, while the silt layer was brown, moist, very soft, low plastic and contained trace clay.

Water seepage was encountered in some test pits, typically at the interface between the sand layer and the silt till layer. This was often due to the proximity of water in some test pit areas. Sloughing occurred in some test pits, typically where the seepage was located. The large excavation and the nature of the non-cohesive soils present also created instability in the excavation, causing sloughing. Suspected permafrost was encountered varying from 2.0 m to 3.0 m below grade at most test pits. Detailed stratigraphy descriptions are presented on the test hole summary logs.

4.0 RECOMMENDATIONS

4.1 General

Based on the soil conditions at the site and the typical loads of the light stands, a foundation design consisting of footings is the most suitable and economical foundation system to use at the site. The footings can be founded on the silt till layer between 1.5 m and 2.0 m below grade. Based on the observations made during test pits excavation, there will be a high potential for excessive seepage and sloughing while excavating the sand for preparation of the sub-grade preparation. Other foundation types were not considered as geotechnically feasible given the soil conditions.

4.1.1 Footings

Footings can be founded on the silt till or bedrock for the proposed lighting between 1.5 and 2.0 m below existing grade. The shape of lighting footings can be circular or square and with shallow foundations at this location, frost can cause movement in the future. Movements can be minimized with adequate sub-grade preparation and site drainage. The design of the foundation to aid to minimize movement would require the base of the footings be prepared as outlined:

- Remove all topsoil, vegetation and soils to 100 mm below the underside of the footings with an additional 0.2 m width on each side of the footings. The exposed sub-grade should consist of silt till, although at TP16 and TP 17 sand was encountered to just below 2.0 m, and shallow refusal occurred on suspected bedrock at TP14 and TP15.
- Hard compact the upper 200 mm of the exposed sub-grade to 97% of its Maximum Dry Density (MDD) at 2% of optimum moisture content in order to decrease the voids created during excavating. The sub-grade should be inspected by ENG-TECH prior to placement of any base material. Instructions for dealing with soft spots will be provided after inspection.
- Place 100 mm of limestone "A" base or material having equivalent property in a single lift and hard compact to 100% of MDD at $\pm 2\%$ of optimum moisture content to the underside of the footings design elevations.
- The base of the footings should be protected from inundation and drying prior to placement of the base material and concrete.

The bearing capacity of 480 kPa (Ultimate Limit States) and 380 kPa (Serviceable Limit States) can be used for the vertical load on the footings. Outline below are other soil parameters that can be used to assess the light stands:

Soil	Ko	Ka	Kp	Unit Weight (kN/m ³)
Sand	0.55	0.38	2.64	19
Till	0.50	0.33	3.00	20

4.2 Concrete

All concrete should be designed, specified, and constructed in accordance with CSA standard A23.1-14, Concrete Materials and Methods of Concrete Construction using the Performance Specification Alternative as outlined in Table 5 of CSA A23.1-14.

Under the performance alternative, the concrete supplier shall assume responsibility for the performance of the concrete as delivered and the contractor shall assume responsibility for the concrete in place. The owner shall specify performance requirements including: the required structural criteria and concrete strength at age, the concrete exposure class for durability, and any other properties that may be required to meet the owner's performance requirements. The owner reserves the right to request the supplier provide satisfactory documentation that the proposed mix design will achieve the strength, durability, and performance requirements specified by the owner, and that the mix design satisfies the requirements of CSA A23.1-14. In addition, the owner may request the contractor submit documentation demonstrating the owner's performance requirements have been met during construction and placement.

Based on Tables 1, 2, 3, and 4 of CSA A23.1-14, the concrete in contact with the local soils can be classified as an S-2 exposure class for the footings. The concrete design can be selected as structurally required; however, the concrete must be designed to meet the minimum specifications outlined below for durability.

Footings

56 day minimum compressive strength of 32 MPa
Maximum water/cementing materials ratio of 0.45
Maximum nominal aggregate size of 20 mm
Type HS or HSb cement
Air content of 4-7%

4.3 Drainage

Proper surface drainage is essential to reduce the potential of frost action, and to reduce excess moisture adjacent the foundation. Medium to highly plastic clay soils should be used to raise the site adjacent the proposed lighting to achieve proper drainage away from the foundation. Surface drainage should be controlled by ensuring a minimum grade away from the lighting of 4% for well compacted surface soils and 2% for paved surfaces for a minimum distance of 3 m.

5.0 CLOSURE

This report was based on the scope of work outlined for the purpose of the investigation, and was prepared in accordance with acceptable professional engineering principles and practices. If you have any questions, please contact the undersigned.

Sincerely,
ENG-TECH Consulting Limited

Alex Wang, M.Sc., EIT
Engineering Department

CDH/zw

DRAFT

Clark Hryhoruk, M.Sc., P.Eng.
President, Geotechnical Engineer



TEST PIT LOCATION TABLE

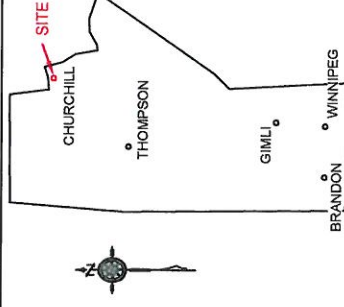
PIT #	APPROXIMATE COORDINATES OF TEST PITS AS OF OCTOBER 1, 2018		PIT #	APPROXIMATE COORDINATES OF TEST PITS AS OF OCTOBER 1, 2018	
	UTM	15V		UTM	15V
TP 1	6508915	439295	TP 10	6509495	439013
TP 2	6508987	439272	TP 11	6510075	438632
TP 3	6509042	439235	TP 12	6511845	437863
TP 4	6509114	439201	TP 13	6511921	437853
TP 5	6509154	439180	TP 14	6512991	437960
TP 6	6509224	439153	TP 15	6512976	438002
TP 7	6509288	439119	TP 16	6513093	438667
TP 8	6509358	439078	TP 17	6513086	438716
TP 9	6509401	439056			



LEGEND



TEST PIT



KEYMAP

NO.	DATE	ISSUE / REVISION
0	Oct 2018	Report



420 Turenne Street
Winnipeg, MB
R2J 3W8
Phone: (204) 233-1694
Fax: (204) 235-1579

ENG. STAMP:



CLIENT:

AVIA NG CONSULTANTS

PROJECT:

GEOTECHNICAL TEST PITS,
CHURCHILL AIRPORT, CHURCHILL,
MANITOBA

DWG DESCRIPTION:

SITE & TEST PIT LOCATION PLAN

SCALE:

N.T.S.

DRAWN BY:

ZW

DATE:

OCTOBER 2018

CLIENT DWGFIG. No.:

18-166-81

ENG-TECH DWGFIG. No.:

1 of 1

MODIFIED UNIFIED CLASSIFICATION SYSTEM FOR SOILS						
MAJOR DIVISION			GROUP SYMBOL	GRAPH SYMBOL	TYPICAL DESCRIPTION	LABORATORY CLASSIFICATION CRITERIA
COARSE GRAINED SOILS (MORE THAN HALF BY WEIGHT LARGER THAN 75 µm)	GRAVELS MORE THAN HALF THE COARSE FRACTION LARGER THAN 4.75 mm	CLEAN GRAVELS (TRACE OR NO FINES)	GW		WELL GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	$C_u = \frac{D_{60}}{D_{10}} > 4$; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}} = 1 \text{ TO } 3$
			GP		POORLY GRADED GRAVELS, GRAVEL- SAND MIXTURES, LITTLE OR NO FINES	NOT MEETING ABOVE REQUIREMENTS
		DIRTY GRAVELS (WITH SOME OR MORE FINES)	GM		SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES	ATTERBERG LIMITS BELOW "A" LINE OR P.I. LESS THAN 4
			GC		CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES	ATTERBERG LIMITS ABOVE "A" LINE AND P.I. MORE THAN 7
	SANDS MORE THAN HALF THE COARSE FRACTION SMALLER THAN 4.75 mm	CLEAN SANDS (TRACE OR NO FINES)	SW		WELL GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES	$C_u = \frac{D_{60}}{D_{10}} > 6$; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}} = 1 \text{ TO } 3$
			SP		POORLY GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES	NOT MEETING ABOVE REQUIREMENTS
		DIRTY SANDS (WITH SOME OR MORE FINES)	SM		SILTY SANDS, SAND-SILT MIXTURES	ATTERBERG LIMITS BELOW "A" LINE OR P.I. LESS THAN 4
			SC		CLAYEY SANDS, SAND-CLAY MIXTURES	ATTERBERG LIMITS ABOVE "A" LINE AND P.I. MORE THAN 7
FINE GRAINED SOILS (MORE THAN HALF BY WEIGHT SMALLER THAN 75 µm)	SILTS BELOW "A" LINE NEGLECTIBLE ORGANIC CONTENT	LL ≤ 50%	ML		INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY SANDS OF SLIGHTY PLASTICITY	CLASSIFICATION IS BASED UPON PLASTICITY CHART (SEE BELOW)
		LL > 50%	MH		INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS, FINE SANDY OR SILTY SOILS	
	CLAYS ABOVE "A" LINE NEGLECTIBLE ORGANIC CONTENT	LL ≤ 30%	CL		INORGANIC CLAYS OF LOW PLASTICITY, GRAVELLY, SANDY OR SILTY CLAYS, LEAN CLAYS	
		30% < LL ≤ 50%	CI		INORGANIC CLAYS OF MEDIUM PLASTICITY, SILTY CLAYS	
		LL > 50%	CH		INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS	
	ORGANIC SILTS & CLAYS BELOW "A" LINE	LL < 50%	OL		ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY	
		LL > 50%	OH		ORGANIC CLAYS OF HIGH PLASTICITY	
	HIGHLY ORGANIC SOILS		PI		PEAT AND OTHER HIGHLY ORGANIC SOILS	

ADDITIONAL SYMBOLS			
TILL		SANDSTONE	
FILL		GRANITE	
TOPSOIL			
CONCRETE			
SHALE			
LIMESTONE			

PLASTIC SOILS					
MOISTURE	PLASTICITY	INTRUSIONS	CONSISTENCY	POCKET PEN (TSF)	(N)
DRY	LOW	ROOTLETS	VERY SOFT		< 2
DAMP	MEDIUM	OXIDES	SOFT	0 - 0.5	2 - 4
MOIST	HIGH	MICA	FIRM	0.5 - 1.0	4 - 8
WET		GYPSUM	STIFF	1.0 - 2.0	8 - 15
		ETC.	VERY STIFF	2.0 - 4.0	15 - 30
			HARD	> 4.0	> 30
TSF x 95.8 = kPa (q _u) S _u = 1/2 x q _u					

SOIL DESCRIPTIONS			
TRACE: 0 - 10%	BOULDERS: > 200 mm	COARSE SAND: 2 - 4.75 mm	
SOME: 10 - 20%	COBBLES: 75 - 200 mm	MEDIUM SAND: 0.425 - 2 mm	
WITH: 20 - 35%	COURSE GRAVEL: 19 - 75 mm	FINE SAND: 0.075 - 0.425 mm	
AND: 35 - 50%	FINE GRAVEL: 4.75 - 19 mm	FINES: < 0.075 mm	

GRANULAR SOILS				
MOISTURE	DENSITY	GRADATION	INTRUSIONS	SPT (N)
DRY	VERY LOOSE	POORLY	ROOTLETS	0 - 4
DAMP	LOOSE	WELL	OXIDES	4 - 10
MOIST	MED. DENSE		MICA	10 - 30
WET	DENSE		FINES	30 - 50
	VERY DENSE		ETC.	> 50

DEFINITIONS	
LL = LIQUID LIMIT	C _c = COMPRESSION INDEX
P.I. = PLASTICITY INDEX	PL = PLASTIC LIMIT
C _u = COEFFICIENT OF UNIFORMITY	
q _u = UNCONFINED COMPRESSIVE STRENGTH	
S _u = UNDRAINED SHEAR STRENGTH	

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F:\Drafting\SOIL CLASSIFICATIONS\SOIL CLASSIFICATIONS.dwg



Engineering And Testing
Solutions That Work For You

Test Hole #: TP1

Client: Avia NG Consultants

Site: See Figure 1

Location: Churchill, MB

Project: Geotechnical Investigation - Churchill Airport

File No.: 18-166-81

Date Drilled: Oct. 1, 2018

Grade Elevation: 100.0 m

Water Elevation: --

SUBSURFACE PROFILE				SAMPLE DATA				SHEAR STRENGTH (kPa)		
Depth (m)	Soil Symbol	Description	Elevation (m)	Sample No.	Sample Type	Moisture Content (%)	Blows/300 mm	Moisture Content (%)		
								PL -----X----- LL	P. Pen	Torvane
								20 40 60 80		UC
0.0		Ground Surface	100.0							
		Sand (SP) - brown, moist, medium dense, poorly graded, some gravel.								
				S1		4.1				
1.0		Silt Till (ML) - grey, moist, firm, low plastic, some sand, some gravel, some clay.	99.0			19.7				
				S2						
2.0		End of Test Pit - end of test pit at 2.0 m below grade on suspected permafrost. - seepage encountered at 0.6 m below grade. - sloughing encountered at 1.2 m below grade. - test pit backfilled with excavated test pit material.	98.0			13.6				
				S3						
3.0			97.0							
4.0			96.0							

ENG-TECH Consulting Limited

Logged by: JD

Reviewed by:

Drilled By: Merv's Excavating

Drill Rig: Doosan DX 190W

Auger Size: Excavator Bucket

Completion Depth: 2.0 m

Completion Elevation: 98.0 m

Sheet: 1 of 1

SAMPLE TYPE



SPLIT BARREL



SHELBY TUBE



AUGER CUTTINGS



SPLIT SPOON



Engineering And Testing
Solutions That Work For You

Test Hole #: TP2

Client: Avia NG Consultants

Site: See Figure 1

Location: Churchill, MB

Project: Geotechnical Investigation - Churchill Airport

File No.: 18-166-81

Date Drilled: Oct. 1, 2018

Grade Elevation: 100.0 m

Water Elevation: --

SUBSURFACE PROFILE				SAMPLE DATA				SHEAR STRENGTH (kPa)		
Depth (m)	Soil Symbol	Description	Elevation (m)	Sample No.	Sample Type	Moisture Content (%)	Blows/300 mm	Moisture Content (%)		
								PL -----X----- LL		
								20 40 60 80	P. Pen	Torvane
									UC	
0.0		Ground Surface	100.0							
		Sand (SP) - brown, moist, medium dense, poorly graded, some gravel.		S1		8.6				
1.0		Silt Till (ML) - grey, moist, firm, low plastic, some sand, some gravel, some clay.	99.0	S2		12.0				
2.0			98.0	S3		12.1				
3.0		End of Test Pit - end of test pit at 2.3 m below grade on suspected permafrost. - no seepage encountered. - no sloughing encountered. - test pit backfilled with excavated test pit material.	97.0							
4.0			96.0							

ENG- TECH Consulting Limited

Logged by: JD

Reviewed by:

Drilled By: Merv's Excavating

Drill Rig: Doosan DX 190W

Auger Size: Excavator Bucket

Completion Depth: 2.3 m

Completion Elevation: 97.7 m

Sheet: 1 of 1

SAMPLE TYPE



SPLIT BARREL



SHELBY TUBE



AUGER CUTTINGS



SPLIT SPOON



**Engineering And Testing
Solutions That Work For You**

Test Hole #: TP3

Client: Avia NG Consultants

Site: See Figure 1

Location: Churchill, MB

Project: Geotechnical Investigation - Churchill Airport

File No.: 18-166-81

Date Drilled: Oct. 1, 2018

Grade Elevation: 100.0 m

Water Elevation: --

SUBSURFACE PROFILE				SAMPLE DATA				SHEAR STRENGTH (kPa)		
Depth (m)	Soil Symbol	Description	Elevation (m)	Sample No.	Sample Type	Moisture Content (%)	Blows/300 mm	Moisture Content (%)		
								PL -----X----- LL	P. Pen	Torvane
								20 40 60 80		UC
0.0		Ground Surface	100.0							
		Sand (SP) - brown, moist, medium dense, poorly graded, some gravel.		S1		11.2				
		Silt Till (ML) - grey, moist, firm, low plastic, trace sand, trace gravel, some clay.								
1.0			99.0	S2		13.3				
2.0			98.0							
				S3		9.6				
3.0		End of Test Pit - end of test pit at 2.6 m below grade on suspected permafrost. - no seepage encountered. - no sloughing encountered. - test pit backfilled with excavated test pit material.	97.0							
4.0			96.0							

ENG- TECH Consulting Limited

Logged by: JD

Reviewed by:

Drilled By: Merv's Excavating

Drill Rig: Doosan DX 190W

Auger Size: Excavator Bucket

Completion Depth: 2.6 m

Completion Elevation: 97.4 m

Sheet: 1 of 1

SAMPLE TYPE



SPLIT BARREL



SHELBY TUBE



AUGER CUTTINGS



SPLIT SPOON



Engineering And Testing
Solutions That Work For You

Test Hole #: TP4

Client: Avia NG Consultants

Site: See Figure 1

Location: Churchill, MB

Project: Geotechnical Investigation - Churchill Airport

File No.: 18-166-81

Date Drilled: Oct. 1, 2018

Grade Elevation: 100.0 m

Water Elevation: --

SUBSURFACE PROFILE				SAMPLE DATA						SHEAR STRENGTH (kPa)		
Depth (m)	Soil Symbol	Description	Elevation (m)	Sample No.	Sample Type	Moisture Content (%)	Blows/300 mm	Moisture Content (%)		P. Pen	Torvane	UC
								PL -----X----- LL 20 40 60 80				
0.0		Ground Surface	100.0									
		Sand (SP) - brown, moist, medium dense, poorly graded, some gravel.		S1		4.9						
		Silt Till (ML) - grey, moist, firm, low plastic, some sand, some gravel, some clay.										
1.0			99.0									
				S2		13.5						
2.0			98.0									
				S3		14.1						
3.0		End of Test Pit - end of test pit at 2.6 m below grade on suspected permafrost. - no seepage encountered. - no sloughing encountered. - test pit backfilled with excavated test pit material.	97.0									
4.0			96.0									

ENG- TECH Consulting Limited

Logged by: JD

Reviewed by:

Drilled By: Merv's Excavating

Drill Rig: Doosan DX 190W

Auger Size: Excavator Bucket

Completion Depth: 2.6 m

Completion Elevation: 97.4 m

Sheet: 1 of 1

SAMPLE TYPE



SPLIT BARREL



SHELBY TUBE



AUGER CUTTINGS



SPLIT SPOON



Engineering And Testing
Solutions That Work For You

Test Hole #: TP5

Client: Avia NG Consultants

Site: See Figure 1

Location: Churchill, MB

Project: Geotechnical Investigation - Churchill Airport

File No.: 18-166-81

Date Drilled: Oct. 1, 2018

Grade Elevation: 100.0 m

Water Elevation: --

SUBSURFACE PROFILE				SAMPLE DATA				SHEAR STRENGTH (kPa)		
Depth (m)	Soil Symbol	Description	Elevation (m)	Sample No.	Sample Type	Moisture Content (%)	Blows/300 mm	Moisture Content (%)		
								PL -----X----- LL	P. Pen	Torvane
								20 40 60 80		UC
0.0		Ground Surface	100.0							
		Sand (SP) - brown, moist, medium dense, poorly graded, some gravel.								
		Silt Till (ML) - grey, moist, firm, low plastic, trace sand, some gravel, some clay.		S1		10.7				
1.0			99.0							
				S2		12.5				
2.0			98.0							
				S3		12.8				
3.0		End of Test Pit - end of test pit at 2.4 m below grade on suspected permafrost. - seepage encountered at 0.5 m below grade. - no sloughing encountered. - test pit backfilled with excavated test pit material.	97.0							
4.0			96.0							

ENG- TECH Consulting Limited

Logged by: JD

Reviewed by:

Drilled By: Merv's Excavating

Drill Rig: Doosan DX 190W

Auger Size: Excavator Bucket

Completion Depth: 2.4 m

Completion Elevation: 97.6 m

Sheet: 1 of 1

SAMPLE TYPE



SPLIT BARREL



SHELBY TUBE



AUGER CUTTINGS



SPLIT SPOON



**Engineering And Testing
Solutions That Work For You**

Test Hole #: TP6

Client: Avia NG Consultants

Site: See Figure 1

Location: Churchill, MB

Project: Geotechnical Investigation - Churchill Airport

File No.: 18-166-81

Date Drilled: Oct. 1, 2018

Grade Elevation: 100.0 m

Water Elevation: --

SUBSURFACE PROFILE				SAMPLE DATA				SHEAR STRENGTH (kPa)		
Depth (m)	Soil Symbol	Description	Elevation (m)	Sample No.	Sample Type	Moisture Content (%)	Blows/300 mm	Moisture Content (%)		
								PL -----X----- LL	P. Pen	Torvane
								20 40 60 80		UC
0.0		Ground Surface	100.0							
		Sand (SP) - brown, moist, medium dense, poorly graded, some gravel.								
		Silt Till (ML) - grey, moist, firm, low plastic, some sand, some gravel, some clay.		S1		6.3				
1.0			99.0							
				S2		13.5				
2.0			98.0							
				S3		10.2				
3.0		End of Test Pit - end of test pit at 2.3 m below grade on suspected permafrost. - seepage encountered at 0.6 m below grade due to proximity to wetlands. - no sloughing encountered. - test pit backfilled with excavated test pit material.	97.0							
4.0			96.0							

ENG- TECH Consulting Limited

Logged by: JD

Reviewed by: *CA*

Drilled By: Merv's Excavating

Drill Rig: Doosan DX 190W

Auger Size: Excavator Bucket

Completion Depth: 2.3 m

Completion Elevation: 97.7 m

Sheet: 1 of 1

SAMPLE TYPE



SPLIT BARREL



SHELBY TUBE



AUGER CUTTINGS



SPLIT SPOON



**Engineering And Testing
Solutions That Work For You**

Test Hole #: TP7

Client: Avia NG Consultants

Site: See Figure 1

Location: Churchill, MB

Project: Geotechnical Investigation - Churchill Airport

File No.: 18-166-81

Date Drilled: Oct. 1, 2018

Grade Elevation: 100.0 m

Water Elevation: --

SUBSURFACE PROFILE				SAMPLE DATA						SHEAR STRENGTH (kPa)		
Depth (m)	Soil Symbol	Description	Elevation (m)	Sample No.	Sample Type	Moisture Content (%)	Blows/300 mm	Moisture Content (%)	P. Pen	Torvane	UC	
0.0		Ground Surface	100.0					PL -----X----- LL 20 40 60 80				
		Sand (SP) - brown, wet, medium dense, poorly graded, some gravel.										
		Silt Till (ML) - grey, moist, firm, low plastic, trace sand, trace gravel, some clay.		S1		12.7						
1.0			99.0	S2		12.2						
2.0			98.0									
		End of Test Pit - end of test pit at 2.3 m below grade on suspected permafrost. - seepage encountered at 0.6 m below grade due to proximity to wetlands. - no sloughing encountered. - test pit backfilled with excavated test pit material.		S3		9.9						
3.0			97.0									
4.0			96.0									

ENG- TECH Consulting Limited

Logged by: JD

Reviewed by:

Drilled By: Merv's Excavating

Drill Rig: Doosan DX 190W

Auger Size: Excavator Bucket

Completion Depth: 2.3 m

Completion Elevation: 97.7 m

Sheet: 1 of 1

SAMPLE TYPE



SPLIT BARREL



SHELBY TUBE



AUGER CUTTINGS



SPLIT SPOON



Engineering And Testing
Solutions That Work For You

Test Hole #: TP8

Client: Avia NG Consultants

Site: See Figure 1

Location: Churchill, MB


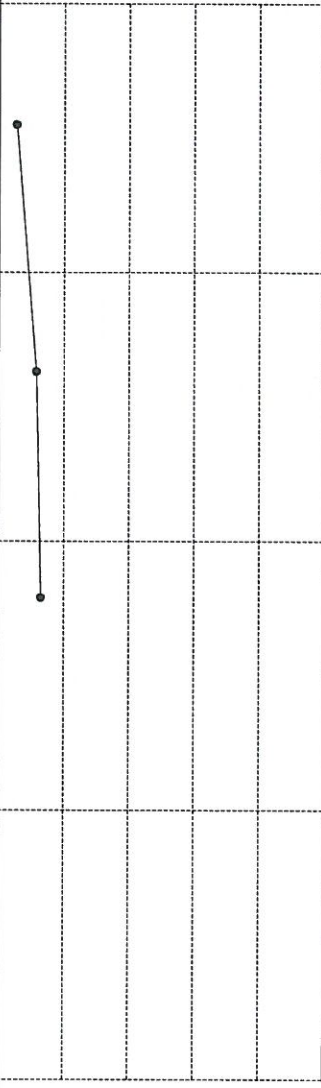



Project: Geotechnical Investigation - Churchill Airport

File No.: 18-166-81

Date Drilled: Oct. 1, 2018

Grade Elevation: 100.0 m

Water Elevation: --

SUBSURFACE PROFILE				SAMPLE DATA				SHEAR STRENGTH (kPa)		
Depth (m)	Soil Symbol	Description	Elevation (m)	Sample No.	Sample Type	Moisture Content (%)	Blows/300 mm			
								Moisture Content (%)		
								PL -----X----- LL 20 40 60 80		
0.0		Ground Surface	100.0							
		Sand (SP) - brown, moist, medium dense, poorly graded, some gravel.		S1		5.3				
1.0		Silt Till (ML) - grey, moist, firm, low plastic, trace sand, trace gravel, trace clay.	99.0	S2		11.5				
2.0			98.0	S3		13.0				
		End of Test Pit - end of test pit at 2.3 m below grade on suspected permafrost. - no seepage encountered. - no sloughing encountered. - test pit backfilled with excavated test pit material.								
3.0			97.0							
4.0			96.0							

ENG-TECH Consulting Limited

Logged by: JD

Reviewed by:

Drilled By: Merv's Excavating

Drill Rig: Doosan DX 190W

Auger Size: Excavator Bucket

Completion Depth: 2.3 m

Completion Elevation: 97.7 m

Sheet: 1 of 1

SAMPLE TYPE



SPLIT BARREL



SHELBY TUBE



AUGER CUTTINGS



SPLIT SPOON



Engineering And Testing
Solutions That Work For You

Test Hole #: TP9

Client: Avia NG Consultants

Site: See Figure 1

Location: Churchill, MB

Project: Geotechnical Investigation - Churchill Airport

File No.: 18-166-81

Date Drilled: Oct. 1, 2018

Grade Elevation: 100.0 m

Water Elevation: --

SUBSURFACE PROFILE				SAMPLE DATA						SHEAR STRENGTH (kPa)		
Depth (m)	Soil Symbol	Description	Elevation (m)	Sample No.	Sample Type	Moisture Content (%)	Blows/300 mm	Moisture Content (%)	P. Pen	Torvane	UC	
								PL -----X----- LL 20 40 60 80				
0.0		Ground Surface	100.0									
		Sand (SP) - brown, moist, medium dense, poorly graded, some gravel.		S1		5.6						
1.0		Silt Till (ML) - grey, moist, firm, low plastic, some sand, trace gravel, some clay.	99.0	S2		12.1						
2.0			98.0									
		End of Test Pit - end of test pit at 2.7 m below grade on suspected permafrost. - no seepage encountered. - no sloughing encountered. - test pit backfilled with excavated test pit material.	97.0	S3		14.2						
3.0												
4.0			96.0									

ENG- TECH Consulting Limited

Logged by: JD

Reviewed by:

Drilled By: Merv's Excavating

Drill Rig: Doosan DX 190W

Auger Size: Excavator Bucket

Completion Depth: 2.7 m

Completion Elevation: 97.3 m

Sheet: 1 of 1

SAMPLE TYPE



SPLIT BARREL



SHELBY TUBE



AUGER CUTTINGS



SPLIT SPOON



**Engineering And Testing
Solutions That Work For You**

Test Hole #: TP10

Client: Avia NG Consultants

Site: See Figure 1

Location: Churchill, MB

Project: Geotechnical Investigation - Churchill Airport

File No.: 18-166-81

Date Drilled: Oct. 1, 2018

Grade Elevation: 100.0 m

Water Elevation: --

SUBSURFACE PROFILE				SAMPLE DATA				SHEAR STRENGTH (kPa)						
Depth (m)	Soil Symbol	Description	Elevation (m)	Sample No.	Sample Type	Moisture Content (%)	Blows/300 mm	Moisture Content (%)			P. Pen	Torvane	UC	
								PL	X	LL				
0.0		Ground Surface	100.0					20	40	60	80			
		Sand (SP) - brown, moist, medium dense, poorly graded, some gravel.		S1		4.7								
1.0			99.0											
		Silt Till (ML) - grey, moist, firm, low plastic, some sand, trace gravel, some clay.		S2		16.4								
2.0			98.0	S3		12.4								
		End of Test Pit - end of test pit at 2.0 m below grade due to excessive sloughing of test pit. - no seepage encountered. - sloughing encountered in sand layer. - test pit backfilled with excavated test pit material.												
3.0			97.0											
4.0			96.0											

ENG- TECH Consulting Limited

Logged by: JD

Reviewed by:

Drilled By: Merv's Excavating

Drill Rig: Doosan DX 190W

Auger Size: Excavator Bucket

Completion Depth: 2.0

Completion Elevation: 98.0

Sheet: 1 of 1

SAMPLE TYPE



SPLIT BARREL



SHELBY TUBE



AUGER CUTTINGS



SPLIT SPOON



**Engineering And Testing
Solutions That Work For You**

Test Hole #: TP11

Client: Avia NG Consultants

Site: See Figure 1

Location: Churchill, MB

Project: Geotechnical Investigation - Churchill Airport

File No.: 18-166-81

Date Drilled: Oct. 1, 2018

Grade Elevation: 100.0 m

Water Elevation: --

SUBSURFACE PROFILE				SAMPLE DATA				SHEAR STRENGTH (kPa)		
Depth (m)	Soil Symbol	Description	Elevation (m)	Sample No.	Sample Type	Moisture Content (%)	Blows/300 mm	Moisture Content (%)		
								PL -----X----- LL	P. Pen	Torvane
								20 40 60 80		UC
0.0		Ground Surface	100.0							
		Sand Till (SP)								
		- brown, damp, medium dense, poorly graded, some gravel.		S1		3.7				
		- below 0.5 m, grey, some to with silt.								
1.0			99.0							
				S2		3.6				
2.0			98.0							
				S3		4.5				
3.0		End of Test Pit	97.0							
		- end of test pit at 3.0 m below grade on suspected permafrost.								
		- no seepage encountered.								
		- no sloughing encountered.								
		- test pit backfilled with excavated test pit material.								
4.0			96.0							

ENG- TECH Consulting Limited

Logged by: JD

Reviewed by:

Drilled By: Merv's Excavating

Drill Rig: Doosan DX 190W

Auger Size: Excavator Bucket

Completion Depth: 3.0 m

Completion Elevation: 97.0 m

Sheet: 1 of 1

SAMPLE TYPE



SPLIT BARREL



SHELBY TUBE



AUGER CUTTINGS



SPLIT SPOON



**Engineering And Testing
Solutions That Work For You**

Test Hole #: TP12

Client: Avia NG Consultants

Site: See Figure 1

Location: Churchill, MB

Project: Geotechnical Investigation - Churchill Airport

File No.: 18-166-81

Date Drilled: Oct. 1, 2018

Grade Elevation: 100.0 m

Water Elevation: --

SUBSURFACE PROFILE				SAMPLE DATA								SHEAR STRENGTH (kPa)		
Depth (m)	Soil Symbol	Description	Elevation (m)	Sample No.	Sample Type	Moisture Content (%)	Blows/300 mm	Moisture Content (%)				P. Pen	Torvane	UC
								PL -----X----- LL 20 40 60 80						
0.0		Ground Surface	100.0											
		Gravel (GP) - brown, moist, dense, poorly graded, some to with sand.		S1		3.3								
1.0		Silt Till (ML) - grey, moist, firm, low plastic, trace sand, trace gravel, some clay.	99.0	S2		8.3								
2.0			98.0											
		End of Test Pit - end of test pit at 2.6 m below grade on suspected permafrost. - seepage encountered at 1.1 m below grade. - no sloughing encountered. - test pit backfilled with excavated test pit material.		S3		10.2								
3.0			97.0											
4.0			96.0											

ENG- TECH Consulting Limited

Logged by: JD

Reviewed by:

Drilled By: Merv's Excavating

Drill Rig: Doosan DX 190W

Auger Size: Excavator Bucket

Completion Depth: 2.6 m

Completion Elevation: 97.4 m

Sheet: 1 of 1

SAMPLE TYPE



SPLIT BARREL



SHELBY TUBE



AUGER CUTTINGS



SPLIT SPOON



**Engineering And Testing
Solutions That Work For You**

Test Hole #: TP13

Client: Avia NG Consultants

Site: See Figure 1

Location: Churchill, MB

Project: Geotechnical Investigation - Churchill Airport

File No.: 18-166-81

Date Drilled: Oct. 1, 2018

Grade Elevation: 100.0 m

Water Elevation: --

SUBSURFACE PROFILE				SAMPLE DATA								SHEAR STRENGTH (kPa)		
Depth (m)	Soil Symbol	Description	Elevation (m)	Sample No.	Sample Type	Moisture Content (%)	Blows/300 mm	Moisture Content (%)				P. Pen	Torvane	UC
								PL	X	LL				
0.0		Ground Surface	100.0											
		Sand (SP) - brown, moist, medium dense, poorly graded, some to with gravel.		S1		6.2								
1.0		Silt Till (ML) - grey, moist, firm, low plastic, trace sand, trace gravel, trace clay.	99.0	S2		9.5								
2.0			98.0											
3.0		End of Test Pit - end of test pit at 3.0 m below grade on suspected permafrost. - no seepage encountered. - no sloughing encountered. - test pit backfilled with excavated test pit material.	97.0	S3		10.2								
4.0			96.0											

ENG- TECH Consulting Limited

Logged by: JD

Reviewed by:

Drilled By: Merv's Excavating

Drill Rig: Doosan DX 190W

Auger Size: Excavator Bucket

Completion Depth: 3.0 m

Completion Elevation: 97.0 m

Sheet: 1 of 1

SAMPLE TYPE



SPLIT BARREL



SHELBY TUBE



AUGER CUTTINGS



SPLIT SPOON



Engineering And Testing
Solutions That Work For You

Test Hole #: TP14

Client: Avia NG Consultants

Site: See Figure 1

Location: Churchill, MB





Project: Geotechnical Investigation - Churchill Airport

File No.: 18-166-81

Date Drilled: Oct. 1, 2018

Grade Elevation: 100.0 m

Water Elevation: --

SUBSURFACE PROFILE				SAMPLE DATA								SHEAR STRENGTH (kPa)		
Depth (m)	Soil Symbol	Description	Elevation (m)	Sample No.	Sample Type	Moisture Content (%)	Blows/300 mm					P. Pen	Torvane	UC
0.0		Ground Surface	100.0											
		Gravel (GP) - brown, moist, dense, poorly graded, with sand.			S1		2.8							
					S2		9.2							
1.0		End of Test Pit - end of test pit at 0.9 m below grade on suspected bedrock. - no seepage encountered. - no sloughing encountered. - test pit backfilled with excavated test pit material.	99.0											
2.0			98.0											
3.0			97.0											
4.0			96.0											

ENG- TECH Consulting Limited

Logged by: JD

Reviewed by:

Drilled By: Merv's Excavating

Drill Rig: Doosan DX 190W

Auger Size: Excavator Bucket

Completion Depth: 0.9 m

Completion Elevation: 99.1 m

Sheet: 1 of 1

SAMPLE TYPE



SPLIT BARREL



SHELBY TUBE



AUGER CUTTINGS



SPLIT SPOON



Engineering And Testing
Solutions That Work For You

Test Hole #: TP15

Client: Avia NG Consultants

Site: See Figure 1

Location: Churchill, MB




Project: Geotechnical Investigation - Churchill Airport

File No.: 18-166-81

Date Drilled: Oct. 1, 2018

Grade Elevation: 100.0 m

Water Elevation: --

SUBSURFACE PROFILE				SAMPLE DATA				Moisture Content (%)	SHEAR STRENGTH (kPa)		
Depth (m)	Soil Symbol	Description	Elevation (m)	Sample No.	Sample Type	Moisture Content (%)	Blows/300 mm		P. Pen	Torvane	UC
0.0		Ground Surface	100.0								
		Gravel (GP) - brown, moist, dense, poorly graded, some sand.			S1		3.8				
1.0		End of Test Pit - end of test pit at 1.0 m below grade on suspected bedrock. - no seepage encountered. - no sloughing encountered.	99.0	S2		4.6					
2.0			98.0								
3.0			97.0								
4.0			96.0								

ENG- TECH Consulting Limited

Logged by: JD

Reviewed by: *CA*

Drilled By: Merv's Excavating

Drill Rig: Doosan DX 190W

Auger Size: Excavator Bucket

Completion Depth: 1.0 m

Completion Elevation: 98.9 m

Sheet: 1 of 1

SAMPLE TYPE



SPLIT BARREL



SHELBY TUBE



AUGER CUTTINGS



SPLIT SPOON



Engineering And Testing
Solutions That Work For You

Test Hole #: TP16

Client: Avia NG Consultants

Site: See Figure 1

Location: Churchill, MB

Project: Geotechnical Investigation - Churchill Airport

File No.: 18-166-81

Date Drilled: Oct. 1, 2018

Grade Elevation: 100.0 m

Water Elevation: --

SUBSURFACE PROFILE				SAMPLE DATA				SHEAR STRENGTH (kPa)		
Depth (m)	Soil Symbol	Description	Elevation (m)	Sample No.	Sample Type	Moisture Content (%)	Blows/300 mm	Moisture Content (%)		
								PL -----X----- LL	P. Pen	Torvane
								20 40 60 80		UC
0.0		Ground Surface	100.0							
		Sand (SP) - brown, moist, medium dense, poorly graded, some gravel.		S1		4.7				
1.0			99.0	S2		4.4				
2.0		Silt (ML) - brown, moist, very soft, low plastic, trace clay.	98.0	S3		13.7				
3.0		End of Test Pit - end of test pit at 3.0 m below grade. - no seepage encountered. - no sloughing encountered. - test pit backfilled with excavated test pit material.	97.0	S4		15.2				
4.0			96.0							

ENG- TECH Consulting Limited

Logged by: JD

Reviewed by:

Drilled By: Merv's Excavating

Drill Rig: Doosan DX 190W

Auger Size: Excavator Bucket

Completion Depth: 3.0 m

Completion Elevation: 97.0 m

Sheet: 1 of 1

SAMPLE TYPE



SPLIT BARREL



SHELBY TUBE



AUGER CUTTINGS



SPLIT SPOON



**Engineering And Testing
Solutions That Work For You**

Test Hole #: TP17

Client: Avia NG Consultants

Site: See Figure 1

Location: Churchill, MB




Project: Geotechnical Investigation - Churchill Airport

File No.: 18-166-81

Date Drilled: Oct. 1, 2018

Grade Elevation: 100.0 m

Water Elevation: --

SUBSURFACE PROFILE				SAMPLE DATA						SHEAR STRENGTH (kPa)		
Depth (m)	Soil Symbol	Description	Elevation (m)	Sample No.	Sample Type	Moisture Content (%)	Blows/300 mm	Moisture Content (%)	P. Pen	Torvane	UC	
								PL -----X----- LL 20 40 60 80				
0.0		Ground Surface	100.0									
		Sand (SP) - brown, moist, medium dense, poorly graded, some gravel.										
				S1		4.0						
1.0			99.0									
2.0			98.0									
		Silt (ML) - brown, moist, very soft, low plastic, trace clay.		S2		13.3						
3.0			97.0									
		End of Test Pit - end of test pit at 3.0 m below grade. - no seepage encountered. - no sloughing encountered. - test pit backfilled with excavated test pit material.		S3		17.2						
4.0			96.0									

ENG-TECH Consulting Limited

Logged by: JD

Reviewed by:

Drilled By: Merv's Excavating

Drill Rig: Doosan DX 190W

Auger Size: Excavator Bucket

Completion Depth: 3.0 m

Completion Elevation: 97.0 m

Sheet: 1 of 1

SAMPLE TYPE



SPLIT BARREL



SHELBY TUBE



AUGER CUTTINGS



SPLIT SPOON



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PARTICLE SIZE ANALYSIS

Avia NG Consultants
143 High Street
Southampton, Ontario
N0H 2L0

File No.: 18-166-81

Ref. No.: 18-166-81-2

Attention: James Gunn, P.Eng

Project: GEOTECHNICAL INVESTIGATION - LIGHTING IMPROVMENTS, CHURCHILL, MB.

Test Hole No. 3

Sample No. 3

Depth: 2.6 m

Sample By: ENG-TECH (Jason Dunn)

Type of Sample: Grab

Source: Project site

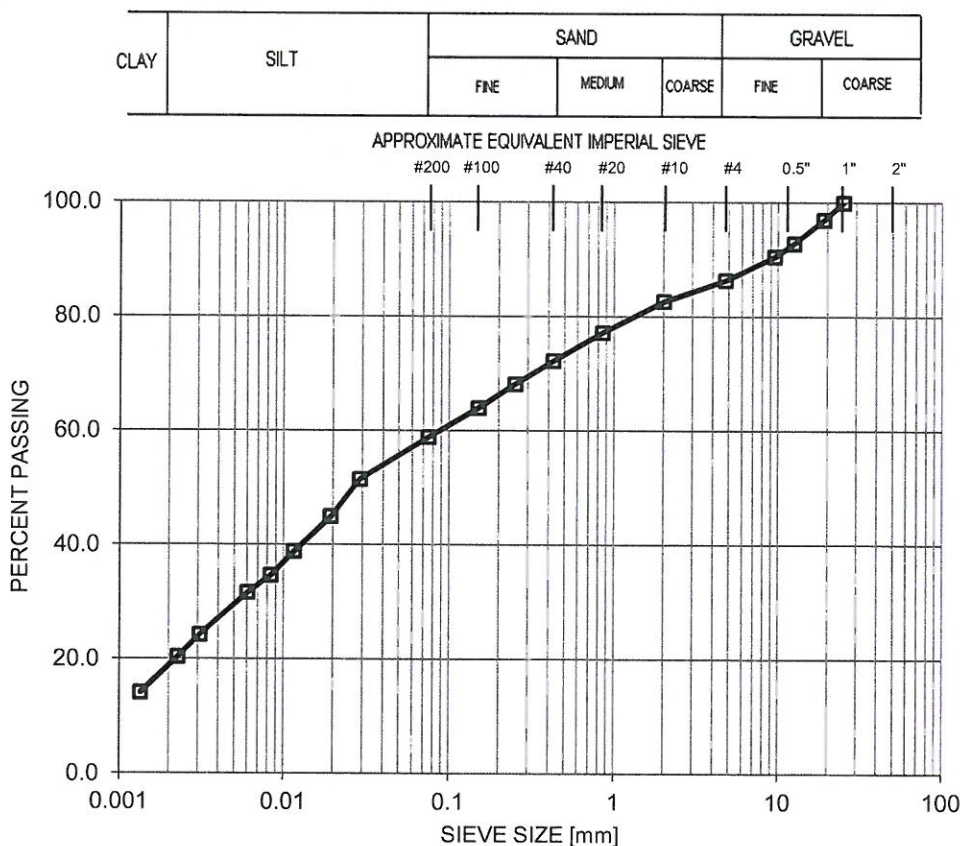
Date Sampled: Oct 1/18

Date Received: Oct 3/18

Date Tested: Oct 11/18

Dispersion Device: Apparatus A: Humboldt Mechanical Analysis Stirrer

Dispersion Time (min.): 1



SIEVE SIZE (mm)	PERCENT PASSING
25.0	100.0
19.0	97.0
12.5	92.8
9.5	90.5
4.75	86.3
2.0	82.6
0.850	77.2
0.425	72.2
0.250	68.2
0.150	64.0
0.075	58.9
0.029	51.5
0.019	44.9
0.012	38.9
0.008	34.6
0.006	31.6
0.003	24.2
0.002	20.4
0.001	14.1

Percent of: GRAVEL (13.7 %), SAND (27.5 %), SILT (40.0 %), CLAY (18.9 %)

Sample Description:

Comments: Insitu Moisture content is 9.6%.



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PARTICLE SIZE ANALYSIS

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File No.: 18-166-81

Ref. No.: 18-166-81-3

Attention: James Gunn, P.Eng

Project: GEOTECHNICAL INVESTIGATION - LIGHTING IMPROVMENTS, CHURCHILL, MB.

Test Hole No. 7

Sample No. 3

Depth: 2.3 m

Sample By: ENG-TECH (Julius Dizon)

Type of Sample: Grab

Source: Project site

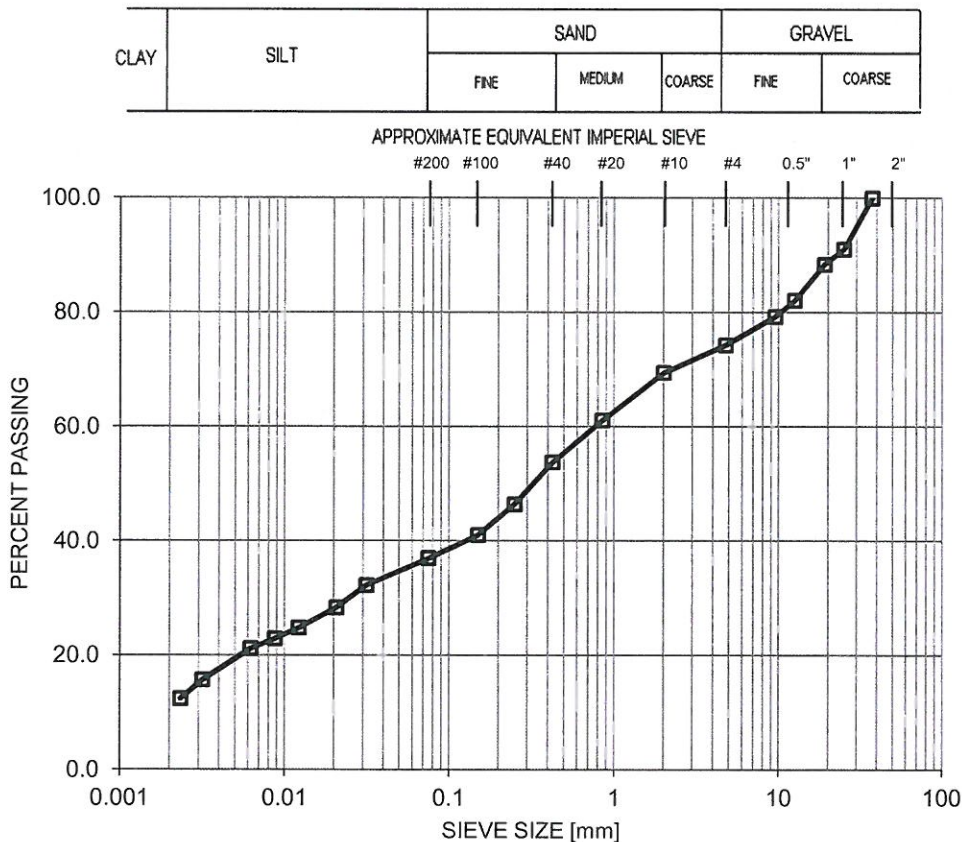
Date Sampled: Oct 1/18

Date Received: Oct 3/18

Date Tested: Oct 11/18

Dispersion Device: Apparatus A: Humboldt Mechanical Analysis Stirrer

Dispersion Time (min.): 1



SIEVE SIZE (mm)	PERCENT PASSING
37.5	100.0
25.0	91.0
19.0	88.4
12.5	82.1
9.5	79.2
4.75	74.3
2.0	69.4
0.850	61.1
0.425	53.7
0.250	46.4
0.150	41.0
0.075	37.0
0.031	32.2
0.021	28.3
0.012	24.8
0.009	22.9
0.006	21.2
0.003	15.7
0.002	12.4

Percent of: GRAVEL (25.7 %), SAND (37.3 %), SILT (25.1 %), CLAY (11.8 %)

Sample Description:

Comments: In situ Moisture content is 9.9%.



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PARTICLE SIZE ANALYSIS

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File No.: 18-166-81

Ref. No.: 18-166-81-4

Attention: James Gunn, P.Eng

Project: GEOTECHNICAL INVESTIGATION - LIGHTING IMPROVMENTS, CHURCHILL, MB.

Test Hole No. 10

Sample No. 3

Depth: 2.0 m

Sample By: ENG-TECH (Julius Dizon)

Type of Sample: Grab

Source: Project site

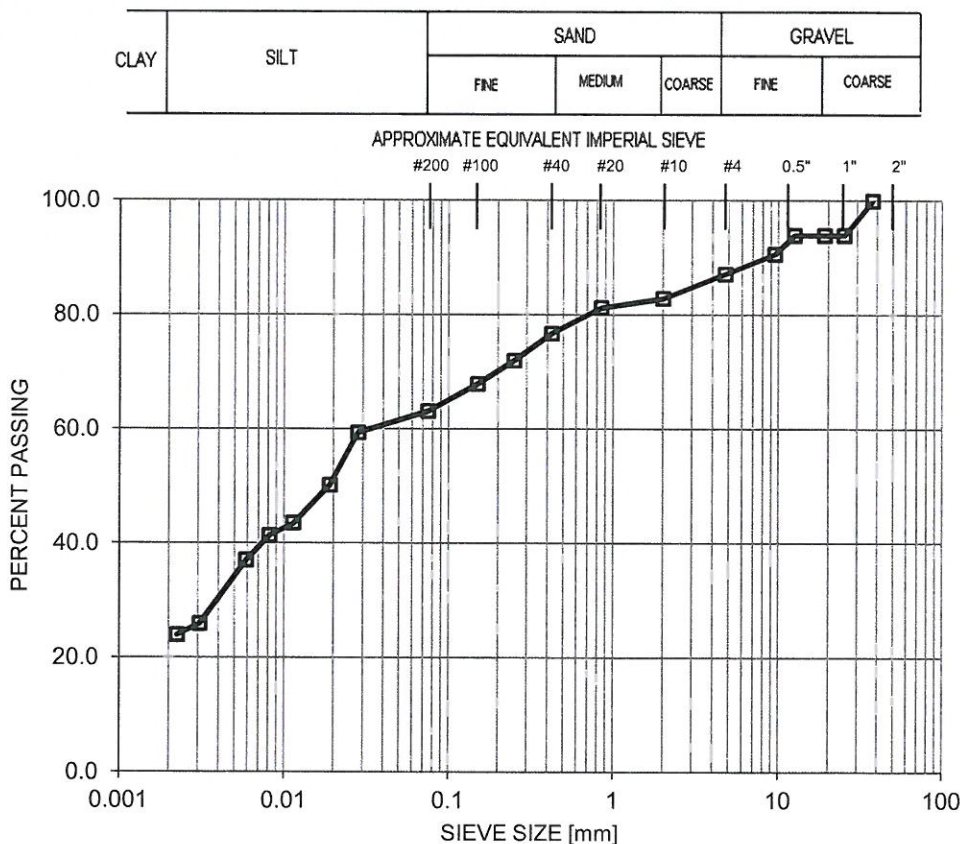
Date Sampled: Oct 1/18

Date Received: Oct 3/18

Date Tested: Oct 11/18

Dispersion Device: Apparatus A: Humboldt Mechanical Analysis Stirrer

Dispersion Time (min.): 1



SIEVE SIZE (mm)	PERCENT PASSING
37.5	100.0
25.0	93.9
19.0	93.9
12.5	93.9
9.5	90.6
4.75	87.1
2.0	82.8
0.850	81.2
0.425	76.7
0.250	72.0
0.150	67.9
0.075	63.1
0.028	59.4
0.019	50.2
0.011	43.5
0.008	41.4
0.006	37.0
0.003	25.9
0.002	24.0

Percent of: GRAVEL (12.9 %), SAND (24.0 %), SILT (40.6 %), CLAY (22.5 %)

Sample Description:

Comments: Insitu Moisture content is 12.4%.



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PARTICLE SIZE ANALYSIS

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File No.: 18-166-81

Ref. No.: 18-166-81-5

Attention: James Gunn, P.Eng

Project: GEOTECHNICAL INVESTIGATION - LIGHTING IMPROVMENTS, CHURCHILL, MB.

Test Hole No. 12

Sample No. 3

Depth: 2.6 m

Sample By: ENG-TECH (Julius Dizon)

Type of Sample: Grab

Source: Project site

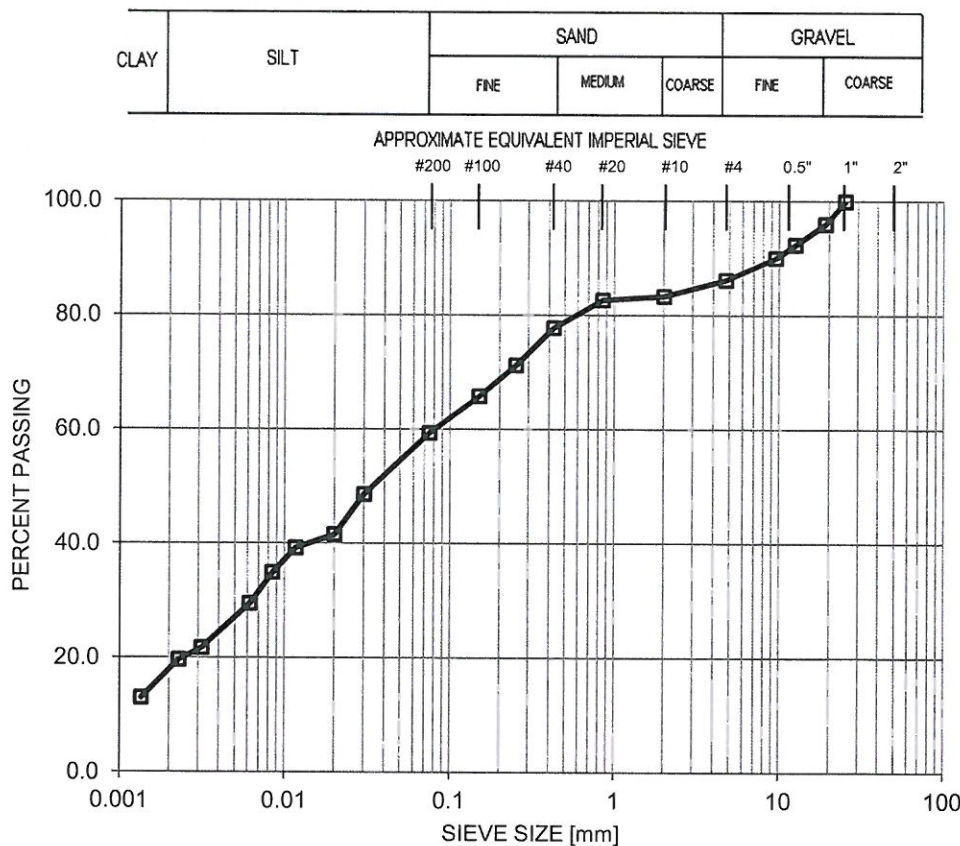
Date Sampled: Oct 1/18

Date Received: Oct 3/18

Date Tested: Oct 11/18

Dispersion Device: Apparatus A: Humboldt Mechanical Analysis Stirrer

Dispersion Time (min.): 1



SIEVE SIZE (mm)	PERCENT PASSING
25.0	100.0
19.0	96.0
12.5	92.4
9.5	90.0
4.75	86.2
2.0	83.3
0.850	82.6
0.425	77.8
0.250	71.2
0.150	65.8
0.075	59.4
0.030	48.6
0.020	41.6
0.012	39.2
0.008	34.9
0.006	29.5
0.003	21.7
0.002	19.7
0.001	13.0

Percent of: GRAVEL (13.8 %), SAND (26.8 %), SILT (41.4 %), CLAY (17.9 %)

Sample Description:

Comments: Insitu Moisture content is 10.2%.



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PARTICLE SIZE ANALYSIS

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File No.: 18-166-81

Ref. No.: 18-166-81-6

Attention: James Gunn, P.Eng

Project: GEOTECHNICAL INVESTIGATION - LIGHTING IMPROVMENTS, CHURCHILL, MB.

Test Hole No. 13

Sample No. 3

Depth: 3.0 m

Sample By: ENG-TECH (Julius Dizon)

Type of Sample: Grab

Source: Project site

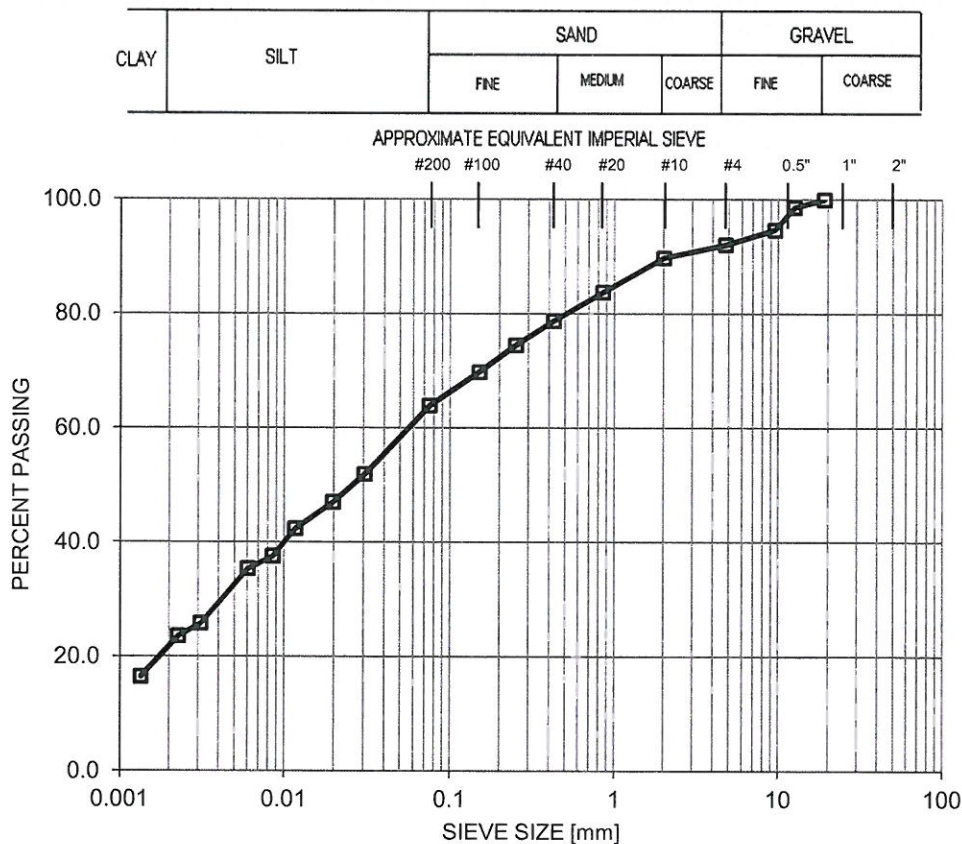
Date Sampled: Oct 1/18

Date Received: Oct 3/18

Date Tested: Oct 11/18

Dispersion Device: Apparatus A: Humboldt Mechanical Analysis Stirrer

Dispersion Time (min.): 1



Percent of: GRAVEL (7.9 %), SAND (28.2 %), SILT (42.0 %), CLAY (21.8 %)

Sample Description:

Comments: Insitu Moisture content is 10.2%.



Transport
Canada

Transports
Canada

CHURCHILL AIRPORT



Airfield Electrical Rehabilitation Phase 1

Plan of Construction Operations

Project No. 18-0071-00

April 17, 2019

PREPARED FOR:

Public Works and Government Services Canada
ATB Place North Tower
10025 Jasper Ave, 5th Floor
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PREPARED BY:

AVIA NG
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PLAN OF CONSTRUCTION OPERATIONS CHANGE RECORD

Revision	Date	Recorded By	Remarks
A	February 28, 2019	N. Heisz, P. Eng, Avia NG	Draft for 66% Design Submission
B	March 13, 2019	N. Heisz, P. Eng, Avia NG	Draft for 99% Design Submission
C	April 17, 2019	N. Heisz, P. Eng, Avia NG	Issued for Tender Submission

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1. INTRODUCTION

1.1 PROJECT DESCRIPTION

Transport Canada is planning to undertake the rehabilitation of the airfield electrical systems at the Churchill Airport in two (2) phases.

Phase 1 includes the rehabilitation of Taxiway Bravo and Runway 07-25 while Phase 2 includes the rehabilitation of Runway 15-33, Taxiway Alpha, the Apron and Field Electrical Centre. This PCO has been prepared specifically for Phase 1.

The project is a safety related project to extend the life of existing facilities. It is not proposed to expand the facilities, increase air traffic or the level of service following construction. New installations will meet TP312 5th Edition.

The project is anticipated to commence in late July 2019 and be completed in September 2019.

1.2 THE AIRPORT ENVIRONMENT

The airport operational environment is extremely dynamic and involves various stakeholders including Transport Canada, airlines and airport users, NAV CANADA and airport staff. The airport environment is highly regulated in the interest of public safety and security. As such, any deviations from standard operating procedures are carefully considered and subject to detailed review and input from stakeholders and regulators.

It is recognized that construction will temporarily impact the “normal” operation of the airport and will require special temporary operational changes. The cooperation of all parties including the Contractor will be paramount in successfully carrying out this project.

1.3 PURPOSE OF THE PLAN OF CONSTRUCTION OPERATIONS

The primary purpose of the Plan of Construction Operations (PCO) is to provide a notification of change in the level of service from the certification standards and the Aerodrome Operations Manual (AOM) published for the airport. The PCO is a statement of the approved operational procedures to be employed to maintain the certification criteria of the airport during the implementation of the planned construction project. The airport will be required to file this PCO with the AOM while the project is in progress.

The secondary purpose of the PCO is to formulate, in advance, the coordination required to implement the proposed project and minimize the impact to airport operations. This is done to ensure that airport security and flight safety are not jeopardized because of construction activities.

The third purpose of the PCO is to inform all stakeholders of the project, so that they may appreciate and plan for potential impacts to their operations.

1.4 SAFETY MANAGEMENT CONSIDERATIONS

This PCO works in collaboration with the Safety Management System (SMS) currently in place at the airport. The SMS program is set up to engage airport staff in actively monitoring and identifying hazards. A risk, or combined series of risks to safety which are determined to be unacceptable will need to be either removed or successfully mitigated to a level as low as reasonably practicable.

A Safety Case will be prepared by Transport Canada as part of the airport's SMS program.

All airport personnel who work within or near a project work area, are obligated to report any accident, incidents or hazards immediately. Reports may be submitted to the employee's direct supervisor.

2. CONSTRUCTION SEQUENCING PLAN AND PRELIMINARY PROJECT SCHEDULE

2.1 GENERAL

This section is intended to outline the proposed construction operations and planned schedule of work. Refer to Appendix A for a Project Site Plan and a Construction Sequencing Plan. These drawings illustrate the proposed scope of work, construction work area and provide additional details regarding access routes, construction/schedule restrictions, and airport operational impacts, etc.

Guiding principles for development of this PCO are as follows:

- All setbacks related to the construction sequencing plan have been checked against TP312 4th Edition (Runway 15-33 and Runway 07-25) and TP 312 5th Edition (Taxiways Alpha and Bravo) and the Airport Operations Manual.
- Taxiway A and apron edge lighting to remain operational throughout construction. Taxiway A edge lighting circuit switchover to new cabling from constant current regulator to be scheduled in advance complete with implementation plan which is to be approved.

Work Zone 1:

- Runway 07-25 will be CLOSED for the duration of construction in Phase 1.
- Runway 07-25 will be available for daytime taxi (no lighting required) with 30 minutes prior notice.
- Taxiway B will be available for daytime taxi (no lighting required) with 30 minutes prior notice.

Work Zone 2:

- The operational certification of Runway 15-33 will remain as published (Code 4 Precision) in accordance with TP312 4th Edition. Ductbank investigation work to be completed on fair weather day, with prior approval and on a pull back basis to accommodate flight schedule.
- The operational certification of Taxiway A will remain as published (AGN IIIA) in accordance with TP312 5th Edition. Ductbank investigation work to be completed on fair weather day, with prior approval and on a pull back basis to accommodate flight schedule.

General plans, details and efforts required by the Contractor to accomplish the above are presented in further sections.

2.2 WORKING OUTSIDE OF DESIGNATED WORK AREA

Work may be required outside of designated work area and within active runway/taxiway strips and/or restricted areas, such as surveying of existing benchmarks, and investigation/isolation of airfield electrical circuits and cabling.

All work outside of the work area indicated on the Construction Sequencing Plan, and that have the potential to impact airport operations, will be undertaken either 1) on a pullback basis under the supervision of the appropriate Airside Safety and Security Escort or 2) the impacted facility will be closed to air traffic.

Refer to Section 2.6 for airside security escorts and security requirements.

2.3 CONSTRUCTION SEQUENCING EQUIPMENT

2.3.1 LOW PROFILE BARRICADES

Barricades, where required, shall be coloured international orange/white. Barricades shall be fitted with steady burning red fixtures meeting the requirements of Transport Canada Document TP312 – Aerodrome Standards and Recommended Practices. All barricades shall be filled with water or sand or otherwise secured. Nails driven into the pavement surface shall not be permitted.

The Contractor shall immediately repair or replace any damaged barricades and repair or replace any unserviceability lights found to be burnt out or non-operational.

The Contractor shall make barricades available throughout construction in the number required to facilitate their work and to properly cordon off work areas as indicated schematically on the Construction Sequencing Drawings. Maximum spacing between barricades shall be 3.0 meters on runways and taxiways and 6.0 meters on aprons.

2.3.2 UNSERVICEABILITY LIGHTING

Where required, temporary red unserviceability lights will be co-located with low profile barricades to delineate areas closed to air traffic.

2.3.3 RUNWAY CLOSURE MARKERS

Runway closure markings meeting the requirements of TP312 shall be placed as indicated on the Construction Sequencing Plan enclosed as Appendix A.

The Contractor will supply two (2) runway closure markers for the duration of the project.

2.3.4 TEMPORARY ELECTRICAL INSTALLATIONS

The Contractor shall supply, install and maintain all temporary lighting arrangements including temporary surface/subsurface edgelifting circuits/connections as indicated on the Contract Drawings.

2.4 CONTRACTOR LAYDOWN AND MATERIAL STOCKPILE AREAS

Contractor Laydown areas shall be as shown on the Construction Sequencing Plan in Appendix A. The exact location of these areas will be determined prior to construction.

The Laydown Area/Yard as indicated on the drawings have been tested against aeronautical clearance requirements. There shall be no deviation from the approved location without prior approval from the Airport Operator and review by NAV CANADA.

Dust control shall be provided on a continuous basis.

2.5 CONSTRUCTION ACCESS ROUTES

The construction areas may be accessible by access routes as indicated on the Construction Sequencing Drawing.

Access to the Airport property will be through the gates indicated on the Construction Sequencing Drawings. Alternative and/or temporary gates may also be utilized with Airport approval as required.

Access route upgrades may be required to accommodate construction vehicles. The Contractor shall be responsible for upgrades as required. Where existing airport access roads are used the Contractor shall be responsible for re-instatement to pre-construction conditions at the completion of the project.

The Contractor will be required to apply water to control dust on a continuous basis. There will be an onsite water source made available to the Contractor however permission is required prior to operation.

Onsite haul routes shall be reviewed with the Contract Administrator and the Airport Operator in the field during construction.

2.6 AIRSIDE SAFETY AND SECURITY ESCORTS AND GATE SECURITY

All personnel and vehicle operators operating within restricted airside areas (outside designated working areas) will require contact with an appropriate airside escort. The escorts will communicate/monitor FSS and communicate with the Construction Site Foreman as required. Using on-site radios (non-aviation), all parties would communicate effectively. The final configuration of any necessary Airport Security Escorts shall be established between the Contractor and the Airport.

The Contractor's site representatives shall be responsible for ensuring that all project personnel follow the instructions provided by the Airside Escort. The Contractor and his employees must comply with instructions given by the Airside Escort immediately.

It will be the responsibility of the Contractor to coordinate any airside escorting requirements with the Airport with sufficient lead time (minimum 48 hours).

The Contractor shall provide gate security at all active gate access points used by construction equipment/personnel for the duration of the project. Gate security is not required if the gates are locked.

2.7 UNDERGROUND UTILITY LOCATES

There are underground utilities located within the work areas including high voltage and communications cables. These utilities are a serious safety hazard and would cause major disruption to airport operations if damaged.

The Contractor is responsible for coordinating and obtaining all utility locates. Under no circumstances will work be permitted in the absence of utility locates. Prior to commencing work, the elevation and location of all utilities shall be recorded.

Prior to commencement of work each day, the General Contractor is required to obtain a Guarantee of Isolation for underground high voltage cables. This Guarantee of Isolation will be coordinated through the Airport Operator, in consultation with the site technician responsible for electrical services.

All existing utilities are to be daylighted and protected within work areas.

Circuit isolation and lock-out procedures will be reviewed during the Preconstruction meeting.

2.8 F.O.D. CONTROL PROGRAM

The Airport Operator has a stringent Foreign Object Debris (F.O.D.) Control Program in place.

Under no circumstances will the Contractor be permitted to dispose of any F.O.D. while on airport property. F.O.D. will be monitored by the Airport Operator, the Airside Escorts, and the Contractor Administrator's Site Representative. Any F.O.D. observed must be removed immediately in accordance with the F.O.D. Control

Program put in place by the Airport Operator. Details of the F.O.D. control program shall be reviewed with the Airport Operator prior to the commencement of work.

3. AIRPORT OPERATIONS AND PROCEDURES

3.1 COMMUNICATION PROTOCOLS AND RESPONSIBILITIES

During construction, communication protocols and responsibilities must be clearly understood, practiced and enforced.

Figure 1 shows the general communication flow during the project.

The following provides additional details as to the responsibilities of the major project participants.

3.1.1 TRANSPORT CANADA – AIRPORT OPERATOR

The Airport Operator (Transport Canada) is responsible for coordination with Transport Canada (Civil Aviation), NAV CANADA and the Airport Users. The Airport Operator will ultimately be responsible for communications with these authorities/groups and will be required to participate in construction meetings to keep informed on project progress. The Airport Operator will liaise with the Contract Administrator during construction.

The Airport Operator, or their designated representative(s) shall be specifically responsible for the following:

- Advising aircraft operators of the construction schedule, schedule updates and operating procedures for the various phases/area of work that may pose a change in their operational procedures.
- Preparation and issuing of NOTAMs advising of operational constraints including closure of runways and taxiway at various times during the project.
- Advising the Contractor Administrator's Site Representative of any operational, safety or security concerns that arise during the project.
- Advising NAV CANADA changes in the construction schedule which might impact their primary responsibilities.
- Participating in the acceptance of the completed work as the operational representative.
- Attending the regular construction progress meetings chaired by the Contract Administrator's Site Representative.
- Meeting with the Contract Administrator's Site Representative prior to the end of each working shift to inspect any surfaces being reopened and to review operational safety, security concerns and schedule for the following work shift.
- Designating representatives who will make periodic inspections of the entire job site and who will review safety, security, and the effectiveness of the F.O.D. prevention program.
- Provide updates to Transport Canada (Civil Aviation) of major milestones reached and phase completions.

The Airport Operator is also responsible for the review and approval of the Contractor's Work Permits throughout the project.

3.1.2 CONTRACT ADMINISTRATOR

Transport Canada has retained the services of a Professional Engineering firm (the Contract Administrator) to administer and monitor execution of the project and provide engineering and full-time inspection services.

The Contract Administrator shall monitor the progress of the work and provide a full-time site representative during construction. The site representative will communicate with the Contractor and/or their site personnel and provide updates/queries to the Airport Operator.

The Contract Administrator will:

- Interact with the Airport Operator and Contractor's security and contractor safety personnel as required to ensure the safe and efficient execution of the work.
- Coordinate and resolve technical issues during construction with the Airport Operator, the Contractor and the Site Representative.
- Provide support to the Airport Operator in the review of Contractor's work permits.

3.1.3 CONTRACTOR

The Contractor shall be responsible for the construction of the project the safety of his personnel and subcontractor's.

The Contractor shall identify a Site Foreman/Project Manager and a Health, Safety and Security Coordinator. The Contractor's site representatives will communicate through the Contract Administrator's Site Representative. The Contractor's administrative office staff will communicate through the Contract Administrator.

The Contractor shall make hand-held radio communication equipment available to all site personnel including the Contractor's personnel, Airside Escorts, Contract Administrator's Site Representative, and Site Foreman. These radios are to be used to facilitate efficient internal (non-aviation) communication for all parties during construction.

The Contractor shall ensure that all personnel are properly briefed on applicable safety and operational procedures by airport personnel prior to entering airside areas.

3.1.4 TRANSPORT CANADA CIVIL AVIATION SAFETY

Transport Canada Civil Aviation Safety Operations is interested in ensuring the continued safe operation of the airport and ensuring that all applicable regulations, standards and recommended practices are complied with. Periodic inspections may be conducted during the construction period to ensure the intent of this Plan of Construction is followed.

Only the Airport Operator shall communicate with Transport Canada.

3.1.5 NAV CANADA

NAV CANADA provides flight services via the Winnipeg Flight Information Centre (FIC) and must always have a clear understanding of the project.

NAV CANADA shall be advised of the project through the Land Use process and routine issuance of NOTAMS.

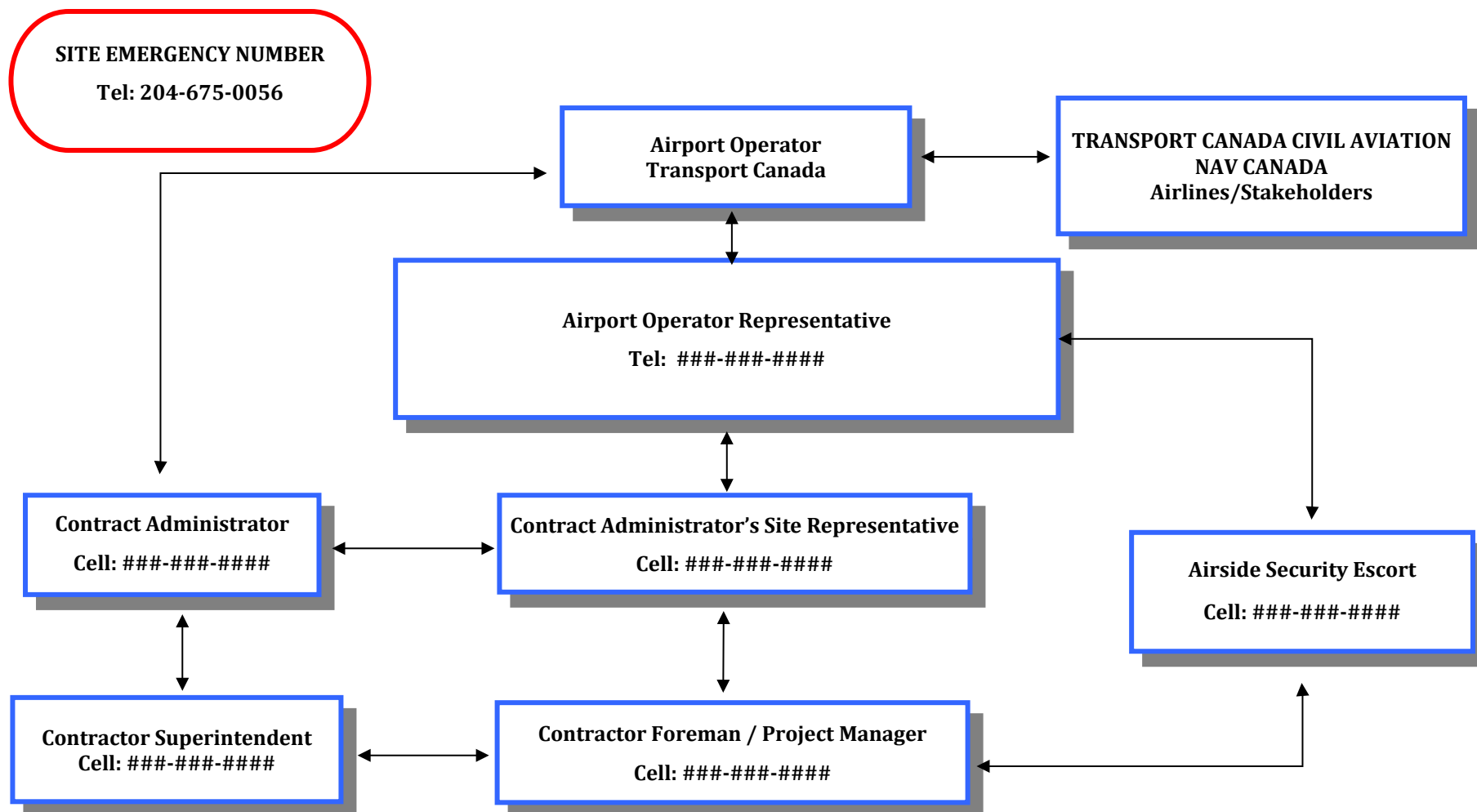


FIGURE 1 – COMMUNICATION CHART

3.1.6 AIRPORT USERS AND OTHER STAKEHOLDERS

The Airport Operator will communicate directly with airport users and the stakeholder community. Initial communications have advised users / stakeholders of the project and its impact to airport operations including project objectives, scope and schedule.

Communications will occur throughout the project to advise of airfield configuration changes, upcoming NOTAMs and other information as required.

3.2 CERTIFICATION STANDARDS AND COMPLIANCE

The Churchill Airport is a certified airport and must comply with Aerodrome Standards and Recommended Practices TP312, Canadian Aviation Safety Regulations (CAR's) and several other regulations and standards. This PCO has been prepared based on recommended practices to accommodate temporary changes to the procedures and described characteristics contained in the Airport Operations Manual to permit the proposed construction activity.

The following outlines the aeronautical safety measures implemented during construction:

1. All construction staging and stockpile areas will be located to remain clear of any airport obstacle limitation surfaces and electronic zoning protection areas. All construction work areas and laydown areas comply with TP312 4th Edition (current operational certification for Runway 15-33 and Runway 07-25) obstacle limitation surfaces and strip zoning requirements and TP312 5th Edition (current operational certification for Taxiways Alpha and Bravo)
2. NOTAMs will be issued by the Airport Operator on an as required basis to advise of closures to Runways, Aprons and Taxiways.
3. Construction barricades with steady-burning red unserviceability lighting will be positioned to delineate the limits of unescorted operation of construction equipment.
4. During closures of Runway 07-25 runway closure markings will be placed at each end of the closed runway.
5. Runway and taxiway graded areas/safety areas shall be reinstated at the end of each construction shift and when the facility is to be operational in accordance with TP312 4th/5th Edition as appropriate.
6. The construction areas will be inspected prior to opening to air traffic ensure that the all pavement surfaces are carefully swept and that adjacent grassed areas are adequately graded.

Following construction, Runway 15-33 will remain certified to TP312 4th Edition except that the new airfield lighting will comply with TP312 5th Edition.

3.3 RELOCATED THRESHOLDS, DECLARED DISTANCES AND RUNWAY CERTIFICATION

It is not proposed to incorporate any relocated thresholds during construction.

The declared distances on Runway 15-33 will remain as published during construction and will remain certified as indicated in the AOM.

Runway 07-25 will be CLOSED for the duration of the project but available for taxi.

3.4 INSTRUMENT APPROACH PROCEDURES

The approach procedures associated with Runway 07-25 and Runway 15-33 will not be impacted however Runway 07-25 will be closed for construction.

All construction equipment and material storage areas remain clear of any onsite navigational aid protection areas. At the end of the project, all equipment will be removed from the site and the areas restored to their original condition.

Impacts to instrument approach procedures will be confirmed based on the NAV CANADA Land Use process and coordinated between the Airport Operator, the Contractor and NAV CANADA as appropriate.

3.5 RADIOS

The Contractor shall identify a Site Foreman and Health, Safety and Security Coordinator that will interface with the Contract Administrator's Site Representative and the Airside Escorts. The Airside Escorts will provide airside escorting services and aviation radio communication services as required.

General (non-aviation) radio communication devices (i.e. Motorola) will be made available by the Contractor for onsite personnel. Portable radios with non-aviation frequencies will be used for this purpose.

The project will not commence until the approved radios are installed and fully operational and found not to conflict with aviation frequencies.

Designated persons shall always monitor these radios while construction is active in approved areas.

If the Site Foreman leaves the site during construction operations, an alternate person shall be responsible for ensuring proper procedures are followed in his absence. Before leaving the site, the Construction Foreman will communicate the temporary designate to the Airside Escorts and the Contract Administrator's Site Representative.

The Site Foreman and his alternate must take full responsibility for construction equipment and personnel operating within the approved construction areas.

3.6 GENERAL SITE PROCEDURES

The Contractor's Site Foreman and Healthy, Safety and Security Coordinator shall be responsible for ensuring that all construction personnel at the aerodrome operate construction equipment and service vehicles in a safe manner in accordance with the procedures outlined in this document and the Construction Sequencing Drawings enclosed as Appendix A.

Prior to the start of construction onsite, the Contractor's Site Foreman in conjunction with the Airport Operator, Airside Escort and the Contract Administrator shall brief all key project/construction personnel on:

- The procedures for the movement of equipment and personnel working on the aircraft maneuvering areas (runway, taxiway, and apron),
- Security regulations, and
- Other applicable aerodrome directives.

The Site Foreman shall ensure that all new personnel to the project are properly briefed and the Contractor shall maintain a record of all project personnel training records.

In addition, prior to the start of construction the Contractor's Site Foreman, in conjunction with the Airport Operator, the Airside Escort and the Contract Administrator's Site Representative, shall coordinate an onsite briefing to review the placement of barricades, delineators, temporary fencing/lighting/markings, NOTAM's, operational procedures including pullbacks, jet blast considerations, construction activities/restrictions, general risks/mitigation measures, etc.

A record of such start-up meetings shall be maintained by the Contract Administrator's Representative and distributed to all project personnel.

3.6.1 AIRSIDE VEHICLE OPERATING REQUIREMENTS

All vehicles that will be operated or driven on the aircraft maneuvering areas (open or closed) will be equipped with an orange warning beacon that will be turned on while the vehicle is on these areas. If equipped with headlights, these will also be turned on.

An orange warning beacon will be mounted on each vehicle in a location that will permit the beam to be seen by aircraft or surface traffic from any position within 360°. If a rotating beacon is used, the light beam shall be set at an angle of 6 ° above the horizontal and it shall rotate at a constant speed of 35 RPM. The enclosing globe of the warning light shall be orange for all vehicles.

All airside access gates must be kept closed and secured to prevent entry of unauthorized personnel/vehicles. It is the responsibility of every person who has authority to use an airside access gate to ensure that the gate is closed prior to leaving the area. The failure to do so can result in the immediate suspension of an AVOP or RAIC.

Personally-owned vehicles or equipment are not authorized on airside unless prior approval is arranged from the Airport Operator.

3.6.2 ALCOHOL AND DRUGS

No person working airside shall be under the influence of any substance, including alcohol, illicit drugs or medications that have the potential to adversely affect their performance in any way. Operating a vehicle under the influence is an offence under the Criminal Code of Canada. Drivers who are suspected of being under the influence of alcohol may be subject to a Breathalyzer test.

3.6.3 SMOKING

Smoking is prohibited airside. No person shall smoke, carry or deposit lighted cigars, cigarettes, pipes or matches, or carry an open flame on airside. This also applies to any other airside areas such as, staircases, baggage rooms, bridges, ramp crew shelters, inside and outside vehicles, equipment and airside buildings. Charges can be laid under the Canadian Aviation Regulations.

3.6.4 PERSONAL AUDIO EQUIPMENT / CELL PHONES

No person shall carry or use personal audio/visual equipment such as portable CD players, MP3 players, iPod, portable DVD players, or cassette players while working airside. Personal cellular telephones and portable communication devices including, but not limited to Blackberries, iPhones are not to be used on airside. Cellular telephones and portable communication devices are authorized for OPERATIONAL PURPOSES ONLY. The portable communication devices shall not be used while driving a vehicle/equipment unless 1) the vehicle is pulled over and brought to a complete stop in a safe location or (2) it is used with hands-free technology approved by law for such purpose (such as "Bluetooth" or hands-free speakers).

3.6.5 REPORTING HAZARDOUS CONDITIONS AND ACCIDENTS

A person encountering a hazardous condition on any aircraft movement surface shall report its nature and location immediately to their supervisor in order that corrective action may be taken.

All accidents shall immediately be reported to the Supervisor, Safety & Security. In the case of vehicle accidents, vehicles are not to be moved unless there is a possibility of further injury or damage to personnel or property. All personnel involved in the accident and witnesses must remain at the scene until the accident investigation is completed.

All other personnel shall remain clear of an accident scene unless authorized by the Airport Operator or responsible agency.

3.7 SCHEDULED FLIGHTS

Scheduled air service to the Airport is presently provided by various air carriers.

The 2019 Summer Flight Schedule is attached as Appendix B.

The project may affect scheduled flights when meteorological conditions favor Runway 07 or Runway 25.

When required due to meteorological conditions (wind, temperature, visibility), NOTAMS related to the closure of Runway 07-25 may be cancelled by the Airport Operator.

Operational impacts will be communicated to stakeholders prior to construction.

3.8 UNSCHEDULED FLIGHTS

The project may affect unscheduled flights, including rotary wing operations, when meteorological conditions favor Runway 07 or Runway 25.

When required due to meteorological conditions (wind, temperature, visibility), NOTAMS related to the closure of Runway 07-25 may be cancelled by the Airport Operator.

Operational impacts will be communicated to stakeholders prior to construction.

3.9 CONSTRUCTION START-UP

The following start-up procedure shall be followed:

1. Construction personnel and equipment, the Site Foreman, and the Gate Security shall gather near a designated Airside access gate.
2. Applicable NOTAMs shall be issued /confirmed in place by the Airport Operator and the Contract Administrator's Site Representative. NOTAM expiries shall be checked.
3. The Airside Escort shall advise that personnel and equipment will be proceeding to the designated construction areas. Only once the Airside Escort has determined that proceeding to the site will not interfere with air traffic will the construction traffic be escorted to the site.
4. The Airside Escort will monitor construction and air traffic frequencies during construction.
5. If required, placement of construction barricades, work delineation posts and runway closure markings shall occur immediately once the Contractor enters the designated area.

6. If required, lights designated to be made unserviceable shall be made unserviceable. All circuit lock-outs to be in place prior to construction work start.

3.10 CONSTRUCTION SHUT-DOWN

The following shut-down procedure shall be followed:

1. Prior to re-opening airside facilities to air traffic, the Contractor must ensure that taxiway and runway graded areas are graded and compacted with no significant high or low areas and no windrows of materials higher than 50mm. All excavations shall be backfilled at the end of each construction shift unless otherwise noted or indicated by the Engineer.
2. All pavement areas must be swept clean of all loose materials by the Contractor.
3. Barricades and unserviceability lighting shall be placed in proper locations and be operational. Barricades shall be secured with sand bags such that they do not move once placed. Additional sand bags may be required depending on final barricade geometry and type.
4. Construction personnel and equipment must be clear of airside operational areas.
5. The Construction Site Foreman and the Airside Escort will conduct an airfield inspection.
6. After confirming the airfield conditions are acceptable and safe and that all construction personnel and equipment are clear, the Airport Operator will cancel NOTAMS.

3.11 WEEKLY CONSTRUCTION PROGRESS MEETINGS

Weekly construction meetings are proposed throughout the construction period. The purpose of the meetings will be to review past and future progress and construction/coordination issues.

Participants generally include the Airport Operator, Contract Administrator and the Contractor's Site Representatives/Subcontractor's.

The Airport Operator will provide regular project status updates to NAV CANADA, Transport Canada (civil Aviation) and Airport Users.

3.12 NOTAMS AND RESPONSIBILITIES

The Airport Operator will be responsible for the origination, revision and cancellation of NOTAM's. The NOTAM will advise the aviation community of the establishment, condition or change in any aeronautical facility, service, procedure or hazard as well as the approximate period involved.

Situations may arise where an urgent NOTAM is required and the Airport Operator cannot be contacted. Under these circumstances the Airport Operator representative, or the Contractor if the situation requires, will be responsible for contacting NAV CANADA advising of the current situation at the airport.

Refer to Appendix D for Draft NOTAMS.

3.13 INCIDENT REPORTING PROCEDURES

If an accident or incident occurs on-site during the construction project, the incident will be reported as per on-site procedures, as outlined in the Airport Operations Manual (AOM). The Airport Operator's representative will be responsible for initiating and carrying out this work.

Immediately report emergencies to 204-675-0056.

3.14 STAKEHOLDER CONSULTATION

The Airport Operator will send a copy of the Plan of Construction Operations (PCO) to the following persons and agencies for their information (when applicable):

1. Airport Management,
2. All scheduled airlines using the airport,
3. NAV CANADA,
4. Transport Canada, Aerodrome Safety, and
5. The Contractor.

Transport Canada, Aerodrome Safety may circulate the PCO to other branches of Transport Canada as deemed necessary.

During the construction period, communications with the airlines and tenants will be the responsibility of the Airport Operator and their designate. The Contract Administrator will be responsible for the coordination of information between the Airport Operator and the General Contractor. Any changes to the plan as outlined within this document will be communicated as required by the Airport Operator.

3.15 AERONAUTICAL NOTIFICATIONS

3.15.1 PROPER NOTIFICATION

It is not advisable to issue a NOTAM for any planned permanent changes to an airport's configuration or facilities. The proper procedure is for the Aerodrome Operator to inform the regional Aerodrome Safety office who then notifies Transport Canada of any planned changes to aeronautical information. A NOTAM would be issued only if the work was not completed as planned.

3.15.2 NOTIFICATION SCHEDULE

Notification of planned changes to the airport must be made well in advance so that all users of the relevant publications will have the correct airport information. Aerodrome Safety Circular ASC2001-010 states that the Airport Operator must submit changes to Aerodrome Safety 85 calendar days in advance, in accordance with the Aeronautical Information Regulation and Control (AIRAC) process. In addition, Canadian Aviation Regulation 302.07, Obligations of Operator, subparagraph (1) (d) requires that planned changes to the airport be sent to Transport Canada in writing at least 14 days in advance. The Airport Operations Manual should be sent to Transport Canada along with the notification.

Project details will be communicated to NAV CANADA through the NAV CANADA Land Use Submission approvals process.

4. AIRPORT OPERATIONS MANUAL

The AOM and associated documents and publications will be updated by the Airport Operator to reflect the revised airfield geometry and physical characteristics.

5. OWNER – ENGINEER ATTESTATION

Upon completion of the project, the Owner along with the Engineer shall conduct a detailed acceptance and compliance inspection. This inspection will be issued and signed by the owner-engineer attesting to the compliance of the project with all applicable aerodrome standards and accepted practices as promulgated in TP312 5th Edition or applicable existing certification as indicated the AOM. This attestation will be forwarded to Transport Canada Aerodrome Safety for their information and appended to the AOM.

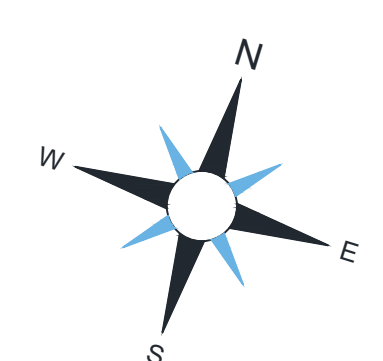
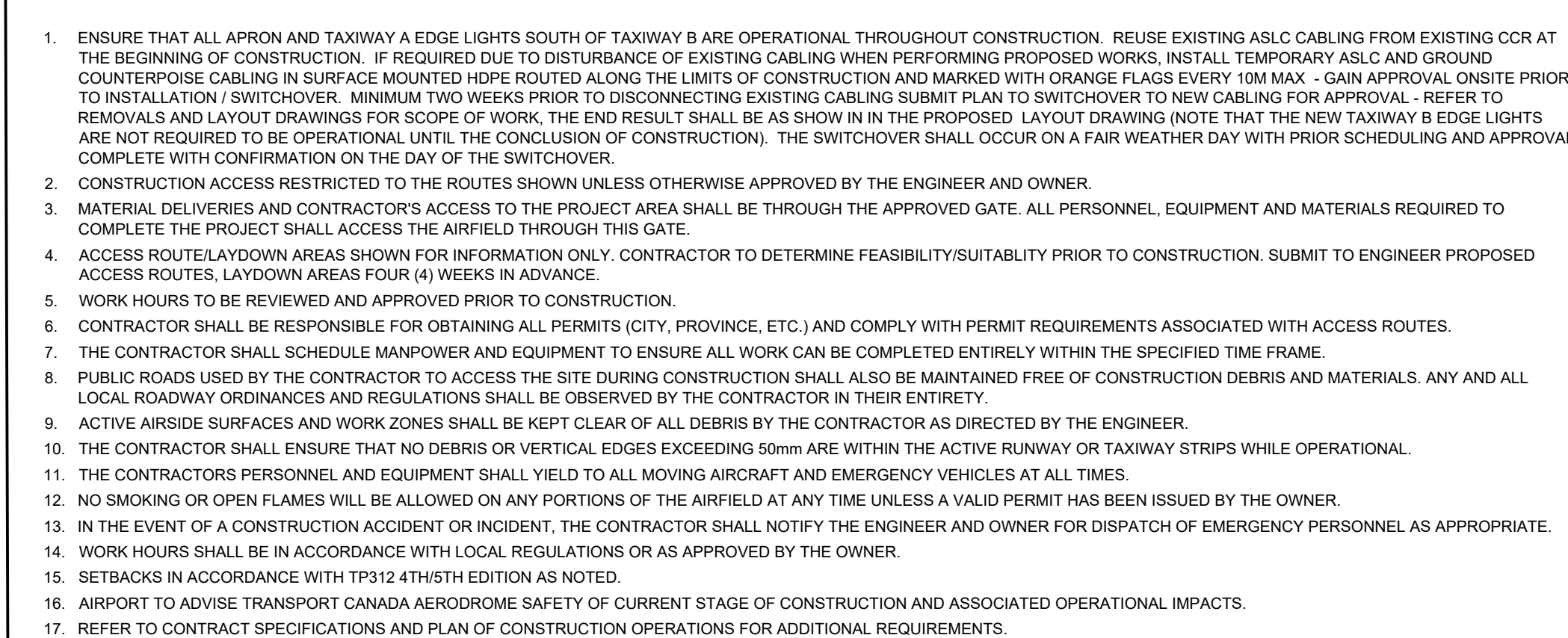
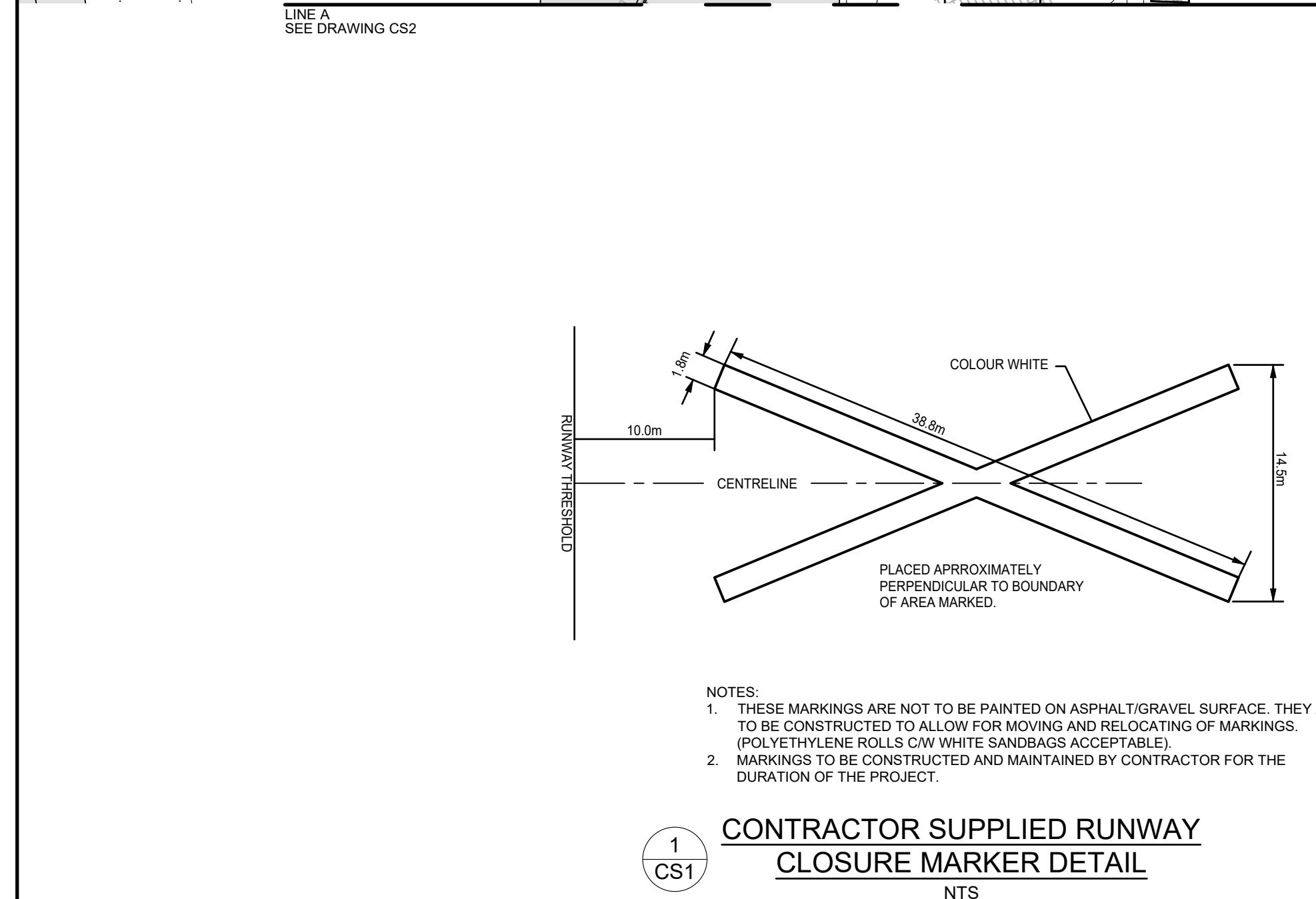
6. ENDORSEMENTS

PROJECT: Airfield Electrical Rehabilitation – Phase 1	
AIRPORT NAME: Churchill Airport	
AIRPORT OPERATOR and CERTIFICATE HOLDER: Transport Canada	
AIRPORT MANAGER Jennifer Schweder	
CERTIFICATE NUMBER AND DATE OF ISSUE 5151-C1111	
<i>This Plan of Construction Operations (PCO) has been prepared and reviewed by the following persons. This PCO documents a coordinated approach to completing the construction projects in the year 2019 at the Churchill Airport while maintaining an acceptable level of safety for those involved in the construction project and the aviation community.</i>	
<i>I undertake to meet the obligations set out in this plan of construction; and I hereby certify that the information in this plan is complete and accurate and no relevant information has been omitted.</i>	
_____, 2019 Date (D-M-Y)	_____ Signature of Airport Operator/Certificate Holder
<i>This Plan of Construction Operations has been approved by:</i>	
_____, 2019 Date (D-M-Y)	_____ For Minister of Transport

cc: Transport Canada Civil Aviation
 Airlines
 NAV CANADA
 Stakeholders/Contractor

APPENDIX A

Site Plan and Construction Sequencing Plan



Seals

TRANSPORT CANADA

Designed by NJH	Conçu par
Drawn by JSM	Dessiné par
Approved by JMG	Approuvé par
PWGSC Project Manager	Administrateur de Projets TPSGC

Drawing title	Titre du dessin	
<p align="center">CONSTRUCTION SEQUENCING</p> <p align="center">PLAN 1</p>		
Project no./No. du projet	Drawing no./No. du dessin	Revision no.
R.095823.001	E2	2

DECLARED DISTANCES (DURING CONSTRUCTION)	07	25
TORA	CLOSED	CLOSED
TODA	CLOSED	CLOSED
ASDA	CLOSED	CLOSED
LDA	CLOSED	CLOSED
DECLARED DISTANCES (DURING CONSTRUCTION)	15	33
TORA	9195	9195
TODA	10179	10179
ASDA	9195	9195
LDA	9195	9195

DEFINED RUNWAY/TAXIWAY EDGE	EXISTING	PROPOSED
ASPHALT SURFACE		
GRAVEL/MILLING SURFACE		
RUNWAY STRIP/GRADED AREA		
TAXIWAY STRIP/RSA		
RUNWAY OLS		
CONSTRUCTION WORK AREA		
GATE SECURITY/ESCORT		
CONSTRUCTION ACCESS ROUTE		
CONTRACTOR LAYDOWN AREA		
RUNWAY EDGE LIGHT [WH]	WH ○	WH ○
RUNWAY EDGE LIGHT [WHYL]	WH ○ YL	WH ○ YL
RUNWAY THRESHOLD/END LIGHT	GN □ RD	GN □ RD
TAXIWAY EDGE LIGHT	BL ○	BL ○
APRON JUNCTION LIGHT	YL ○	YL ○
RWY THRESH. ID. LIGHT (RTL)	WH ■	WH ■
RTL MINI-POWER CENTRE		
PULLPIT		
PAPI LIGHT UNITS		
INSTRUCTION / INFORMATION SIGN		
WIND DIRECTION INDICATOR		

TRANSPORT CANADA

**AIRFIELD ELECTRICAL
REHABILITATION - PHASE 1
RUNWAY 07-25 & TAXIWAY B**

PWGSC Project Manager	Administrateur de Projets TPSGC
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CONSTRUCTION SEQUENCING
PLAN 2

R.095823.001	E3	2
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3 OF 11

LINE
ING CS1

0-800

0-800

ATB

APRON

WORK ZONE 2

WORK ZONE 2

WORK ZONE 2

WORK ZONE 2

TAXIWAY ALPHA

RUNWAY 15-33
CODE A PRECISION

1-200

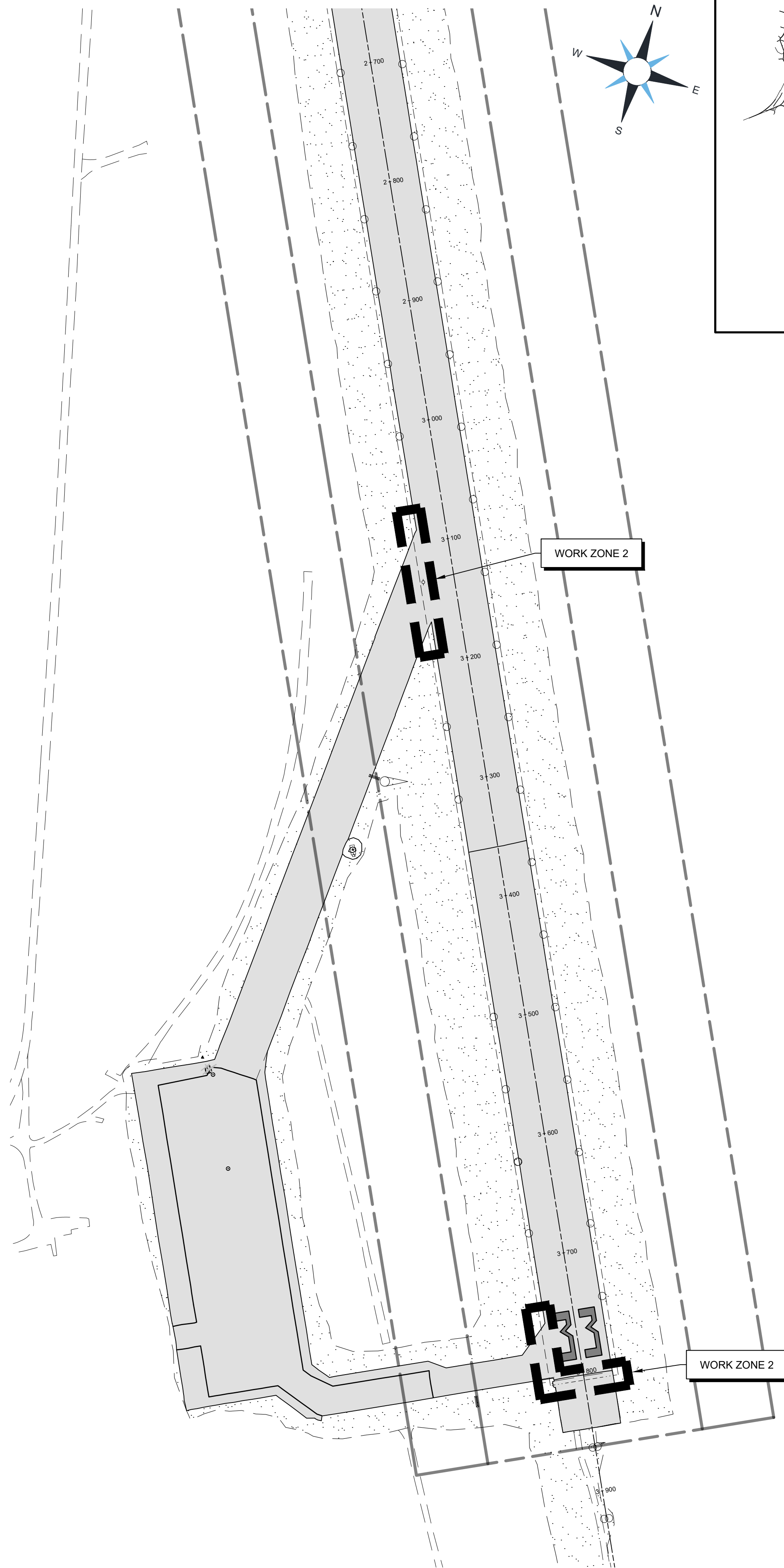
1-300

1-400

CONSTRUCTION ACTIVITY	1. INVESTIGATION OF EXISTING PULLPITS AND CONDUITS.
DURATION	1. TBD
CONSTRUCTION / SCHEDULE RESTRICTIONS	<p>1. CONSTRUCTION HEIGHT RESTRICTION: N/A</p> <p>2. WORK TO BE COMPLETED ON A FAIR WEATHER DAY WITH PRIOR APPROVAL.</p> <p>3. ALL WORKERS & EQUIPMENT TO PULL BACK 90m FROM RUNWAY 15-33 AND 26m FROM TAXIWAY 'A' CENTRELINES DURING AIRCRAFT MOVEMENTS AS DIRECTED BY AIRSIDE ESCORTS.</p> <p>4. ALL ACTIVE CIRCUITS CONTAINED WITHIN THE PULLPITS AND CONDUITS BEING INSPECTED TO BE LOCKED OUT PRIOR TO COMMENCING WORK.</p>
AIRPORT OPERATIONS	1. NO CLOSURES

1. ENSURE THAT ALL APRON AND TAXIWAY A EDGE LIGHTS SOUTH OF TAXIWAY B ARE OPERATIONAL THROUGHOUT CONSTRUCTION. REUSE EXISTING ASLC CABLING FROM EXISTING CCR AT THE BEGINNING OF CONSTRUCTION. IF REQUIRED DUE TO DISTURBANCE OF EXISTING CABLING WHEN PERFORMING PROPOSED WORKS, INSTALL TEMPORARY ASLC AND GROUND COUNTERPOISE CABLING IN SURFACE MOUNTED HDPE ROUTED ALONG THE LIMITS OF CONSTRUCTION AND MARKED WITH ORANGE FLAGS EVERY 10M MAX. - GAIN APPROVAL ONSITE PRIOR TO INSTALLATION / SWITCHOVER. MINIMUM TWO WEEKS PRIOR TO DISCONNECTING EXISTING CABLING SUBMIT PLAN TO SWITCHOVER TO NEW CABLING FOR APPROVAL. -REFER TO REMOVAL AND LAYDOWN OF WORK IN THE PROPOSED LAYOUT DRAWING (NOTE THAT THE NEW TAXIWAY B EDGE LIGHTS ARE NOT REQUIRED TO BE OPERATIONAL UNTIL THE CONCLUSION OF CONSTRUCTION). THE SWITCHOVER SHALL OCCUR ON A FAIR WEATHER DAY WITH PRIOR SCHEDULING AND APPROVAL COMPLETE WITH CONFIRMATION ON THE DAY OF THE SWITCHOVER.
2. CONSTRUCTION ACCESS RESTRICTED TO THE ROUTES SHOWN UNLESS OTHERWISE APPROVED BY THE ENGINEER AND OWNER.
3. MATERIAL DELIVERIES AND CONTRACTOR'S ACCESS TO THE PROJECT AREA SHALL BE THROUGH THE APPROVED GATE. ALL PERSONNEL, EQUIPMENT AND MATERIALS REQUIRED TO COMPLETE THE PROJECT SHALL ACCESS THE AIRFIELD THROUGH THIS GATE.
4. ACCESS ROUTE/LAYDOWN AREAS SHOWN FOR INFORMATION ONLY. CONTRACTOR TO DETERMINE FEASIBILITY/SUITABILITY PRIOR TO CONSTRUCTION. SUBMIT TO ENGINEER PROPOSED ACCESS ROUTES, LAYDOWN AREAS FOUR (4) WEEKS IN ADVANCE.
5. WORK HOURS TO BE REVIEWED AND APPROVED PRIOR TO CONSTRUCTION.
6. CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING ALL PERMITS (CITY, PROVINCE, ETC.) AND COMPLY WITH PERMIT REQUIREMENTS ASSOCIATED WITH ACCESS ROUTES.
7. THE CONTRACTOR SHALL SCHEDULE MANPOWER AND EQUIPMENT TO ENSURE ALL WORK CAN BE COMPLETED ENTIRELY WITHIN THE SPECIFIED TIME FRAME.
8. PUBLIC ROADS USED BY THE CONTRACTOR TO ACCESS THE SITE DURING CONSTRUCTION SHALL ALSO BE MAINTAINED FREE OF CONSTRUCTION DEBRIS AND MATERIALS. ANY AND ALL LOCAL ROADWAY ORDINANCES AND REGULATIONS SHALL BE OBSERVED BY THE CONTRACTOR IN THEIR ENTIRETY.
9. ACTIVE AIRSIDE SURFACES AND WORK ZONES SHALL BE KEPT CLEAR OF ALL DEBRIS BY THE CONTRACTOR AS DIRECTED BY THE ENGINEER.
10. THE CONTRACTOR SHALL ENSURE THAT NO DEBRIS OR VERTICAL EDGES EXCEEDING 50mm ARE WITHIN THE ACTIVE RUNWAY OR TAXIWAY STRIPS WHILE OPERATIONAL.
11. THE CONTRACTORS PERSONNEL AND EQUIPMENT SHALL YIELD TO ALL MOVING AIRCRAFT AND EMERGENCY VEHICLES AT ALL TIMES.
12. NO SMOKING OR OPEN FLAMES WILL BE ALLOWED ON ANY PORTIONS OF THE AIRFIELD AT ANY TIME UNLESS A VALID PERMIT HAS BEEN ISSUED BY THE OWNER.
13. IN THE EVENT OF A CONSTRUCTION ACCIDENT OR INCIDENT, THE CONTRACTOR SHALL NOTIFY THE ENGINEER AND OWNER FOR DISPATCH OF EMERGENCY PERSONNEL AS APPROPRIATE.
14. WORK HOURS SHALL BE IN ACCORDANCE WITH LOCAL REGULATIONS OR AS APPROVED BY THE OWNER.
15. SETBACKS IN ACCORDANCE WITH P313.24/15TH EDITION AS NOTED.
16. AIRPORT TO ADVISE TRANSPORT CANADA AERODROME SAFETY OF CURRENT STAGE OF CONSTRUCTION AND ASSOCIATED OPERATIONAL IMPACTS.
17. REFER TO CONTRACT SPECIFICATIONS AND PLAN OF CONSTRUCTION OPERATIONS FOR ADDITIONAL REQUIREMENTS.

1. ALL PERSONNEL OUTSIDE OF THE RUNWAY 07-25 AND TAXIWAY B LIMITS TO BE ESCORTED BY OWNER PERSONNEL. ALL PERSONNEL TO PULL BACK OUTSIDE OF TEMPORARY TAXIWAY STRIPS DURING TAXIING OPERATIONS.



APPENDIX B

Flight Schedule

CYYQ - CHURCHILL AIRPORT
Airfield Electrical Rehabilitation – Phase 1
Flight Schedule

Day	Flight	From	To	Arr	Dep	AC Type
S/M/T/W/R/F	Calm Air 300 / First Air 700	YWG	YYQ	0930		737-200
S/M/T/W/R/F	Calm Air 300 / First Air 700	YYQ	YRT		1005	737-200
S/M/T/W/R/F	Calm Air 303 / First Air 703	YRT	YYQ	2030		737-200
S/M/T/W/R/F	Calm Air 303 / First Air 703	YYQ	YWG		2110	737-200
SAT	Calm Air 300 / First Air 704	YWG	YYQ	0930		737-200
SAT	Calm Air 300 / First Air 704	YYQ	YRT		1005	737-200
SAT	Calm Air 305 / First Air 705	YRT	YYQ	1400		737-200
SAT	Calm Air 305 / First Air 705	YYQ	YWG		1440	737-200

APPENDIX C

Aircraft Mix

CYYQ - CHURCHILL AIRPORT

Airfield Electrical Rehabilitation – Phase 1

AIRCRAFT MIX AND AIRCRAFT GROUP NUMBER

- Boeing B737-200 (B732) AGN IIIB
- CRJ 200 (CRJ2) AGN IIIB (Runway Environment) AGN II (Taxiway Environment)
- Cessna Citation V (C560) AGN II
- Piper Navajo (PA31) AGN I
- Douglas DC-3 (DC3T) AGN IIIA
- Metroliner (SW4) AGN II
- Cessna Conquest 2 (C441) AGN II
- ATR 42 (AT45) AGN IIIA
- Cessna Caravan AGN II
- Cessna 182 AGN I
- ATR 72 AGN IIIA
- King Air 200 AGN I

APPENDIX D

Draft NOTAMS

CYYQ - CHURCHILL AIRPORT
Airfield Electrical Rehabilitation – Phase 1
DRAFT NOTAMS

XXXXXX CYYQ CHURCHILL
RWY 07-25 CLOSED DUE TO CONST
AVLBL FOR TAXI 30 MINS PNR
YYMMDDHHMM TIL YYMMDDHHMM

XXXXXX CYYQ CHURCHILL
RWY 07-25 E/L U/S
YYMMDDHHMM TIL YYMMDDHHMM

XXXXXX CYYQ CHURCHILL
TWY B CLOSED DUE TO CONST
AVLBL FOR TAXI 30 MINS PNR
YYMMDDHHMM TIL YYMMDDHHMM

CHURCHILL AIRPORT

AIRFIELD ELECTRICAL LIGHTING REHABILITATION

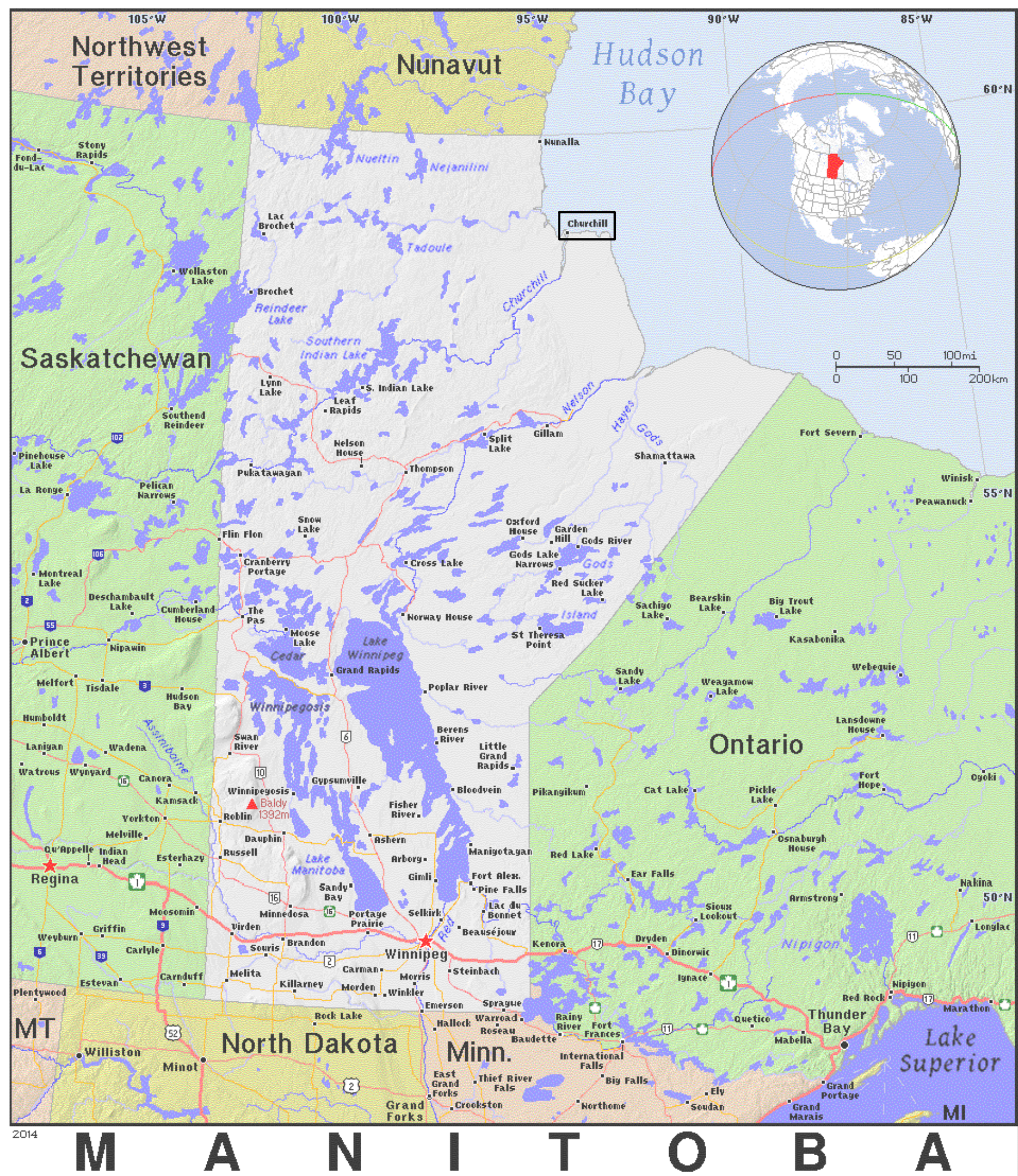


Transport
Canada

Transports
Canada



PROJECT PLAN LOCATION





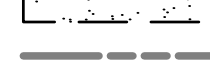






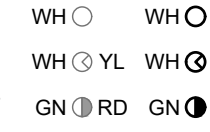













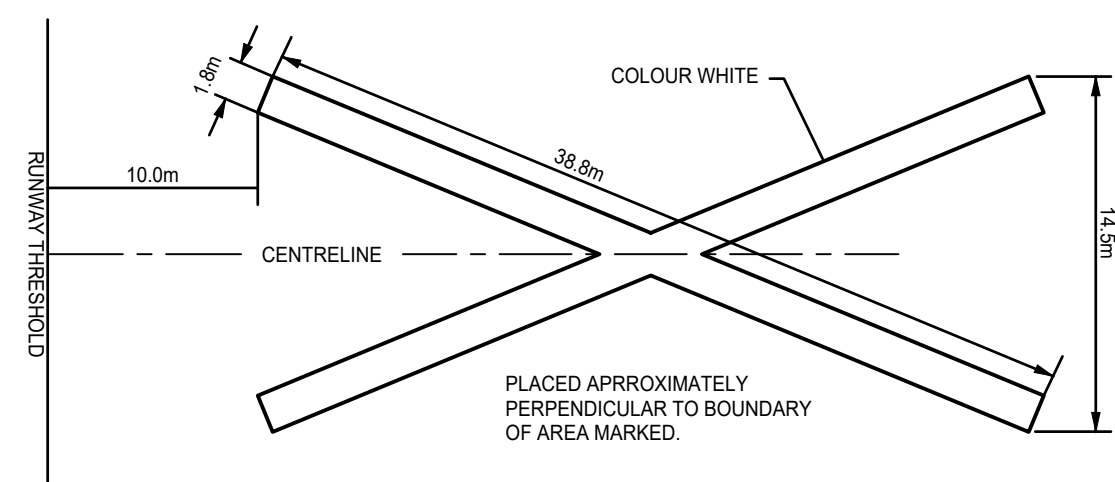
DRAWING INDEX

DWG	SHEET	TITLE
E1	001	SITE PLAN
E2	002	CONSTRUCTION SEQUENCING PLAN 1
E3	003	CONSTRUCTION SEQUENCING PLAN 2
E4	004	ELECTRICAL REMOVALS 1
E5	005	ELECTRICAL REMOVALS 2
E6	006	ELECTRICAL LAYOUT 1
E7	007	ELECTRICAL LAYOUT 2
E8	008	ELECTRICAL LAYOUT 3
E9	009	ELECTRICAL DETAILS 1
E10	010	ELECTRICAL DETAILS 2
E11	011	ELECTRICAL DETAILS 3

ISSUED FOR TENDER
MAY 2nd, 2019
AVIA NG No. 18-0071-00



	Public Works and Government Services Canada	Travaux publics et Services gouvernementaux Canada	
REAL PROPERTY SERVICES Western Region SERVICES IMMOBILIERS Région de l'ouest			
			
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Legend			
RUNWAY/TAXIWAY EDGE 			
ASPHALT SURFACE 			
GRAVEL/MILLING SURFACE 			
RUNWAY STRIP/GRADED AREA 			
TAXIWAY STRIP/RSA 			
RUNWAY OLS 			
CONSTRUCTION WORK AREA 			
GATE SECURITY/ESCORT 			
CONSTRUCTION ACCESS ROUTE 			
CONTRACTOR LAYDOWN AREA 			
EXISTING PROPOSED			
RUNWAY EDGE LIGHT [WH] WH ○ WH ○			
RUNWAY EDGE LIGHT [WHYL] WH ○ YL WH ○ YL			
RUNWAY THRESHOLD/END LIGHT GN ○ RD GN ○ RD			
TAXIWAY EDGE LIGHT BL ○ BL ○			
APRON JUNCTION LIGHT YL ○ YL ○			
RWY THRESH. ID. LIGHT (RTL) WH ■ WH ■			
RTL MINI-POWER CENTRE  			
PULLPIT  			
PAPI LIGHT UNITS  			
INSTRUCTION / INFORMATION SIGN  			
WIND DIRECTION INDICATOR  			
Seals			
			
5			
4			
3	ISSUED FOR TENDER	2019/05/02	
2	ISSUED FOR 99% DESIGN	2019/03/13	
1	ISSUED FOR 66% DESIGN	2019/02/28	
0	ISSUED FOR PRE-DESIGN REPORT	2018/01/11	
Revision	Description	Date	
Client		client	
TRANSPORT CANADA			
Project Title Project CHURCHILL AIRPORT, MANITOBA			
AIRFIELD ELECTRICAL REHABILITATION - PHASE 1 RUNWAY 07-25 & TAXIWAY B			
Designed by NJH	Conçu par		
Drawn by JSM	Dessiné par		
Approved by JMG	Approuvé par		
PWOSC Project Manager		Administrateur de Projets TPSOC	
Drawing title		Titre du dessin	
CONSTRUCTION SEQUENCING PLAN 1			
Project no./No. du projet	Drawing no./No. du dessin	Revision no.	
R.095823.001	E2	2	
2 OF 11			



- NOTES:
1. THESE MARKINGS ARE NOT TO BE PAINTED ON ASPHALT/GRAVEL SURFACE. THEY ARE TO BE CONSTRUCTED TO ALLOW FOR MOVING AND RELOCATING OF MARKINGS. (POLYETHYLENE ROLLS C/W WHITE SANDBAGS ACCEPTABLE).
 2. MARKINGS TO BE CONSTRUCTED AND MAINTAINED BY CONTRACTOR FOR THE DURATION OF THE PROJECT.

CONTRACTOR SUPPLIED RUNWAY CLOSURE MARKER DETAIL

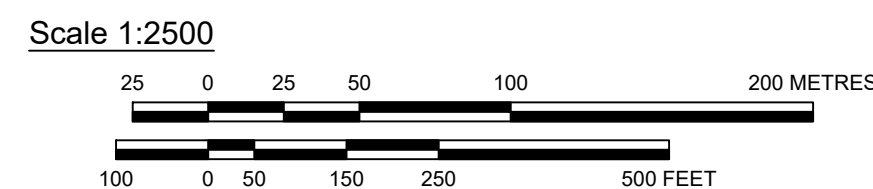
NTS

GENERAL CONSTRUCTION SEQUENCING NOTES:

1. ENSURE THAT ALL APRON AND TAXIWAY A EDGE LIGHTS SOUTH OF TAXIWAY B ARE OPERATIONAL THROUGHOUT CONSTRUCTION. REUSE EXISTING ASLC CABLEING FROM EXISTING CCR AT THE BEGINNING OF CONSTRUCTION. IF REQUIRED DUE TO DISTURBANCE OF EXISTING CABLING WHEN PERFORMING PROPOSED WORKS, INSTALL TEMPORARY ASLC AND GROUND CROSSLING CABLEING IN SURFACE MOUNTED HOES ROUTED ALONG THE LIMITS OF CONSTRUCTION AND MARKED WITH ORANGE FLAGS EVERY 10M MAX. - GAIN APPROVAL ONSITE PRIOR TO INSTALLATION / SWITCHOVER. MINIMUM TWO WEEKS PRIOR TO DISCONNECTING EXISTING CABLING SUBMIT PLAN TO SWITCHOVER TO NEW CABLING FOR APPROVAL. - REFER TO REMOVAL AND LAYDOWN SCHEDULE. THE RESULT SHALL BE AS SHOWN IN THE PROPOSED LAYOUT DRAWING (NOTE THAT THE NEW TAXIWAY B EDGE LIGHTS ARE NOT REQUIRED TO BE OPERATIONAL UNTIL THE CONCLUSION OF CONSTRUCTION). THE SWITCHOVER SHALL OCCUR ON A FAIR WEATHER DAY WITH PRIOR SCHEDULING AND APPROVAL. COMPLETE WITH CONFIRMATION ON THE DAY OF THE SWITCHOVER.
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6. CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING ALL PERMITS (CITY, PROVINCE, ETC.) AND COMPLY WITH PERMIT REQUIREMENTS ASSOCIATED WITH ACCESS ROUTES.
7. THE CONTRACTOR SHALL SCHEDULE MANPOWER AND EQUIPMENT TO ENSURE ALL WORK CAN BE COMPLETED ENTIRELY WITHIN THE SPECIFIED TIME FRAME.
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9. ACTIVE AIRSIDE SURFACES AND WORK ZONES SHALL BE KEPT CLEAR OF ALL DEBRIS BY THE CONTRACTOR AS DIRECTED BY THE ENGINEER.
10. THE CONTRACTOR SHALL ENSURE THAT NO DEBRIS OR VERTICAL EDGES EXCEEDING 50mm ARE WITHIN THE ACTIVE RUNWAY OR TAXIWAY STRIPS WHILE OPERATIONAL.
11. THE CONTRACTORS PERSONNEL AND EQUIPMENT SHALL YIELD TO ALL MOVING AIRCRAFT AND EMERGENCY VEHICLES AT ALL TIMES.
12. NO SMOKING OR OPEN FLAMES WILL BE ALLOWED ON ANY PORTIONS OF THE AIRFIELD AT ANY TIME UNLESS A VALID PERMIT HAS BEEN ISSUED BY THE OWNER.
13. IN THE EVENT OF A CONSTRUCTION ACCIDENT OR INCIDENT, THE CONTRACTOR SHALL NOTIFY THE ENGINEER AND OWNER FOR DISPATCH OF EMERGENCY PERSONNEL AS APPROPRIATE.
14. WORK HOURS SHALL BE IN ACCORDANCE WITH LOCAL REGULATIONS OR AS APPROVED BY THE OWNER.
15. SETBACKS IN ACCORDANCE WITH TP312 (2TH/5TH EDITION AS NOTED).
16. AIRPORT TO ADVISE TRANSPORT CANADA AERODROME SAFETY OF CURRENT STAGE OF CONSTRUCTION AND ASSOCIATED OPERATIONAL IMPACTS.
17. REFER TO CONTRACT SPECIFICATIONS AND PLAN OF CONSTRUCTION OPERATIONS FOR ADDITIONAL REQUIREMENTS.

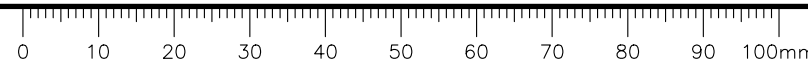
AIRSIDE SAFETY AND SECURITY ESCORTS:

1. ALL PERSONNEL OUTSIDE OF THE RUNWAY 07-25 AND TAXIWAY B LIMITS TO BE ESCORTED BY OWNER PERSONNEL. ALL PERSONNEL TO PULL BACK OUTSIDE OF TEMPORARY TAXIWAY STRIPS DURING TAXIING OPERATIONS..

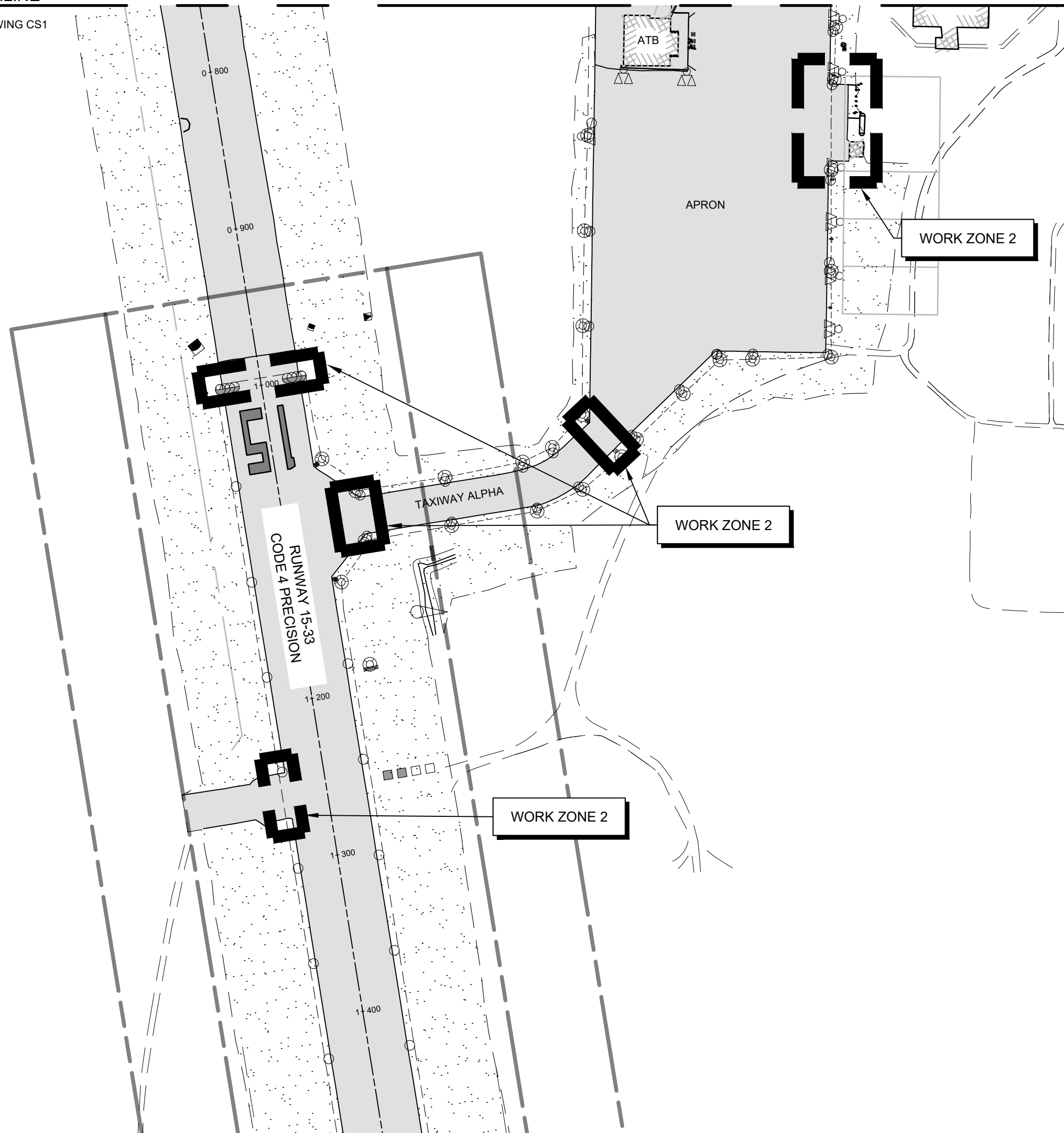


CONSTRUCTION ACTIVITY- WORK ZONE 1	
CONSTRUCTION ACTIVITY	<ol style="list-style-type: none"> 1. MOUNTING STRUCTURES FOR NEW PAPIS, SIGNS, RTILS & WINDCONES 2. AIRFIELD ELECTRICAL SYSTEM ABANDONMENT, REMOVAL & REPLACEMENT 3. RESTORATION
DURATION	<ol style="list-style-type: none"> 1. APPROXIMATELY 8 WEEKS
CONSTRUCTION / SCHEDULE RESTRICTIONS	<ol style="list-style-type: none"> 1. CONSTRUCTION HEIGHT RESTRICTION: 6.0m 2. WORK ON AIRPORT PROPERTY MAY BE PERMITTED 7:00 TO 19:00 DAILY 3. ALL WORKERS & EQUIPMENT TO PULL BACK 26m FROM RUNWAY 07-25 AND TAXIWAY BRAVO CENTRELINES DURING AIRCRAFT MOVEMENTS AS DIRECTED BY AIRSIDE ESCORTS. 4. ALL TRENCHES TO BE BACKFILLED AT THE END OF EACH CONSTRUCTION SHIFT. NARROW TRENCHES NOT EXCEEDING 9m² ARE PERMITTED DURING AIRCRAFT MOVEMENTS. 5. STOCKPILES ARE TO BE REMOVED OR BE LIMITED TO A MAX. HEIGHT OF 1.0m DURING AIRCRAFT MOVEMENTS AND AT THE END OF EACH CONSTRUCTION SHIFT.
AIRPORT OPERATIONS	<ol style="list-style-type: none"> 1. RUNWAY 07-25 CLOSED. AVAILABLE FOR TAXI ONLY, 30 MINUTES PRIOR NOTICE REQUIRED. 2. TAXIWAY BRAVO CLOSED, AVAILABLE WITH 30 MINUTES PRIOR NOTICE.

DECLARED DISTANCES (DURING CONSTRUCTION)	07	25
TORA	CLOSED	CLOSED
TODA	CLOSED	CLOSED
ASDA	CLOSED	CLOSED
LDA	CLOSED	CLOSED
DECLARED DISTANCES (DURING CONSTRUCTION)	15	33
TORA	9195	9195
TODA	10179	10179
ASDA	9195	9195
LDA	9195	9195

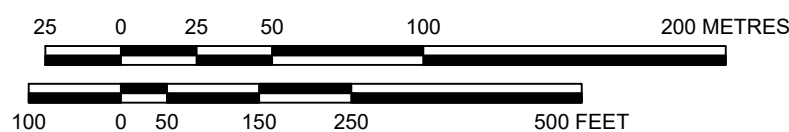


MATCHLINE
LINE A
SEE DRAWING CS1



CONSTRUCTION ACTIVITY - WORK ZONE 2	
CONSTRUCTION ACTIVITY	1. INVESTIGATION OF EXISTING PULLPITS AND CONDUITS.
DURATION	1. TBD
CONSTRUCTION / SCHEDULE RESTRICTIONS	1. CONSTRUCTION HEIGHT RESTRICTION: N/A 2. WORK TO BE COMPLETED ON A FAIR WEATHER DAY WITH PRIOR APPROVAL. 3. ALL WORKERS & EQUIPMENT TO PULL BACK 90m FROM RUNWAY 15-33 AND 28m FROM TAXIWAY A CENTRE LINES DURING AIRCRAFT MOVEMENTS AS DIRECTED BY AIRSIDE ESCORTS. 4. ALL ACTIVE CIRCUITS CONTAINED WITHIN THE PULLPITS AND CONDUITS BEING INSPECTED TO BE LOCKED OUT PRIOR TO COMMENCING WORK.
AIRPORT OPERATIONS	1. NO CLOSURES

Scale 1:2500

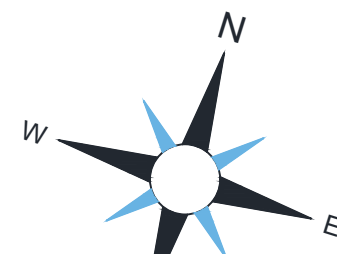


GENERAL CONSTRUCTION SEQUENCING NOTES:

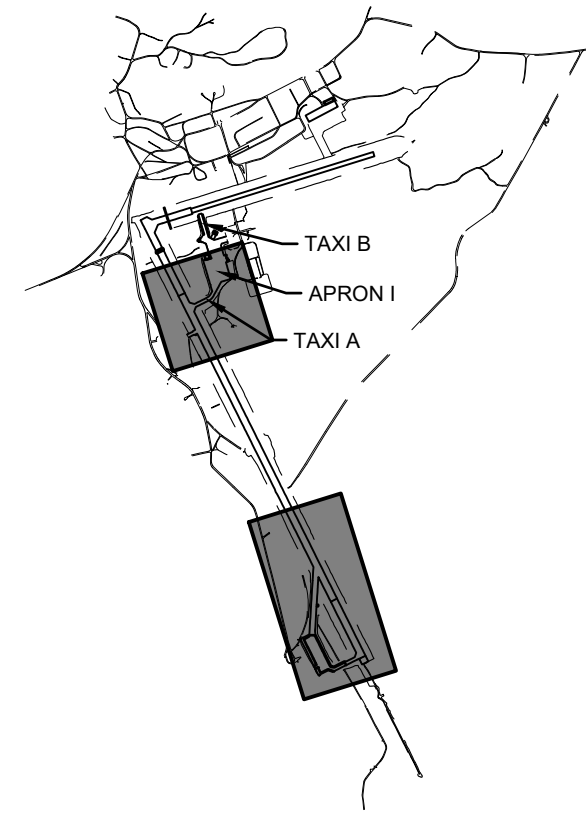
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- WORK HOURS SHALL BE IN ACCORDANCE WITH LOCAL REGULATIONS OR AS APPROVED BY THE OWNER.
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- AIRPORT TO ADVISE TRANSPORT CANADA AERODROME SAFETY OF CURRENT STAGE OF CONSTRUCTION AND ASSOCIATED OPERATIONAL IMPACTS.
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Key Plan



Legend

DEFINED RUNWAY/TAXIWAY EDGE	
ASPHALT SURFACE	
GRAVEL/MILLING SURFACE	
RUNWAY STRIP/GRADED AREA	
TAXIWAY STRIP/RSA	
RUNWAY OLS	
CONSTRUCTION WORK AREA	
GATE SECURITY/ESCORT	
CONSTRUCTION ACCESS ROUTE	
CONTRACTOR LAYDOWN AREA	
EXISTING PROPOSED	
RUNWAY EDGE LIGHT [WH]	WH ○ WH ○
RUNWAY EDGE LIGHT [WHYL]	WH ○ YL WH ○ YL
RUNWAY THRESHOLD/END LIGHT	GN ○ RD GN ○ RD
TAXIWAY EDGE LIGHT	BL ○ BL ○
APRON JUNCTION LIGHT	YL ○ YL ○
RWY THRESH. ID. LIGHT (RTIL)	WH ■ WH ■
RTIL MINI-POWER CENTRE	
PULLPIT	
PAPI LIGHT UNITS	
INSTRUCTION / INFORMATION SIGN	
WIND DIRECTION INDICATOR	

Seals



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3	ISSUED FOR TENDER	2019/05/02
2	ISSUED FOR 99% DESIGN	2019/03/13
1	ISSUED FOR 66% DESIGN	2019/02/28
0	ISSUED FOR PRE-DESIGN REPORT	2018/01/11
Revision	Description	Date

Client client

TRANSPORT CANADA

Project title Projet

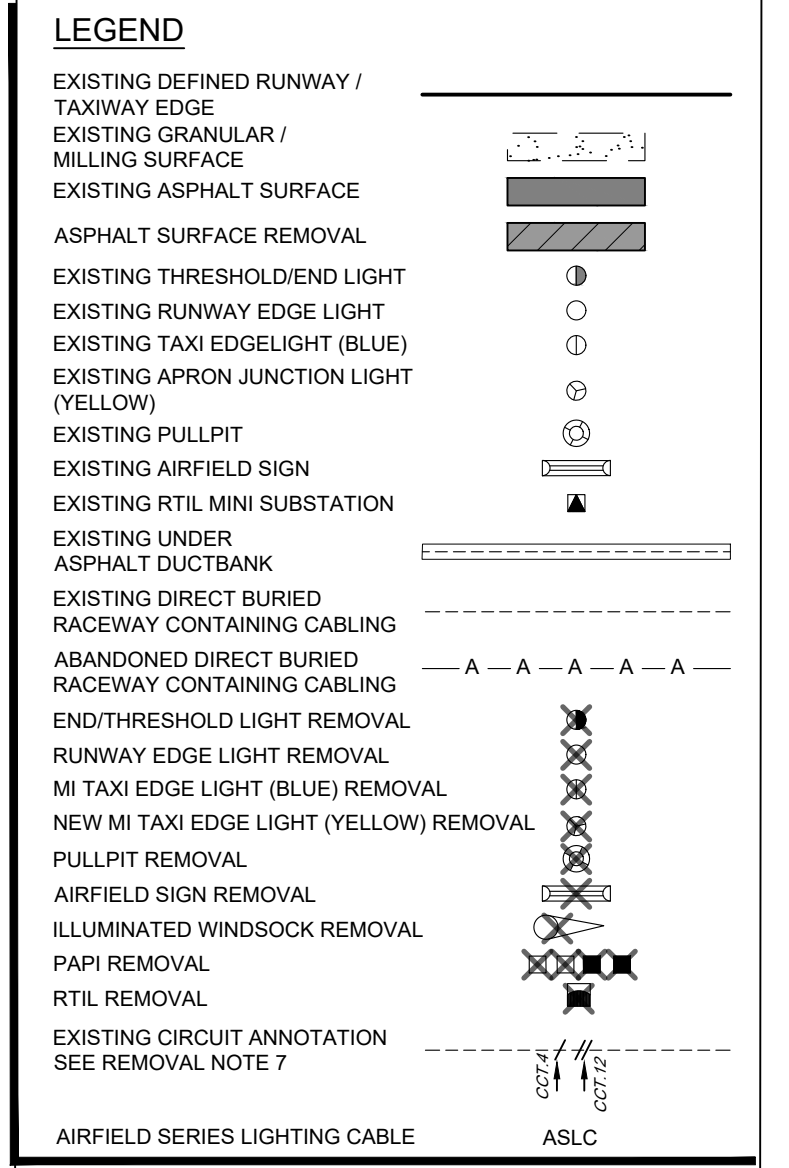
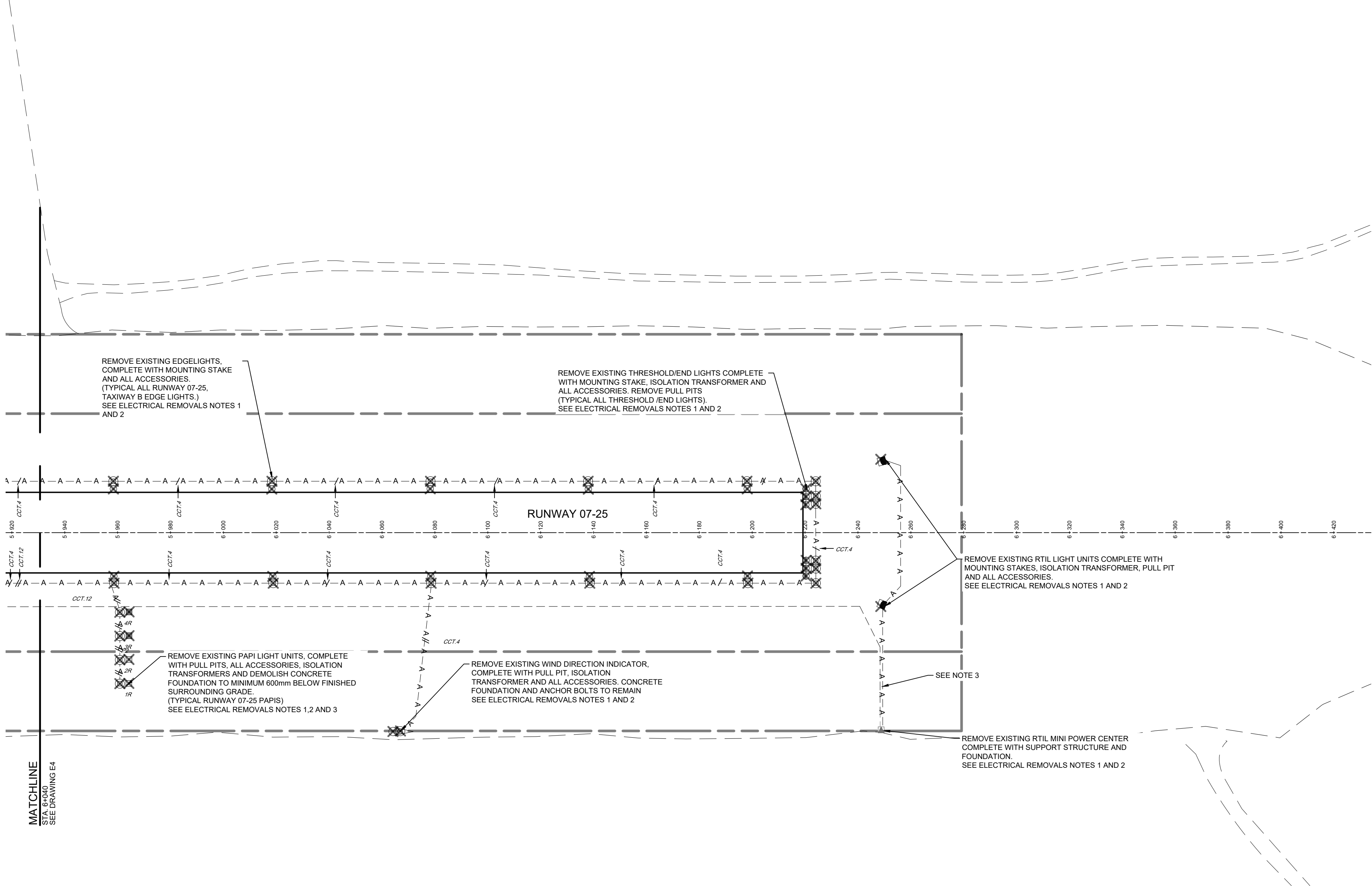
CHURCHILL AIRPORT, MANITOBA

AIRFIELD ELECTRICAL REHABILITATION - PHASE 1 RUNWAY 07-25 & TAXIWAY B

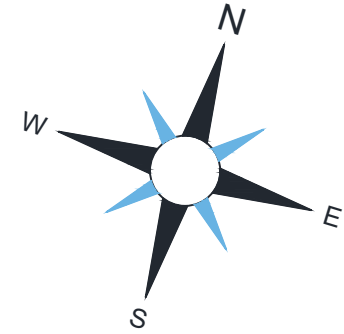
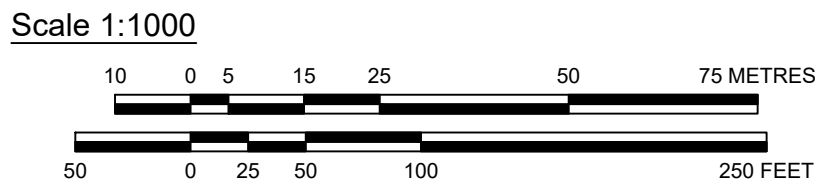
Designed by N.J.H.	Conçu par
Drawn by J.S.M.	Dessiné par
Approved by J.M.G.	Approuvé par
PWSSC Project Manager	Administrateur de Projets TPSSC

Drawing title Titre du dessin
**CONSTRUCTION SEQUENCING
PLAN 2**

Project no./No. du projet R.095823.001	Drawing no./No. du dessin E3	Revision no. 2
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- ELECTRICAL REMOVAL NOTES:**
- FOR ALL REMOVALS IMPACTING THE EXISTING SURFACE RESTORE SURFACE TO MATCH SURROUNDING GRADE OR PROPOSED GRADE AS APPLICABLE.
 - SALVAGE AND TEMPORARILY RETAIN ALL EXISTING EDGE LIGHTING, PAPIs, RTIL, ILLUMINATED SIGNS AND WINDCONES COMPLETE WITH ASSOCIATED ISOLATION TRANSFORMERS AND TEMPORARILY STORE ONSITE AS DIRECTED. ENSURE DURING SALVAGING THAT THEY ARE NOT DAMAGED AND AVAILABLE FOR OPERATIONAL USE. AT THE CONCLUSION OF CONSTRUCTION DISPOSE OF MATERIALS OFFSITE.
 - ALL RACEWAYS MADE OBSOLETE AS A RESULT OF THIS PROJECT ABOVE GRADE AND A MINIMUM OF 150mm BELOW GRADE ARE TO BE REMOVED. RACEWAYS MORE THAN 150mm BELOW GRADE ARE TO BE ABANDONED OR REMOVED IF REQUIRED TO EXECUTE SPECIFIED WORKS.
 - ALL CABLING MADE OBSOLETE IS TO BE REMOVED. REMOVE PULL PITS AS INDICATED COMPLETE WITH SURFACE RESTORATION TO MATCH SURROUNDING GRADE.
 - UNLESS OTHERWISE NOTED, ALL RACEWAYS MADE OBSOLETE BY THIS PROJECT WHICH ENTER PULL PITS AND MANHOLES ARE TO BE CUT 75mm INSIDE AT PULLPIT/MAHOLE WALL OR BASE, PLUGGED AND LABELLED OBSOLETE.
 - UNLESS OTHERWISE NOTED ALL REMOVED MATERIALS ARE TO BE DISPOSED OF OFFSITE.
 - Xs DENOTE MATERIALS TO BE REMOVED.
 - EXISTING CIRCUIT ANNOTATION WHERE CCT.4 INDICATES ASLC CABLING FOR CIRCUIT #4 AND // INDICATES 2-1/C ASLC CABLES ROUTED THROUGH EXISTING DIRECT BURIED CONDUIT.



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2	ISSUED FOR TENDER	2019/05/02
1	ISSUED FOR 99% DESIGN	2019/03/14
0	ISSUED FOR 66% DESIGN	2019/01/11

Revision	Description	Date
Client		client

TRANSPORT CANADA

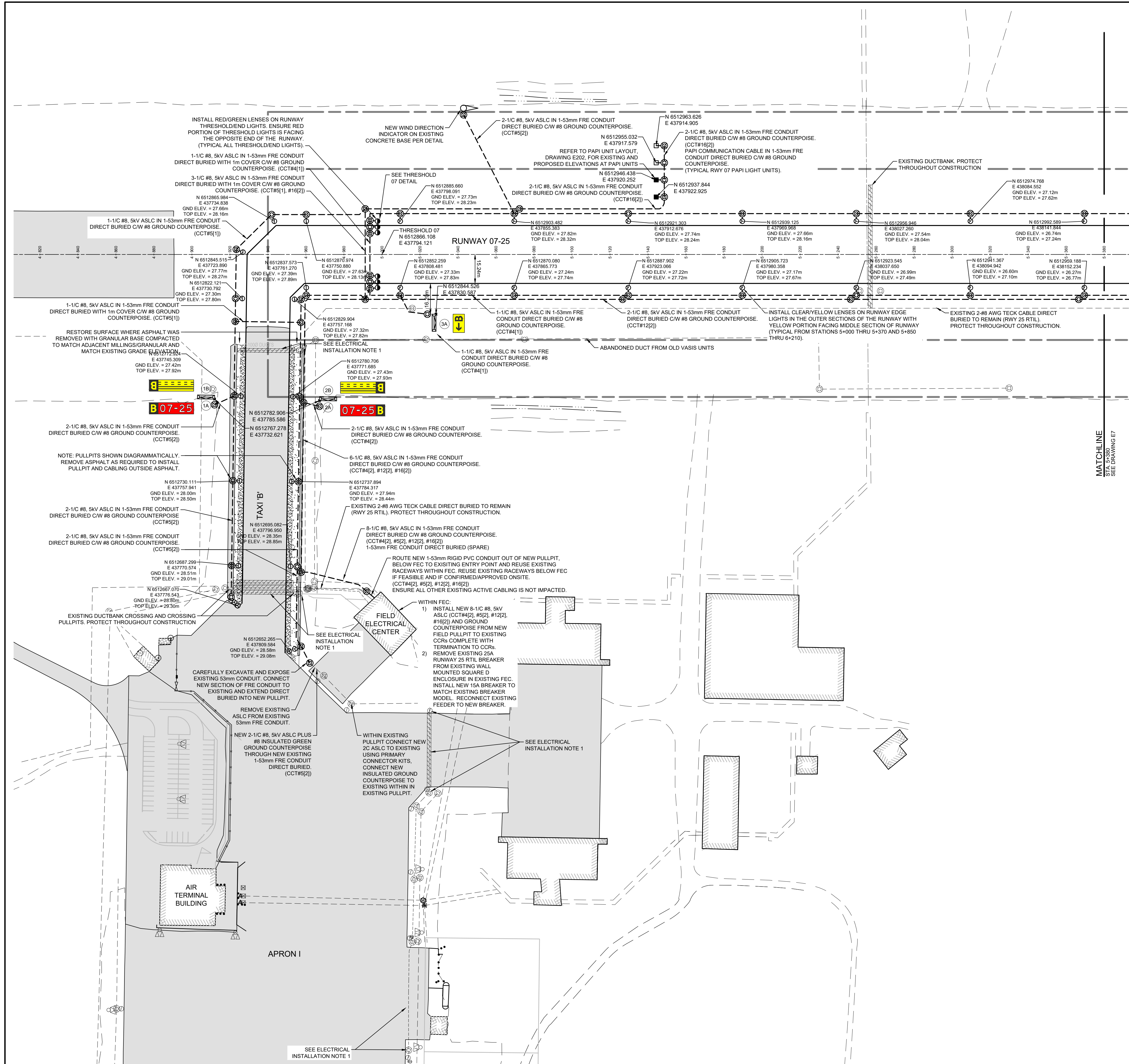
Project title
CHURCHILL AIRPORT, MANITOBA

AIRFIELD ELECTRICAL
REHABILITATION - PHASE 1
RUNWAY 07-25 & TAXIWAY B

Designed by NJH	Conçu par
Drawn by JSM / MDZ	Dessiné par
Approved by NJH	Approuvé par
PWGSC Project Manager	Administrateur de Projets TPSCG

Drawing title
ELECTRICAL REMOVALS 2

Project no./No. du projet R.095823.001	Drawing no./No. du dessin E5	Revision no. 1
	05 OF 11	



LEGEND

EXISTING DEFINED RUNWAY / TAXIWAY EDGE	
EXISTING GRANULAR / MILLING SURFACE	
EXISTING ASPHALT SURFACE	
EXISTING TAXI EDGE LIGHT (BLUE)	
EXISTING PULLPIT	
NEW PULLPIT	
NEW END/THRESHOLD LIGHT	
NEW RUNWAY EDGE LIGHT (WHITE/WHITE)	
NEW RUNWAY EDGE LIGHT (YELLOW/WHITE)	
NEW TAXI EDGE LIGHT (BLUE)	
NEW APRON JUNCTION LIGHT (YELLOW)	
NEW FLASHING LIGHT UNIT, UNI-DIRECTIONAL	
NEW ILLUMINATED GUIDANCE SIGN	
NEW ILLUMINATED WINDSOCK	
NEW PAPI LIGHTS	
NEW RTIL MINI SUBSTATION	
EXISTING UNDERGROUND DUCTBANK	
EXISTING RACEWAY/ CABLEING AS NOTED	
NEW RACEWAY / CABLEING AS NOTED	
AIRFIELD SERIES LIGHTING CABLE	ASLC

CABLE SCHEDULE

CABLE TYPE	DESCRIPTION
ASLC	AIRFIELD SERIES LIGHTING CABLE. NOTES INDICATE NUMBER OF CABLES IN TRENCH. CABLE RUN ALSO INCLUDES ONE RUN OF #8 SOFT DRAWN BARE COPPER (SDBC) COUNTERPOISE FOR DIRECT BURIED INSTALLATION OR 1-#8 GREEN INSULATED COPPER COUNTERPOISE IN DUCT UNDER RUNWAYS. REFER TO SPECIFICATION 16521.
TECK	ALUMINUM INTERLOCKING ARMORED PVC JACKETED TECK CABLE VOLTAGE CLASS 600V UNLESS OTHERWISE INDICATED.

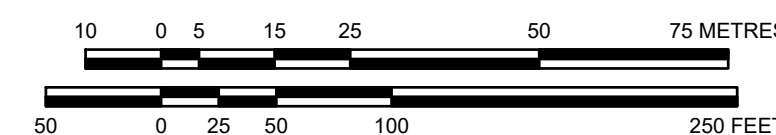
AIRFIELD CABLE CIRCUIT SCHEDULE

CIRCUIT No.	CABLE TYPE	DESCRIPTION
1	ASLC	RUNWAY 15/33 EDGE LIGHTS
2	ASLC	RUNWAY 15/33 EDGE LIGHTS
4	ASLC	RUNWAY 07/25 EDGE LIGHTS
5	ASLC	TAXIWAY A, B AND APRON
10	2-#8 TECK	RTIL 15
12	ASLC	PAPI 25
14	ASLC	PAPI 15
15	CONC.	ABANDON
16	ASLC	PAPI 07
17	ASLC	SSALR 33 STEADY BURNING LIGHTS
18	ASLC	SSALR 33 FLASHING LIGHTS

ELECTRICAL INSTALLATION NOTES:

- AT THE BEGINNING OF CONSTRUCTION, ON A FAIR WEATHER DAY, WITH PRIOR APPROVAL AND WITH ALL ACTIVE CIRCUITS CONTAINED WITHIN THE PULL PITS AND CONDUITS IN QUEST OF LOCKED OUT, INVESTIGATE EXISTING UNDERGROUND CONDUIT / PULL PITS FOR RE-USABILITY. DETERMINE THE SIZE, TYPE AND INSTALLATION METHOD OF CONDUIT. DETERMINE WHAT THE EXISTING CABLES ARE IN THE EXISTING CONDUITS. HOW MANY CONDUITS ARE IN EACH DUCTBANK, WHICH CABLES ARE IN WHICH CONDUIT AND THE AVAILABILITY OF SPARE REUSABLE CONDUITS. DETERMINE IF THE EXISTING CONDUIT UNDER THE CONCRETE/PAVED SURFACE CAN BE REUSED BETWEEN PULL PITS AND/OR FLOODLIGHT POLES ADJACENT TO CONCRETE/PAVED SURFACE. REPORT ALL FINDINGS TO DEPARTMENTAL REPRESENTATIVE PRIOR TO LAYING OUT THE NEW WORKS.
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- ALL EXISTING STRUCTURES, FIXTURES AND OTHER UNDERGROUND UTILITIES WITHIN THE CONSTRUCTION LIMITS SHALL BE PROTECTED DURING CONSTRUCTION.
- CONTRACTOR TO MAINTAIN SURFACE DRAINAGE AND ALL SEDIMENT/EROSION CONTROLS AT ALL TIMES DURING CONSTRUCTION.
- CONTRACTOR TO VERIFY EXISTING BASEPLAN. DO NOT ASSUME ALL INFORMATION IS CORRECT. BASEPLAN IS BASED ON AS-RECORDED DRAWINGS AND SURVEY COMPLETED BY AVIA NG IN OCTOBER 2018.
- ENSURE PLAN OF CONSTRUCTION IS FOLLOWED AND THAT ALL REQUIRED LIGHTS IN EACH STAGE ARE SERVICEABLE.
- PRIOR TO DE-ENERGIZING ANY CIRCUIT CONFIRM WITH ENERGIZER/ AND GAIN APPROVAL. LOCK OUT ALL DE-ENERGIZED CIRCUITS.
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- CONTRACTOR TO CONFIRM ALL TRENCH LOCATIONS WITH DEPARTMENTAL REPRESENTATIVE PRIOR TO LAYOUT AND EXCAVATION.
- REFER TO ELECTRICAL DETAIL SHEETS FOR INSTALLATION DETAILS PERTAINING TO NEW INFRASTRUCTURE.

Scale 1:1000



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1	ISSUED FOR 99% DESIGN	2019/03/14	
0	ISSUED FOR 66% DESIGN	2019/01/11	
Revision	Description	Date	
Client		client	

TRANSPORT CANADA

Project title
CHURCHILL AIRPORT, MANITOBA

AIRFIELD ELECTRICAL
REHABILITATION - PHASE 1
RUNWAY 07-25 & TAXIWAY B

Designed by
NJH

Conçu par
NJH

Drawn by
JSM / MDZ

Dessiné par
JSM / MDZ

Approved by
NJH

Approuvé par
NJH

PWSSC Project Manager
Administrateur de Projets TPSSC

Drawing title
ELECTRICAL LAYOUT 1

Titre du dessin
ELECTRICAL LAYOUT 1

Project no./No. du projet
R.095823.001

Drawing no./No. du dessin
E6

Revision no.
1

06 OF 11

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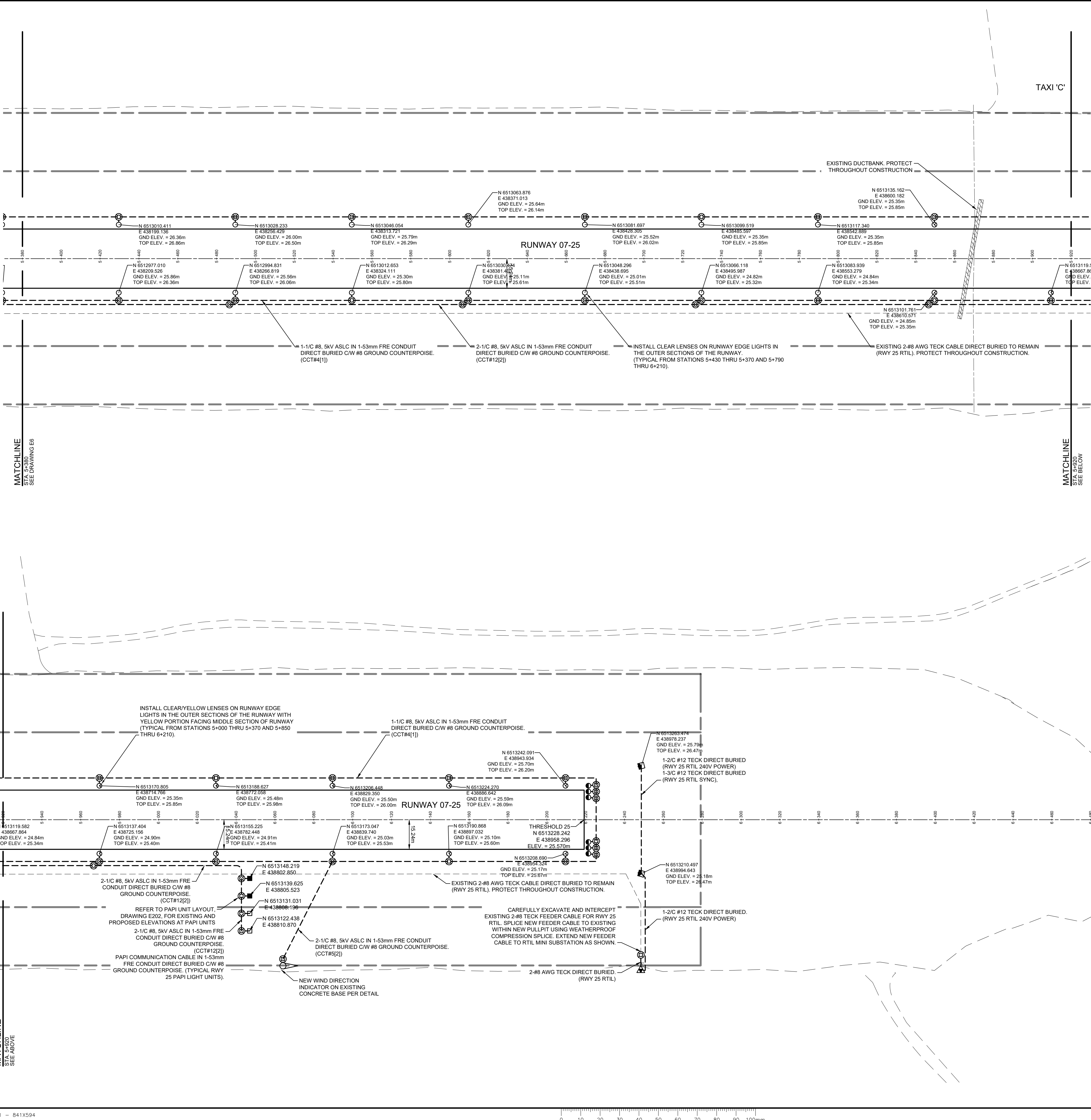
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MATCHLINE
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MATCHLINE
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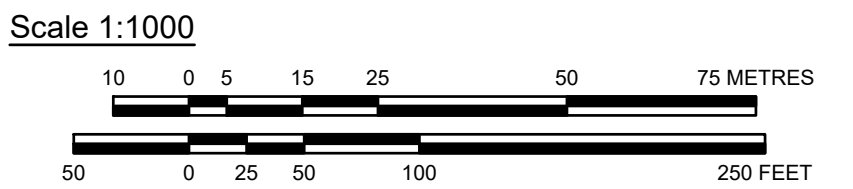
LEGEND

EXISTING DEFINED RUNWAY / TAXIWAY EDGE
EXISTING GRANULAR / MILLING SURFACE
EXISTING ASPHALT SURFACE
EXISTING TAXI EDGLIGHT (BLUE)
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AIRFIELD SERIES LIGHTING CABLE ASLC

CABLE SCHEDULE	
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CIRCUIT No.	CABLE TYPE	DESCRIPTION
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1	ISSUED FOR 99% DESIGN	2019/05/14
0	ISSUED FOR 66% DESIGN	2019/01/11
Revision	Description	Date
Client		client

TRANSPORT CANADA

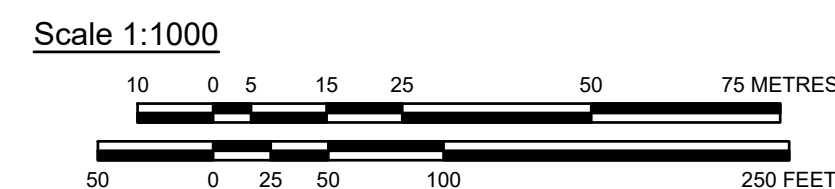
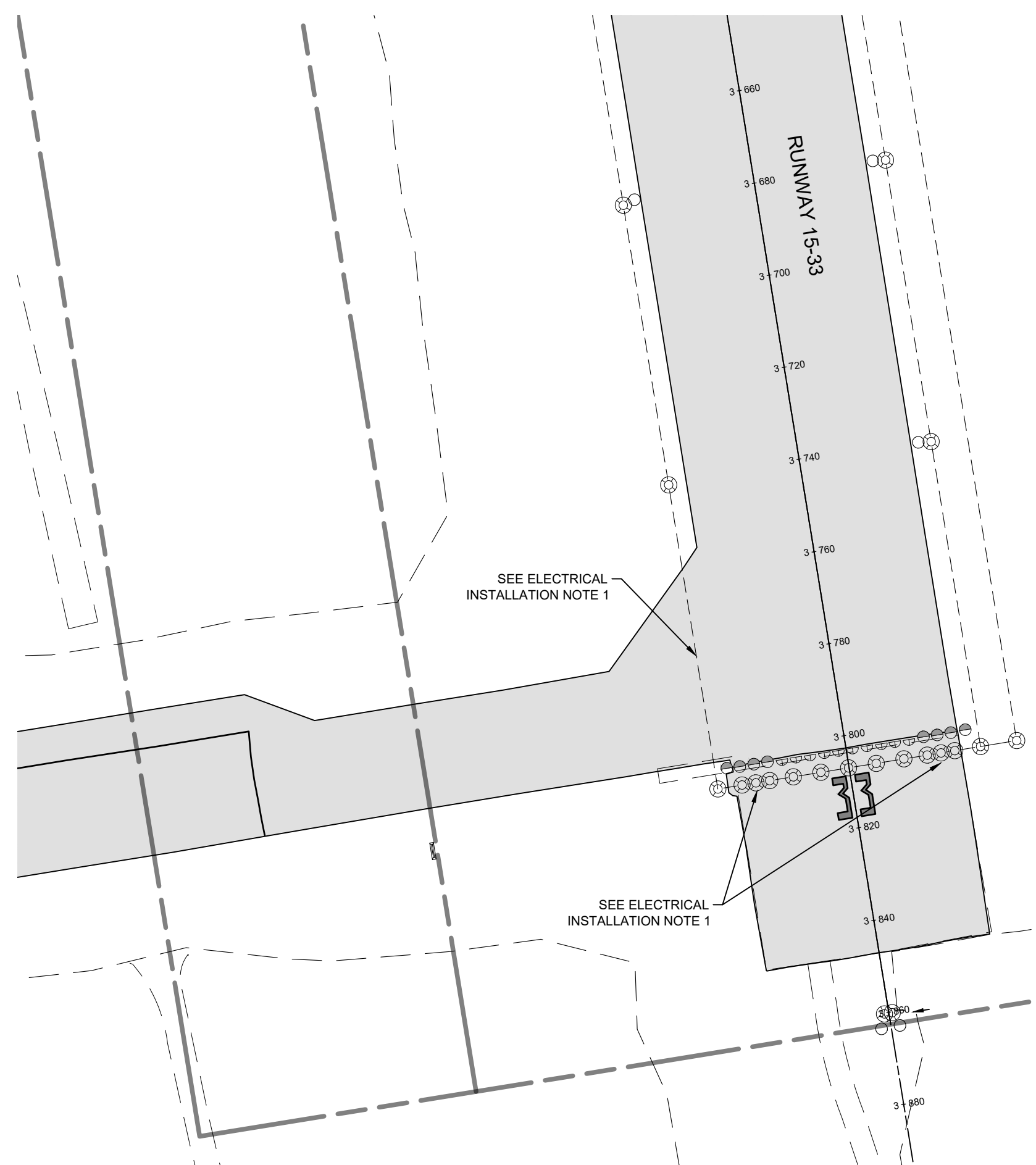
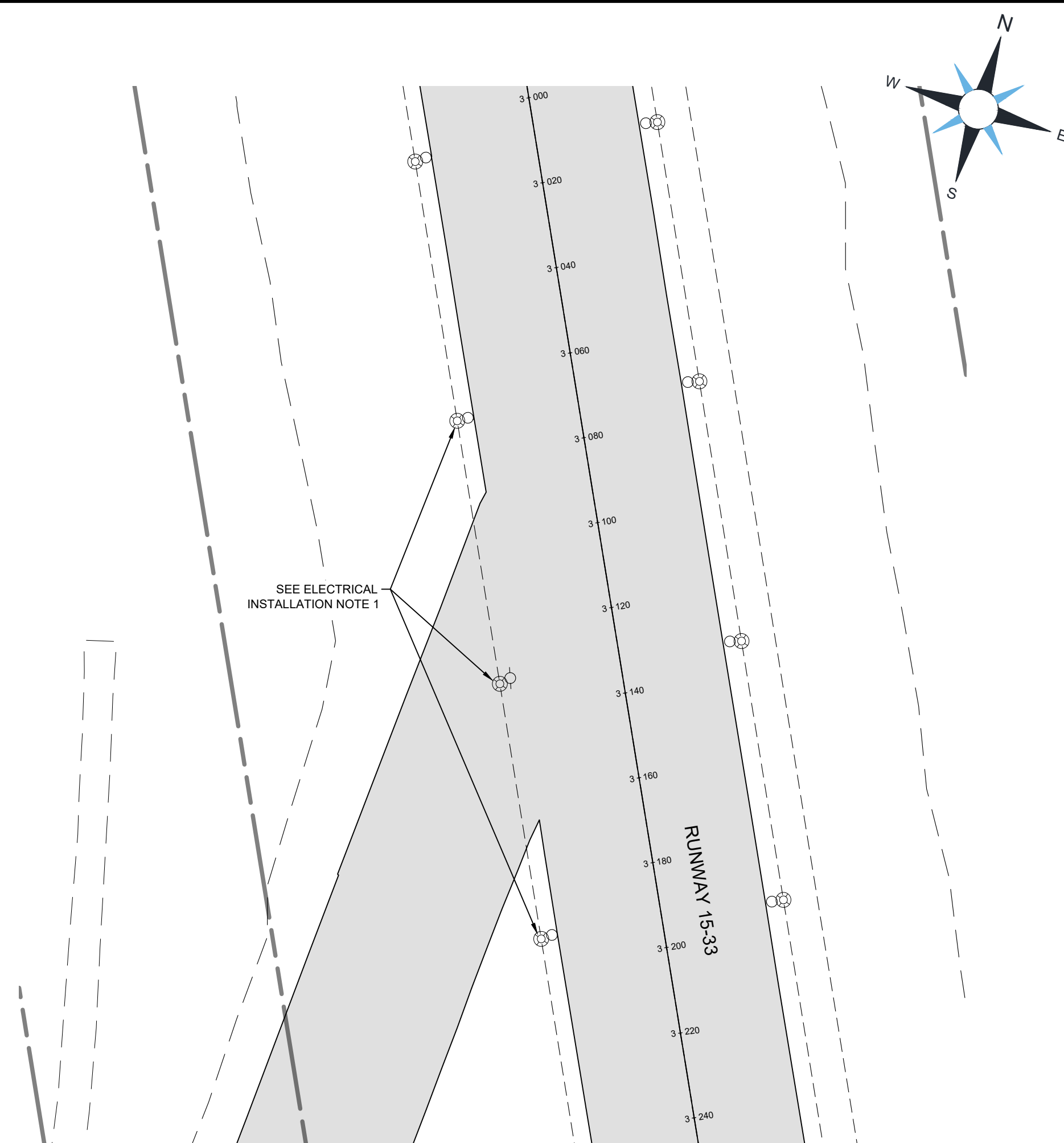
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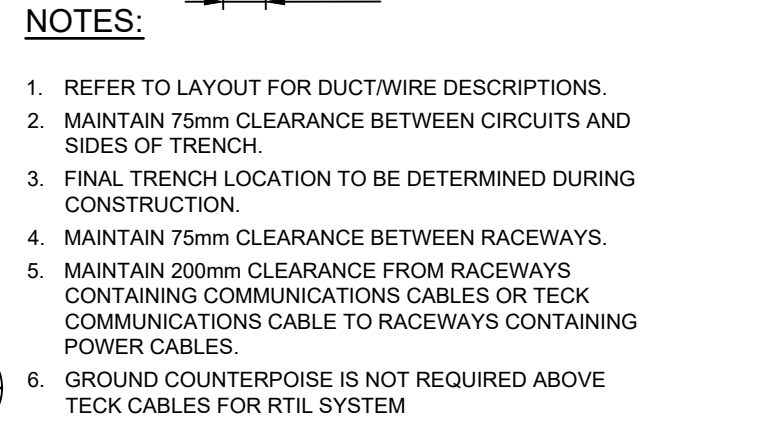
CHURCHILL AIRPORT, MANITOBA

AIRFIELD ELECTRICAL REHABILITATION - PHASE 1 RUNWAY 07-25 & TAXIWAY B

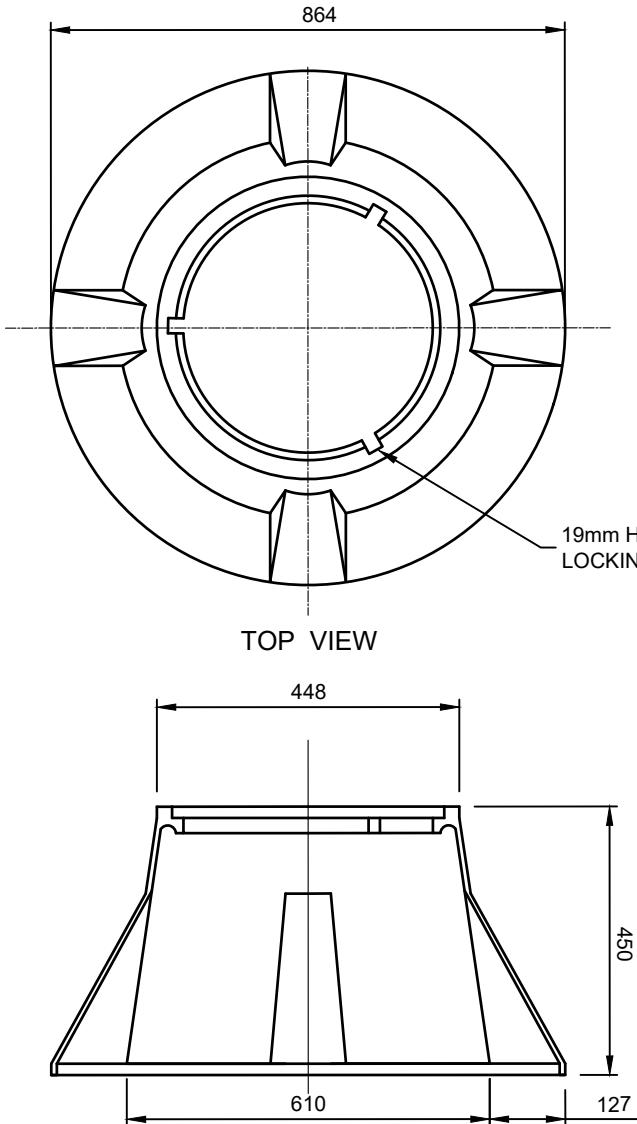
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NJH	
Drawn by	Dessiné par
MDZ	
Approved by	Approuvé par
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PWSSC Project Manager	Administrateur de Projets TPSSC
Drawing title	Titre du dessin
ELECTRICAL LAYOUT 2	

Project no./No. du projet	Drawing no./No. du dessin	Revision no.
R.095823.001	E7	1
		07 OF 11

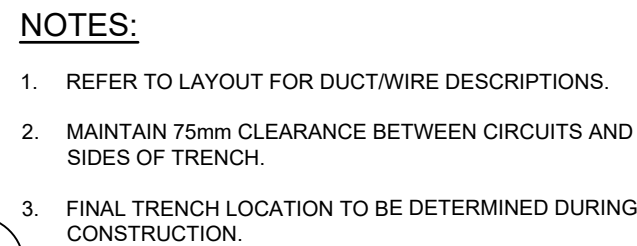
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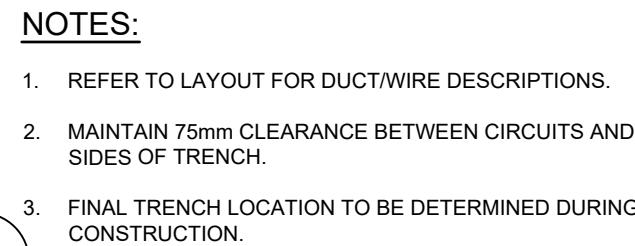
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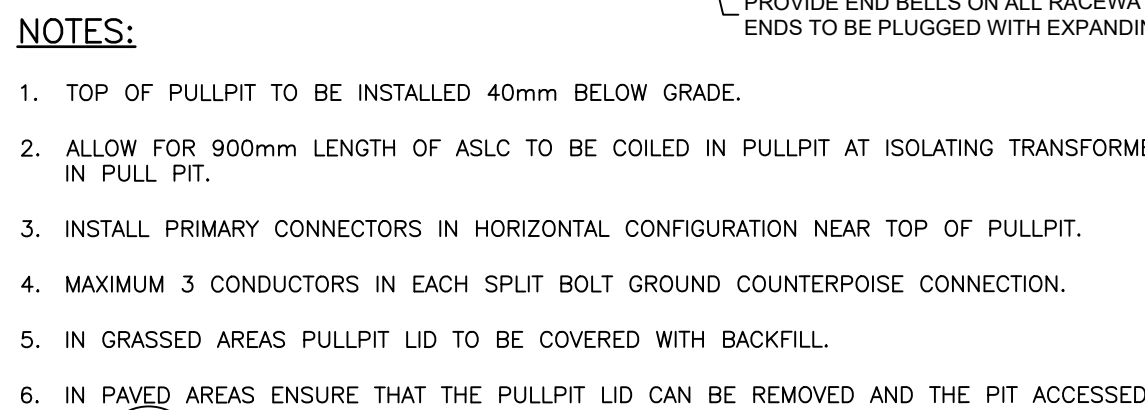
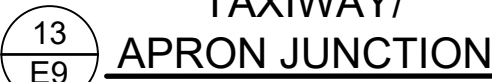
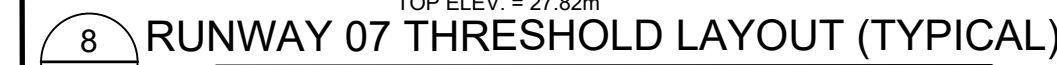
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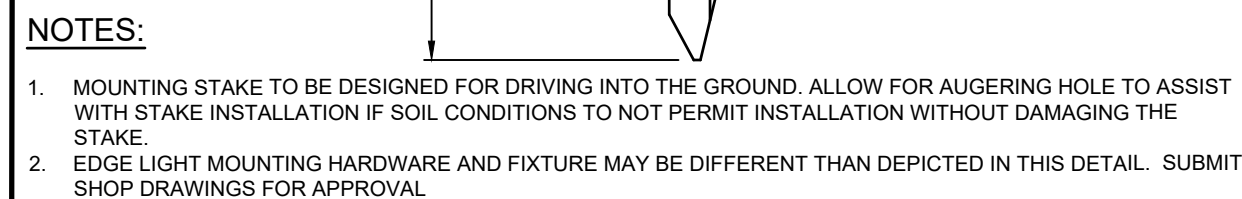


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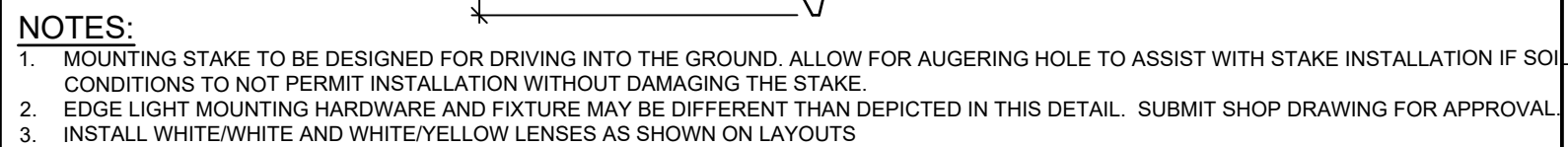


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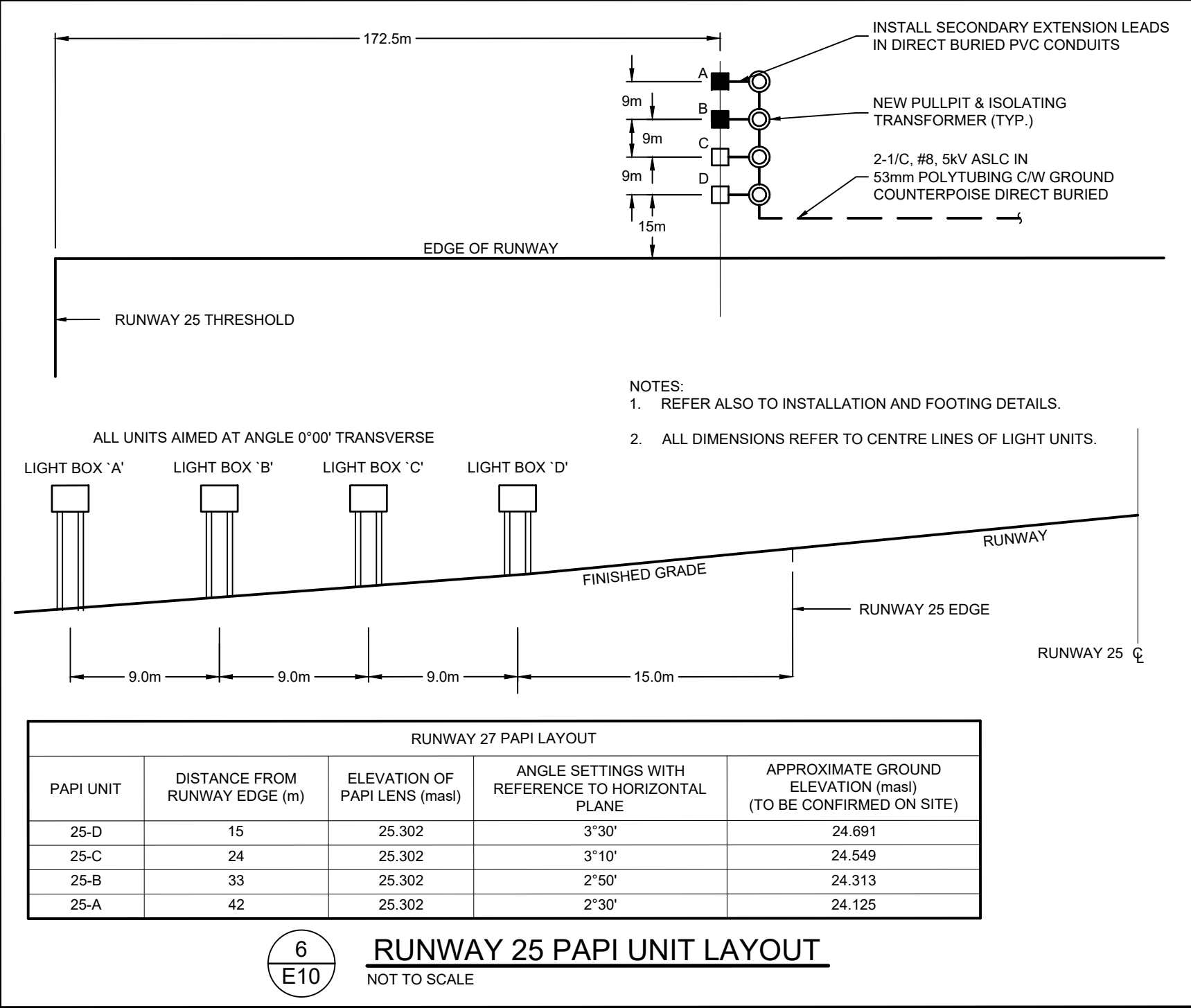
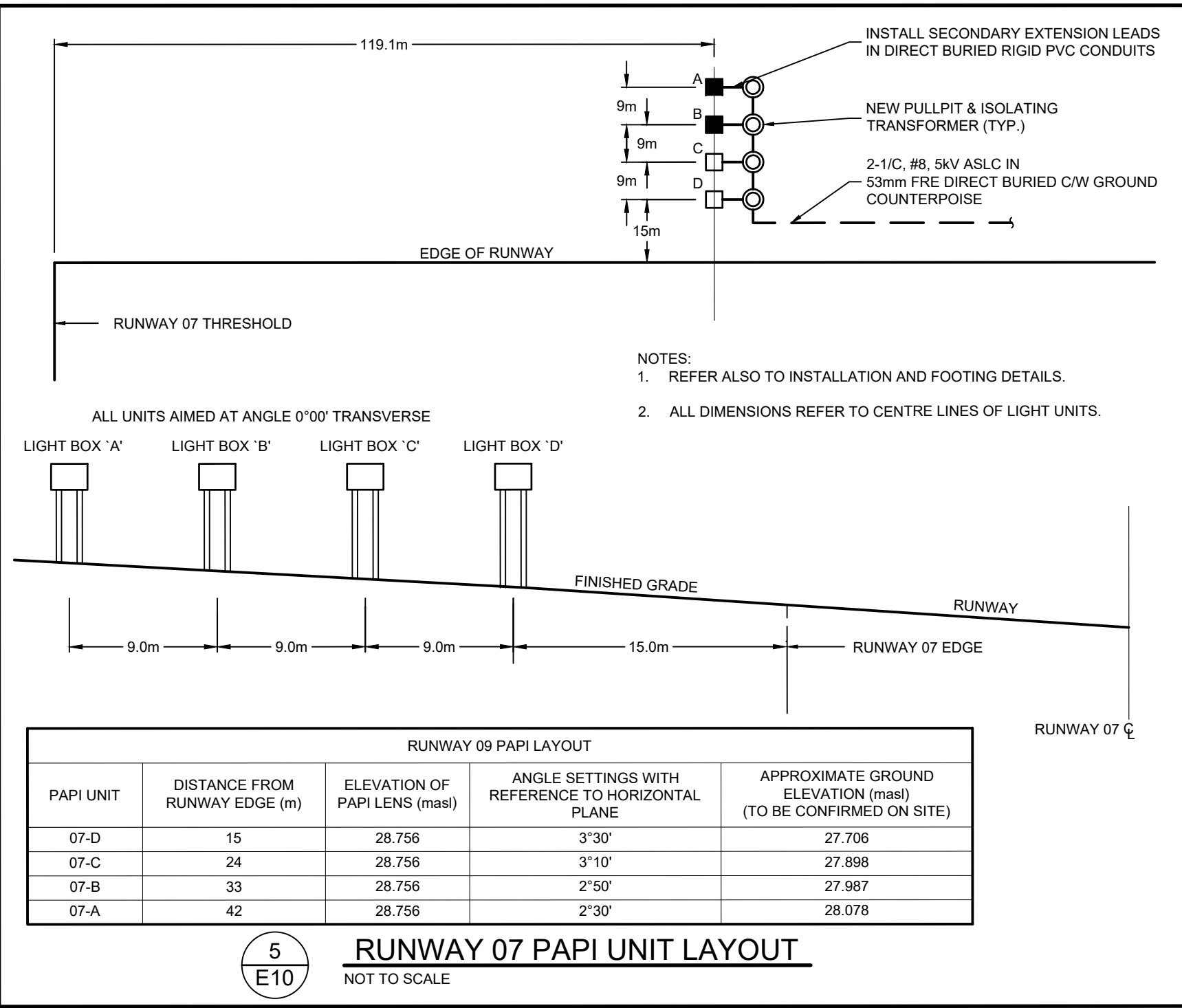
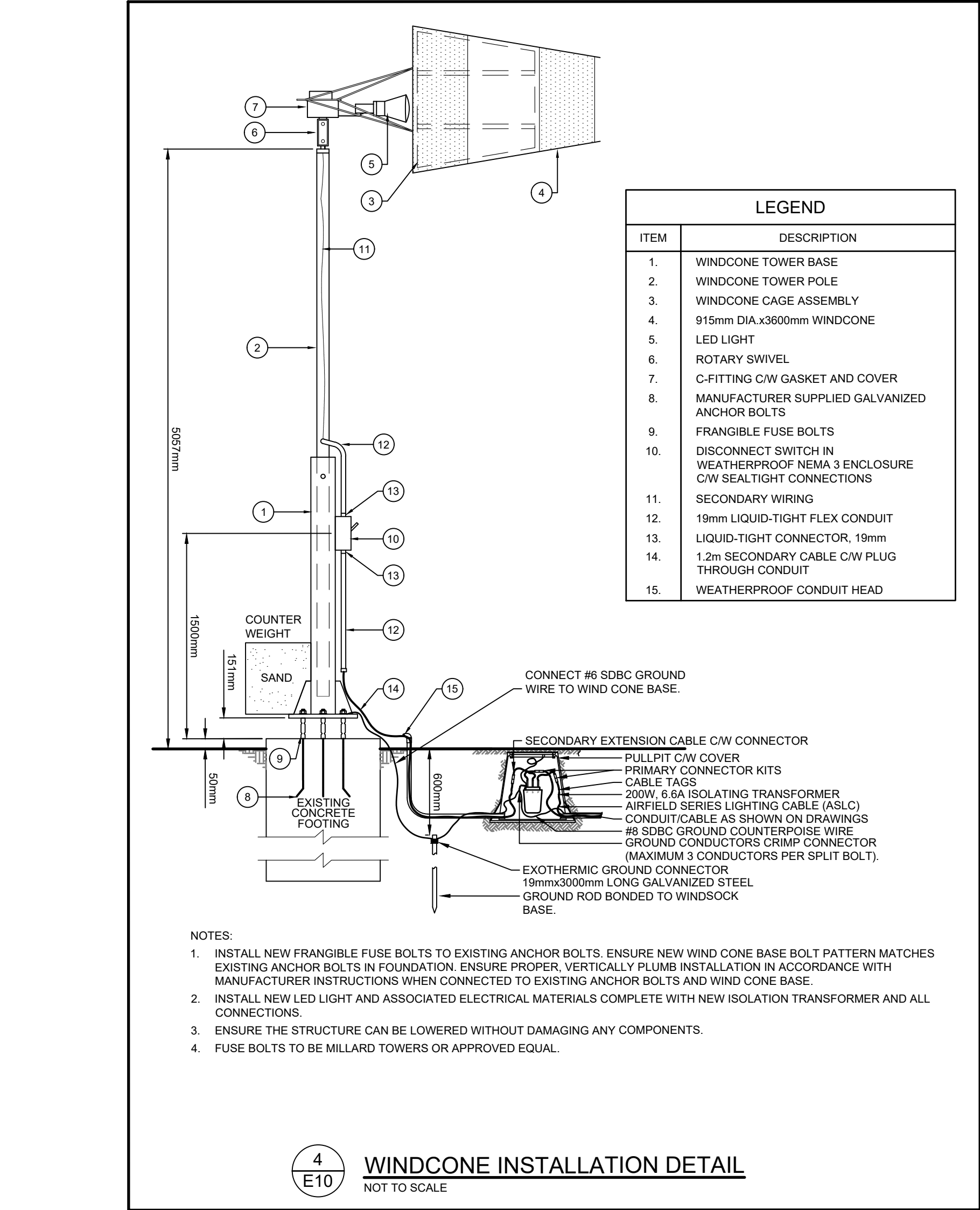
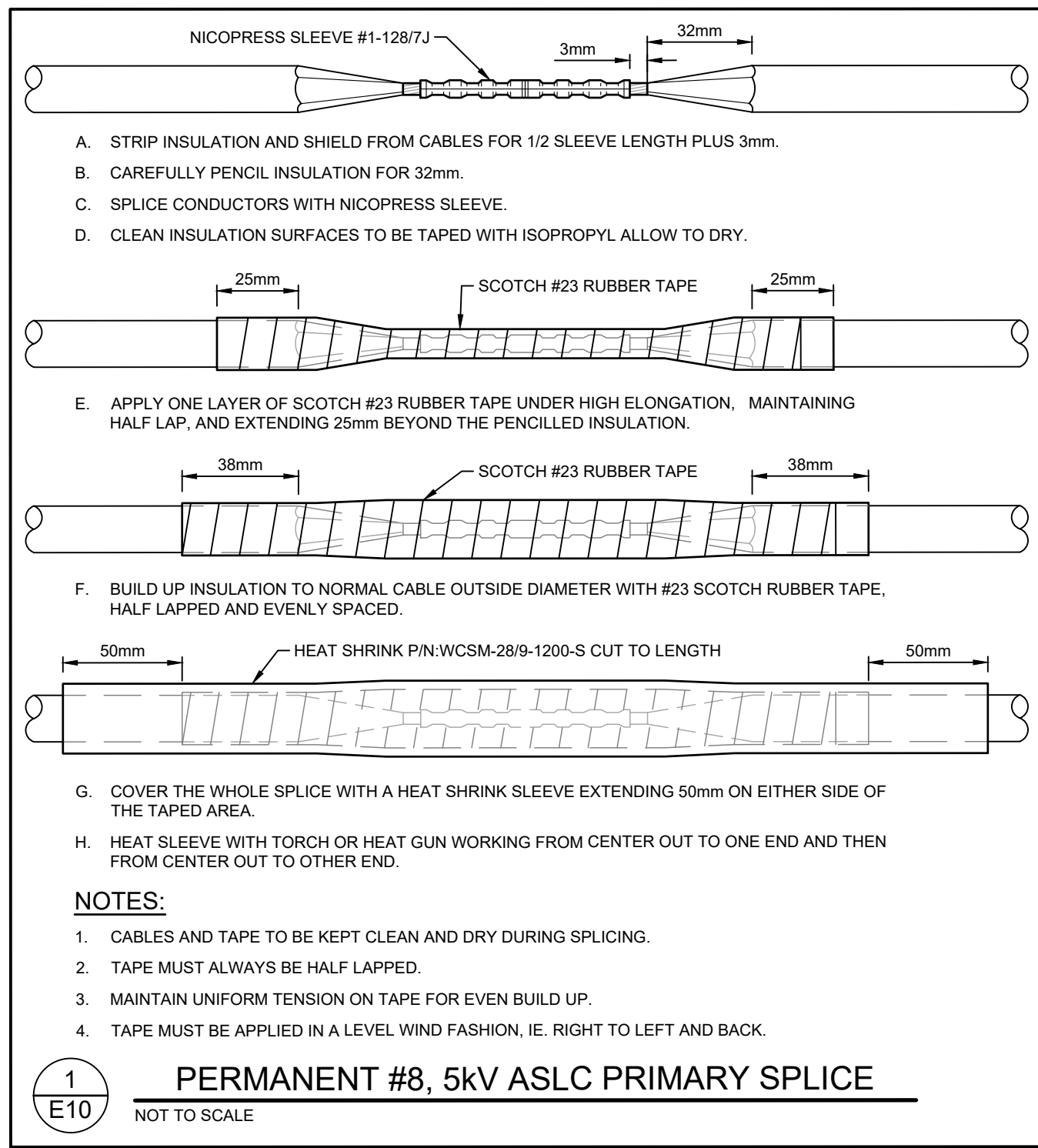
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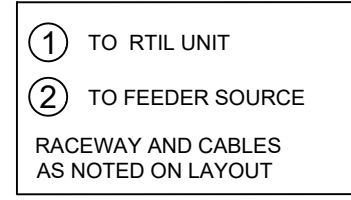


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NOT TO SCALE





1. REFER TO DIV 16 SPECIFICATIONS FOR LOAD CENTER, DISCONNECT SWITCH AND TRANSFORMER REQUIREMENTS
2. CONCRETE IN FOUNDATION SHALL BE PLACED AGAINST UNDISTURBED GROUND.
3. SLOPE TOP OF CONCRETE TO SHED WATER OR PROVIDE 4 SLOPED DRAINAGE GROOVES.
4. ALL FITTINGS AND JOINTS TO BE WATER TIGHT.



1. IT IS THE SOLE RESPONSIBILITY OF THE CONTRACTOR TO ENSURE THAT ALL WORK COMPLIES WITH GOVERNING SAFETY STANDARDS.
2. CONFIRM LOCATION OF ALL SUB-GRADE SERVICES PRIOR TO COMMENCING SITE WORK.
3. LOCATING AND ISOLATING OF UNDERGROUND UTILITIES SHALL BE COMPLETED BEFORE ANY EXCAVATION COMMENCES. CARE SHALL BE EXERCISED DURING EXCAVATION TO AVOID DAMAGE TO EXISTING UNDERGROUND PIPES, STRUCTURES, DUCTS, POWER AND GROUNDING CABLES. IF DAMAGE TO ANY OF THESE OCCURS, THE CONSULTANT SHALL BE NOTIFIED IMMEDIATELY.
4. THE CONTRACTOR SHALL INSTALL AND MAINTAIN CONSTRUCTION BARRIERS, FENCING, GUARD RAILS AND LIGHTING AS REQUIRED FOR THE WORK.
5. ANY RE-ESTABLISHMENT OF DESIGN GRADES DUE TO OVER EXCAVATIONS MUST BE DONE USING LIME CONCRETE OR WITH COMPACTED STRUCTURAL FILL TO ACHIEVE THE ALLOWABLE SAFE DESIGN BEARING PRESSURES, AT NO COST TO THE OWNER.
6. EXCAVATE ALL TOPSOIL, ORGANIC MATERIAL, ASPHALT, LOOSE AND UNSUITABLE FILL TO THE APPROVAL OF THE CONSULTANT.

1. ALL CONCRETE TO MEET THE REQUIREMENTS OF CSA A23.1 / A23.2 (LATEST EDITION)
2. CEMENT TO BE SULPHATE RESISTANT PORTLAND CEMENT.
3. MINIMUM COMPRESSIVE STRENGTH AT 28 DAYS: 25 MPa, UNLESS OTHERWISE SPECIFIED.
4. CLASS OF EXPOSURE: C-1.
5. WATER-CEMENT RATIO SHALL CONFORM TO CSA-A23.1 (LATEST EDITION)
6. MAXIMUM SLUMP FOR ALL CONCRETE SHALL BE 75mm, ± 25 mm PRIOR TO THE ADDITION OF ANY SUPERPLASTISIZER
7. NOMINAL SIZE OF COARSE AGGREGATE: 37.5mm.
8. AIR CONTENT: 4% TO 7%.
9. USE VIBRATORS FOR PLACEMENT OF CONCRETE.
10. DO NOT PLACE CONCRETE FOR SLABS IF RAIN IS ANTICIPATED AT MORE THAN 30% WITHIN 12 HOURS OF PLACEMENT.
11. FOR COLD WEATHER CONCRETING, ALL ICE, SNOW AND FROST SHALL BE REMOVED FROM FORMWORK AND THE TEMPERATURE OF ALL CONTACT SURFACES SHALL BE RAISED ABOVE 10°C FOR 24 HOURS PRIOR TO CASTING CONCRETE. CONCRETE SHALL BE NOT LESS THAN 10°C NOR MORE THAN 30°C WHEN DEPOSITED. CONCRETE SHALL BE ENCLOSED AND THIS AREA HAVE A TEMPERATURE OF NOT LESS THAN 10°C FOR 3 DAYS AND 5°C FOR AN ADDITIONAL 7 DAYS.

1. ALL REINFORCING STEEL SHALL BE NEW, DEFORMED BILLET-STEEL BARS TO CSA STANDARD G30.18, LATEST EDITION, GRADE 400R.
2. MINIMUM CLEAR COVER TO REINFORCEMENT SHALL BE AS FOLLOWS:

i)	CAST AGAINST EARTH AND PERMANENTLY EXPOSED TO EARTH:	75mm
ii)	EXPOSED TO CHLORIDES OR SULPHIDES:	60mm
iii)	EXPOSED TO EARTH OR WEATHER:	50mm
3. BEFORE PLACING ENSURE REINFORCING IS CLEAN, FREE OF LOOSE SCALE, DIRT, OR OTHER FOREIGN COATING WHICH WOULD REDUCE THE BOND TO CONCRETE
4. CONCRETE PAD REINFORCING TO CONSIST OF 15M BARS ON 300mm CENTRES IN BOTH DIRECTIONS WITHIN PAD SET BARS IN TOP THIRD OF SLAB WITH 50mm COVER ABOVE TOP LAYER OF REINFORCEMENT.



APPROXIMATE SIGN LENGTH	PAD LENGTH	PAD WIDTH
920	1070	600
1840	1990	600
2770	2920	600
3690	3840	600
4610	4760	600

NOTE:

- CEMENT TO BE SULPHATE RESISTANT PORTLAND CEMENT
- MINIMUM COMPRESSIVE STRENGTH AT 28 DAYS: 25 MPa, UNLESS OTHERWISE SPECIFIED.
- CLASS OF EXPOSURE: F-1.
- NOMINAL SIZE OF COARSE AGGREGATE: 37.5mm.
- SUMP AT TIME AND POINT OF DISCHARGE: 50 TO 70mm.
- AIR CONTENT: 4% TO 7%.

NOT TO SCALE

NOTES

5		
4		
3		
2	ISSUED FOR TENDER	2019/05/02
1	ISSUED FOR 90% DESIGN	2019/03/14
0	ISSUED FOR 60% DESIGN	2019/01/11
Revision	Description	Date
Client		client

TRANSPORT CANADA

Project title	Project
CHURCHILL AIRPORT, MANITOBA	

**AIRFIELD ELECTRICAL
REHABILITATION - PHASE 1
RUNWAY 07-25 & TAXIWAY B**

Designed by NJH	Conçu par
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Drawn by MDZ	Dessiné par
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Approved by NJH	Approuvé par
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PWGSC Project Manager	Administrateur de Projets TPSGC
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Drawing title	Titre du dessin
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ELECTRICAL DETAILS 3

Project no./No. du projet	Drawing no./No. du dessin	Revision no.
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