TECHNICAL SPECIFICATION FOR
Design, Fabrication and Install of one (1) 24.4m (80ft) Self-Support Radar Tower
Chebucto Head, NS

Canadian Coast Guard
Maritime and Civil Infrastructure

Part 1 General

1.1 PRECEDENCE

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

1.2 WORK COVERED BY CONTRACT DOCUMENTS

.1 The work covered under this specification consists of the Design, Fabrication and Installation of a 24.4m self-support Radar Tower located at Chebucto Head, Nova Scotia

.2 The work to be done under this Specification shall include all labor, materials and equipment necessary to complete the design, fabrication and installation to the full extent of the Specification and Drawings.

.3 Work shall include but not be limited to the following:

- .1 Engineering design, fabrication and installation of a 24.4m self-support tower structure for Chebucto Head, NS as per site specific environmental and loading conditions including, foundations, waveguide bridge, lighting system, ice shields and all other material required to meet the terms of this contract.
- .2 Tower must be knockdown. All-weld sections **must not** be used.
- .3 Tower design shall incorporate 4 legs and shall be uniform width throughout the entire height of the tower.
- .4 Tower design shall incorporate a metal stairway that leads to a working platform at the top of the tower. Stairway shall be equipped with approved hand railing and a self-closing gate at both ends.
- .5 Tower design shall support wind and ice loading requirements for the Radar antenna unit.
- .6 Tower shall be designed to support Owner's existing Radar Antenna unit: Terma SCANTER High Gain X-band. Mounting platform design shall allow access for future maintenance. See Appendix F: Existing Radar Antenna Unit Manual
- .7 Tower and waveguide bridge layout shall be in accordance with approved engineering drawings. Such layout shall be subject to the approval of the Engineer.
- .8 Design and supply of a TX ladder to accommodate (5) five transmission lines. Positioning on tower shall be subject to the approval of Departmental Representative.
- .9 The contractor is responsible for the supply of all mounting brackets to interface appropriately the transmission lines to the tower.
- .10 The supply and installation of all line hangers and necessary hardware. All hangers shall be heavy duty and constructed of material that is compatible with hot dip galvanized steel.
- .11 Supply and installation of the grounding systems including connection to the tower and related structures, and the supply of the above and below grade grounding systems (lightning rods, continuous ground to lightning rod buried

ground radials and rings, all bus bars etc.). See Appendix E for grounding layout.

.12 All exposed surfaces to be coated in RAL3020 – Traffic Red.

.13 Temporary fencing to be used during installation.

.14 Tower and footing layout in accordance with approved engineering drawings. Actual layout shall be subject to the approval of Departmental Representative prior to commencement of any work.

.15 Transportation of tower, equipment and all materials to Chebucto Head site; loading and unloading. The material shall be properly tarped for protection.

.16 The Contractor will be responsible for the review and implementation of all Coast Guard safety requirements and those safety requirements of the Workers Compensation Commission, Canada Labour Code Part 2, CSA Standards, and other applicable Provincial and Federal Regulations.

.17 Contractor will be responsible for arranging all snow clearing requirements.

.18 Clean up of site following completion of all work.

1.3 DEFINITIONS

.1 "Departmental Representative" means: Fisheries & Oceans Canada/Canadian Coast Guard. (CCG)

.2 "(Tower) Design Engineer" means: Contractor's Design Engineer of Record.

1.4 EXISTING SITE CONDITIONS

.1 The contractor should note that this work is to be performed on an active site and must coordinate with Departmental Representative to limit interruption of daily operations. Refer to the site survey and location maps appended to this specification for site details and new tower location.

.2 Before tendering it is recommended that the Contractor familiarize themselves with the location, scope of work, site restrictions and temporary measures required to complete work as specified. **No after claim will be allowed** for any work or material necessary for proper execution and completion of the contract.

.3 Site is located at 44°30'27" N (Latitude) and 63°31'23"W (Longitude), at the Canadian Coast Guard site in Chebucto Head, NS. Refer to Appendix A for site location map.

.4 Any dimensions given in this Specification or appended drawings are approximate and are for guidance only. Exact dimensions and layouts to be determined by the Contractor in the field.

.5 The site is accessible by 2WD vehicle using a public road.

.6 Contractors should note that there are restrictions at this location with regard.

.1 The available space

.2 Ongoing operational activities

.3 Location of overhead power lines

.4 Location of adjacent towers

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.5 Location of waveguide bridging
.6 Location of buried powercables
.7 Location of buildings
.8 Location of Eastlink cellular tower

.7 It shall be the Contractor's responsibility to locate and protect all buried cables and other underground or overhead structures. Any damage to such structures shall be the responsibility of Contractor. Where unknown services are encountered, Contractor to log location and advise Departmental Representative immediately.

.8 A Geotechnical report is provided.

.9 Store all materials and equipment to prevent theft or damage. Repair or replace all material or equipment damaged in transit or storage to the satisfaction of and to no cost to the Departmental Representative.

1.5 CODES

.1 Perform work in accordance with the latest edition of CSA S37 Antennas, towers, and antenna-supporting structures and any other code of provincial or local application provided that in any case of conflict or discrepancy, the more stringent requirements shall apply.

.2 Meet or exceed requirements of:

.1 Contract documents,
.2 Specified standards, codes and referenced documents.

1.6 REQUIRED DOCUMENTS

.1 Contractor to maintain on job site, one copy of each of thefollowing:

.1 Health and Safety Plan
.2 First Aid Kit
.3 Contract drawings and specifications
.4 Addenda
.5 Reviewed shop drawings
.6 Change orders
.7 Other modifications to contract
.8 Field test reports
.9 Copy of approved work schedule
.10 Manufacturers installation and applications instructions
.11 Contact information for Departmental Representative.
.12 Other items as requested

1.7 WORK SCHEDULE

.1 All work on the project shall be completed within the time indicated in the tender document.

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.2 Design and fabrication to be completed within 8 weeks of award. Installation to be completed within 20 weeks of award.

.3 All drawings shall be submitted to Consultant for approval prior to fabrication.

.4 Contractor is to provide an updated detailed schedule and commence work immediately upon award of contract and after review and approval of all submittals.

.5 The Contractor is to make every effort to ensure sufficient material and equipment is delivered to site at the earliest time possible upon award of the contract.

1.8 COST BREAKDOWN

.1 Before submitting first progress claims submit breakdown of Contract price in detail as directed by Engineer. After approval by Engineer, cost breakdown will be used as basis for progress payments.

1.9 CONTRACTOR USE OF PREMISES

.1 Contractor shall follow security procedures as established by Canadian Coast Guard, within existing procedures at the site, and any project – specific requirements as directed by Engineer.

.2 Maintain parking, storage of materials, construction trailers, etc., within the confines directed by the Engineer.

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

.4 At completion of work restore area to its original condition. The Contractor must repair damage to ground and property. Remove all construction materials, residue, excess etc., and leave site in a condition acceptable to Engineer.

1.10 PARTIAL OWNER OCCUPANCY

.1 Existing facilities to remain open and fully operational during the course of this project.

.2 Coordinate use of premises under direction of Engineer.

1.11 PROJECT MEETINGS

.1 Departmental Representative will arrange and give notice of all project meetings. Contractor is responsible for any expenses related to attending these meetings.

.2 All project meetings will take place at site of work unless otherwise directed by the Departmental Representative.

.3 Prior to commencement of work there will be a Project “Kick-Off” Meeting. The Contractors Project Manager (at their own expense), the Departmental Representative will be in attendance. The meeting will be held in Dartmouth, NS or virtually, if required due to the Covid-19 pandemic.

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.4 Departmental Representative will be responsible for recording minutes and distribution.

.5 Contractor to have a responsible representative present at all job meetings and to the maximum extent possible, this should be the same person.

1.12 PROTECTION OF MATERIALS AND EQUIPMENT

.1 Store all materials and equipment to prevent theft or damage. Repair or replace all material or equipment damaged in transit or storage to the satisfaction of and to no cost to the Engineer.

1.13 EXISTING SERVICES

.1 Where works involves breaking into or connecting to existing services, carry out work at times directed by Engineer, by authorities having jurisdiction, with minimum of disturbance to operation.

.2 Before commencing work, establish location and extent of service lines in area of Work and notify Engineer of findings.

.3 Submit schedule to and obtain approval from Engineer for any shut-down or closure of active service or facility. Adhere to approved schedule and provide notice to affected parties.

.4 Where unknown services are encountered, immediately advise Engineer and confirm findings in writing.

1.14 ORAL AGREEMENT

.1 No oral order, objection, claim or notice by any party to the others shall affect or modify any of the terms or obligations contained in any of the Contract Documents and none of the provisions of the Contract Documents shall be held to be waived or modified by reason of any act whatsoever, other than by a definitely agreed waiver or modification thereof in writing, and no evidence shall be introduced in any proceeding of any other waiver or modification.

1.15 TAXES AND PERMITS

.1 Contractor to obtain all Federal, Provincial and Municipal permits and pay all applicable taxes.

Part 2 Products

2.1 NOT USED

.1 Not used.

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Part 3 Execution

3.1 NOT USED

.1 Not used.

END OF SECTION

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Part 1 General

1.1 SECTION INCLUDES

.1 Inspecting and testing by inspecting firms or testing laboratories designated by Engineer.

1.2 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

.1 Particular requirements for inspection and testing to be carried out by testing laboratory designated by Engineer are specified under various sections.

1.3 APPOINTMENT AND PAYMENT

.1 Engineer will appoint and pay for services of testing laboratory except follows:

- .1 Inspection and testing required by laws, ordinances, rules, regulations or orders of public authorities.
- .2 Inspection and testing performed exclusively for Contractor's convenience.
- .3 Testing, adjustment and balancing of conveying systems, mechanical and electrical equipment and systems.
- .4 Mill tests and certificates of compliance.
- .5 Tests specified to be carried out by Contractor under the supervision of Engineer.
- .6 Additional tests specified in the following paragraph.

.2 Where tests or inspections by designated testing laboratory reveal Work not in accordance with contract requirements, pay costs for additional tests or inspections as required by Engineer to verify acceptability of corrected work.

1.4 CONTRACTOR'S RESPONSIBILITIES

.1 Provide labour, equipment and facilities to:

- .1 Provide access to Work to be inspected and tested.
- .2 Facilitate inspections and tests.
- .3 Make good Work disturbed by inspection and test.
- .4 Provide storage on site for laboratory's exclusive use to store equipment and cure test samples.

.2 Notify Engineer sufficiently in advance of operations to allow for assignment of laboratory personnel and scheduling of test.

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

.4 Pay costs for uncovering and making good Work that is covered before required inspection or testing is completed and approved by Engineer.

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Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

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Part 1 General

1.1 SECTION INCLUDES

.1 Shop drawings and product data.

.2 Samples.

.3 Certificates and transcripts.

1.2 RELATED SECTIONS

.1 Section 01 45 00 - Quality Control.

.2 Section 01 78 00 - Closeout Submittals.

1.3 ADMINISTRATIVE

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

.2 Present shop drawings, product data, samples and mock-ups in SI Metric units.

.3 Where items or information is not produced in SI Metric units converted values are acceptable.

.4 Review submittals prior to submission to Engineer. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and co-ordinated with requirements of Work and Contract Documents. Submittals not stamped, signed, dated and identified as to specific project will be returned without being examined and shall be considered rejected.

.5 Notify Engineer, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.

.6 Verify field measurements and affected adjacent Work are coordinated.

.7 Contractor's responsibility for errors and omissions in submission is not relieved by Engineers review of submittals.

.8 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Engineers review of submittals.

.9 Keep one reviewed copy of each submission on site.

1.4 SHOP DRAWINGS AND PRODUCT DATA

.1 The Contractor shall submit for review design and detail drawings in PDF format to the Departmental Representative. The review period by the Departmental Representative shall be two (2) weeks. After successful review, one copy of each submitted drawing will be returned to the Contractor either “Reviewed” or “Reviewed as Noted”. There after no

change shall be made to the drawing without the permission of the Departmental Representative. The Professional Engineer, responsible for the design, shall seal all drawings submitted to the Departmental Representative and must be registered to practice by the Association of Professional Engineers and Geoscientists of Nova Scotia.

.2 The Contractor, at no additional cost to the Departmental Representative, shall make any changes in the drawings which may be required, consistent with this Specification and shall submit revised copies for review in the manner herein set out. The review does not relieve the Contractor from responsibility for ensuring that his complete work meets all the requirements for the drawings and Specifications contained herein. Items submitted are to be complete, in final form and ready “for construction”. Incomplete submissions will be returned. The Contractor shall ensure that the tower design does not interfere with the operation of the antenna systems.

.3 Any work done prior to the return of the reviewed drawings shall be at the Contractor’s own risk. The Departmental Representative or his representative may issue a stop work order if any site work is started prior to approval of engineering drawings. Any costs associated with this shall be the Contractor’s responsibility.

.4 Drawings of the work produced by the Contractor and all rights and privileges associated therewith shall become the exclusive property of the Departmental Representative who will be free to make any use or reuse of said drawings which in the opinion of the Departmental Representative is reasonable and/or required in the Departmental Representative’s interest.

1.5 SAMPLES

.1 Submit for review samples in duplicate as requested in respective specification Sections. Label samples with origin and intended use.

.2 Deliver samples prepaid to Engineer's business address.

.3 Notify Engineer in writing, at time of submission of deviations in samples from requirements of Contract Documents.

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

.5 Adjustments made on samples by Engineer are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Engineer prior to proceeding with Work.

.6 Make changes in samples which Engineer may require, consistent with Contract Documents.

.7 Reviewed and accepted samples will become standard of workmanship and material against which installed Work will be verified.

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1.6 MANDATORY CONSTRUCTION PLAN SUBMITTAL

.1 Within 14 days from date of Contract Award notice, a construction plan of sufficient detail to demonstrate that the contractor has considered all the challenges of the project and is prepared to undertake the works in a competent and professional manor in accordance with all legislation including:

.1 List of subcontractors proposed for: steel fabrication, galvanizing, painting, groundwork and tower erection.

.2 Project specific safety program

.3 Project environment protection plan

.4 Tower Erection plan

.5 Detailed work schedule including all project milestones for design, fabrication, transport and installation.

1.7 MANDATORY TECHNICAL SUBMISSION

.1 Within 14 days from date of Contract Award notice, copies of all Quality Control and Quality Assurance programs in place relating to, governing and demonstrating the ability to complete the work in question, including but not limited to, the tower painting process, steel fabrication process and the tower steel galvanizing process. Details of all material handling procedures are to be included.

.2 Details with regard to the steel supplier and fabrication company and their CWB certification number.

.3 Sealed drawings which include details of the tower base foundations showing all dimensions and steel reinforcement or rock anchor details, if applicable. Drawings shall show concrete strength. Where rock bolts are used, installation and testing procedures shall be clearly indicated on the drawings. Generic copies of typical foundations are not adequate.

.4 On acceptance of the Tender, the Contractor shall submit for review sealed design calculation report which include

.1 Reference design standard.

.2 All foundation analysis and calculations.

.3 Any other information requested by Departmental Representative

.5 Contractor shall maintain and update the work schedule. Each revision shall be submitted to the Departmental Representative for review.

1.8 AS BUILT DRAWINGS

.1 Upon completion of all work, and prior to release of contract holdback, the Contractor shall issue a full set of As Built drawings, which reflect any and all changes from the original contract drawings. These drawings shall be stamped AS BUILT DRAWINGS and shall be sealed by a Professional Engineer in accordance with the requirements of this specification. Submit a full set of drawings (with Tower Engineer's stamp) in AutoCAD format and a copy of **ALL** product data on the lighting system and controller, antennas, Tx lines, etc. File to have cover page with the Project Name and Location, Departmental

Representatives Name (Canadian Coast Guard), design engineer, Manufacturer, Installer and date of completion. A tower profile photo should also be included.

.2 All As-built submissions as a digital copy.

1.9 INSPECTION REPORTS

.1 The Contractor is to submit a PDF copy of all quality control test reports required by this specification immediately upon completion of testing.

1.10 SAFETY PLAN

.1 The Contractor is to submit a digital copy of their project and site specific Safety Plan, including, climbing safety, rescue techniques, rigging procedures, equipment maintenance and inspections, general work site safety, hazardous material safety (WHMIS), site security, public safety etc. and emergency response plans, for review prior to commencement of work on site.

1.11 SCHEDULES, PERMITS AND CERTIFICATES

.1 Upon award of contract, submit to Engineer a copy of the Work Schedule and various other schedules, permits, certification documents and project management plans as specified in other sections of the specifications.

.2 Submit copy of permits, notices, compliance certificates received by Regulatory Agencies having jurisdiction and as applicable to work.

1.12 CERTIFICATES AND TRANSCRIPTS

.1 Immediately after award of Contract, submit Workers' Compensation Board status.

.2 Submit transcription of insurance immediately after award of Contract.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

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Part 1 General

1.1 SECTION INCLUDES

.1 Health and safety considerations required to ensure that CCG shows due diligence towards health and safety on construction sites.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

1.3 REFERENCES

.1 Canada Labour Code, Part 2, Canada Occupational Safety and Health Regulations.

.2 Province of Newfoundland and Labrador

.1 Occupational Health and Safety Act, R.S.N. 1990.

1.4 SUBMITTALS

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

.2 Submit site-specific Health and Safety Plan: Within seven days after date of Notice to Proceed and prior to commencement of Work. Health and Safety Plan must include:

.1 Results of site specific safety hazard assessment.

.2 Results of safety and health risk or hazard analysis for site tasks and operation.

.3 Submit two copies of Contractor's authorized representative's work site health and safety inspection reports to Engineer and authority having jurisdiction, weekly.

.4 Submit copies of reports or directions issued by Federal, Provincial health and safety inspectors.

.5 Submit copies of incident and accident reports.

.6 Submit Material Safety Data Sheets (MSDS) to Engineer.

.7 Engineer will review Contractor's site-specific Health and Safety Plan and provide comments to Contractor within seven days after receipt of plan. Revise plan as appropriate and resubmit plan to Engineer within two days after receipt of comments from Engineer.

.8 Engineer's review of Contractor's final Health and Safety plan should not be construed as approval and does not reduce the Contractor's overall responsibility for construction Health and Safety.

.9 Medical Surveillance: Where prescribed by legislation, regulation or safety program, submit certification of medical surveillance for site personnel prior to commencement of Work, and submit additional certifications during emergency situations.

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.10 On-site Contingency and Emergency Response Plan: Address standard operating procedures to be implemented during emergency situations.

1.5 CONSTRUCTION SAFETY

.1 Provide all workers, including sub-trades, with adequate and appropriate safety regulations prior to commencement of their duties. Ensure all workers comply with all safety regulations required by Federal and Provincial Regulations, Worker's Compensation Board and municipal statutes. Take all precautions and provide all required protection to ensure the safety of the general public and the workers in accordance with the current edition of the Occupational Health and Safety Act and Regulations applicable for construction projects and all applicable regulations such as but not limited to The Canada Labour Code, The Provincial Workers Compensation Regulations, Health and Welfare Canada Safety Code 6.

.2 In the event of conflict between any provisions of the above authorities the most stringent shall govern.

.3 Provide health and safety protection required by the manufacturer's printed literature and ensure that all workers are trained in the safe use of health and safety equipment and the handling of materials. Ensure that at least one-person remains on site at all times who is properly trained in the first aid aspects required to deal with emergency situations that may arise. The safety person should be trained in the proper use of climbing harnesses and equipment.

.4 A first aid station must be maintained on site, available to workers at all times.

.5 Protect all utilities and services against damage or interruption. Any claims resulting from damage will be the Contractor's responsibility. The possible location of any underground cables must be established and marked prior to any excavation.

.6 Post "NO SMOKING" signage where flammable materials are being used. Do not allow use of spark producing equipment during application of flammable materials. Ensure that at least one site person is trained to deal with emergency situations that may arise due to fire.

.7 Take all required precautions, including those recommended by the manufacturers printed instructions, to protect persons and property, including vehicles from over-spray of materials.

.8 Contractors' Site/Project specific Safety Plan shall incorporate the following.

.1 Continuous attachment at all times while on the tower. No unattached climbing will be permitted at any time.

.2 Use of CSA approved; full body harness, belts, lanyards, trolleys, safety hats, safety boots, safety vest, and other equipment used to complete the job.

.3 Only experienced personnel with previous training and demonstrated experience working on similar structures and heights to work on the project.

.4 Not allowing personal to use equipment winches for transport of personnel.

.5 The ability for any worker to discuss issues that they feel affects workers safety.

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.6 Tailgate/job assessment forms to be completed daily and made available upon request.

.7 Appropriate fall rescue plans and equipment.

.9 The Contractor shall prepare a written **Project/site specific Construction Safety Plan** outlining all procedures and safe work practices which must be followed by all personnel working on the construction site. This plan is to be developed in conjunction with all subcontractors who will be working on site. It is the Contractor's responsibility to become familiar with all safety laws and regulations applicable to the type of work to be undertaken. These safety laws and regulations shall be addressed in the safety plan as clear and specific safety rules, procedures and work practices. The Contractor shall ensure that all of their workers and their sub-contractors, as well as any other authorized persons working or circulating in the construction work area, have been briefed and are familiar with the safety rules and measures indicated in the Safety Plan and understand that these measures are mandatory at the construction site. Regular Site Safety Meetings and daily tailgate/job assessment meetings shall be held and minuted by the Contractor.

1.6 MEETINGS

.1 Schedule and administer Health and Safety meeting with Engineer prior to commencement of Work.

1.7 GENERAL REQUIREMENTS

.1 Develop written site-specific Health and Safety Plan based on hazard assessment prior to beginning site Work and continue to implement, maintain, and enforce plan until final demobilization from site. Health and Safety Plan must address project specifications.

.2 Engineer may respond in writing, where deficiencies or concerns are noted and may request re-submission with correction of deficiencies or concerns.

.3 Design and construct all falsework as per CSA S269.1 (latest edition) and scaffolding as per SAS 269.2 (latest edition).

.4 Ensure no part of the work is subject to load(s) which endanger safety or will cause permanent deformations.

1.8 SINAGE AND BARRIERS

.1 The contractor is to maintain necessary signage to ensure workers, people accessing the site and the general public are aware of any hazards or potential hazards. Barriers are to be provided as required by regulation to ensure access to work by the general public is restricted.

.2 The Safety Plan must be placed on the Construction Site in a common area visible to all workers and other persons accessing the site. All employees are to be advised of the Safety Plan. The Safety Plan shall also address the means to communicate the intent to all persons.

.3 Submission of a Safety Plan to the Departmental Representative does not relieve the Contractor of any legal obligations for the provision of construction safety as specified by Federal and/or Provincial Safety Acts or Regulations.

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.4 Contractor shall ensure compliance with the Safety Plan. The Departmental Representative or authorised representative reserves the right to demand removal of any person(s) not complying. Any person removed shall not be permitted reentry to the site.

.5 Provide Safety Plan immediately upon award of contract. The Safety Plan shall be submitted to the Departmental Representative for review prior to commencement of work. Work shall not be allowed to begin until safety plan has been submitted. Revise Safety Plan as required for changes in work procedures or when directed by Departmental Representative, Safety Officer or authority.

1.9 HAZARDOUS PRODUCTS

.1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials, and regarding labeling and provision of material safety data sheets acceptable to Labour Canada and Health and Welfare Canada.

.2 Deliver copies of WHMIS data sheets to Departmental Representative on delivery of materials.

.3 All data sheets must be posted on site in a common area visible to all workers and subcontractors.

.4 Make all efforts to select and use materials (ie. adhesives, solvents, cleaners etc.) for the type and nature of work being performed which are the least hazardous products available, of low VOC content or low toxicity type products and emitting low noxious odours. Select products known to be friendly to the environment and to human health. Communicate this intent to all subcontractors, suppliers and manufacturers.

.5 Where the use of hazardous and toxic products cannot be avoided.

.1 Advise Departmental Representative beforehand of the product(s) intended for use. Submit WHMIS data sheets as per requirements above.

.2 Schedule in conjunction with the Departmental Representative, to carry out the work during “Off Hours” where workers and employees have left the site.

1.10 RESPONSIBILITY

.1 Inclusion of these safety requirements shall not constitute a relief of the Contractors responsibility but is a precaution against oversight and errors.

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

.3 Comply with and enforce compliance by employees with safety requirements of Contract Documents, applicable federal, provincial, territorial and local statutes, regulations, and ordinances, and with site-specific Health and Safety Plan.

.4 The Contractor is solely responsible for safety procedures necessary to; meet the requirements of these specifications and to ensure the safety of workers and the general public.

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1.11 COMPLIANCE REQUIREMENTS

.1 Comply with Occupational Health and Safety Act, Occupational Health and Safety Regulations, C. NS.

.2 Comply with Occupational Health and Safety Regulations, 1996.

.3 Comply with Canada Labour Code Part II, Canada Occupational Safety and Health Regulations made under Part II of the Canada Labour Code.

.4 Observe and enforce construction safety measures required by:

.1 Latest edition of the National Building Code of Canada.

.2 Provincial Worker's Compensation Board.

.3 Municipal statutes and ordinances.

.5 In the event of conflict between any provisions of the above authorities, the most stringent provision will apply. Should a dispute arise in determining the most stringent requirement, the Engineer will advise on the course of action to be followed.

1.12 UNFORESEEN HAZARDS

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

1.13 HEALTH AND SAFETY CO-ORDINATOR

.1 Employ and assign to Work, competent and authorized representative as Health and Safety Co-ordinator. Health and Safety Co-ordinator must:

.1 Have minimum 2 years' site-related working experience as Health and Safety associated with building construction.

.2 Have working knowledge of occupational safety and health regulations.

.3 Be responsible for completing Contractor's Health and Safety Training Sessions and ensuring that personnel not successfully completing required training are not permitted to enter site to perform Work.

.4 Be responsible for implementing, enforcing daily and monitoring site-specific Contractor's Health and Safety Plan.

.5 Be on site during execution of Work and report directly to and under the direction of the supervisor.

1.14 POSTING OF DOCUMENTS

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

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1.15 CORRECTION OF NON-COMPLIANCE

.1 Immediately address health and safety non-compliance issues identified by authority having jurisdiction or by Engineer.

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

.3 Engineer may stop Work if non-compliance of health and safety regulations is not corrected.

1.16 WORK STOPPAGE

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

END OF SECTION

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Part 1 General

1.1 REPORTING FIRES

.1 Know location of nearest fire alarm box and telephone, including emergency phone number.

.2 Report immediately all fire incidents to Fire Department as follows:

.1 telephone.

.3 When reporting fire by telephone, give location of fire, name or number of building and be prepared to verify the location.

1.2 FIRE EXTINGUISHERS

.1 Supply fire extinguishers necessary to protect work in progress and contractor's physical plant on site.

1.3 SMOKING PRECAUTIONS

.1 Observe smoking regulations at all times.

1.4 RUBBISH AND WASTE MATERIALS

.1 Rubbish and waste materials are to be kept to a minimum.

.2 Burning of rubbish is prohibited.

.3 Removal:

.1 Remove all rubbish from work site at end of work day or shift or as directed.

.4 Storage:

.1 Store oily waste in approved receptacles to ensure maximum cleanliness and safety.

.2 Deposit greasy or oily rags and materials subject to spontaneous combustion in approved receptacles and remove as required in 1.8.3.1.

1.5 FLAMMABLE AND COMBUSTIBLE LIQUIDS

.1 Handling, storage and use of flammable and combustible liquids are to be governed by the current National Fire Code of Canada.

.2 Flammable and combustible liquids such as gasoline, kerosene and naphtha will be kept for ready use in quantities not exceeding 45 litres provided they are stored in approved safety cans bearing Underwriters' Laboratory of Canada or Factory Mutual seal of approval. Storage of quantities of flammable and combustible liquids exceeding 45 litres for work purposes requires permission of Fire Chief.

.3 Transfer of flammable and combustible liquids is prohibited within buildings or jetties.

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.4 Transfer of flammable and combustible liquids will not be carried out in vicinity of open flames or any type of heat-producing devices.

.5 Flammable liquids having a flash point below 38°C, such as naphtha or gasoline, will not be used as solvents or cleaning agents.

.6 Flammable and combustible waste liquids, for disposal, will be stored in approved containers located in a safe ventilated area. Quantities are to be kept to a minimum and Fire Department is to be notified when disposal is required.

1.6 HAZARDOUS SUBSTANCES

.1 Work entailing use of toxic or hazardous materials, chemicals and/or explosives, or otherwise creating hazard to life, safety or health, will be in accordance with the latest edition of the National Fire Code of Canada.

.2 Obtain from Fire Chief a "Hot Work" permit for work involving welding, burning or use of blow torches and salamanders, in buildings or facilities.

.3 When Work is carried out in dangerous or hazardous areas involving the use of heat, provide fire watchers equipped with sufficient fire extinguishers. Determination of dangerous or hazardous areas along with level of protection necessary for Fire Watch is at discretion of the Fire Chief. Contractors are responsible for providing fire watch service for work on a scale established and in conjunction with Fire Chief at pre-work conference.

1.7 FIRE INSPECTION

.1 Site inspections by Fire Chief will be coordinated through Engineer.

.2 Co-operate with Fire Chief during routine fire safety inspection of work site.

.3 Immediately remedy all unsafe fire situations observed by Fire Chief.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

□

Part 1 General

1.1 GENERAL

.1 The Contractor is solely responsible for all environmental protection procedures deemed necessary by the Contractor to meet the requirements of these Specifications. Contractor shall comply with all applicable Federal, Provincial and Municipal regulatory requirements.

.2 Contractor is fully responsible for all costs associated with required remediation occurring from contractors work on site.

1.2 PRODUCTS

.1 Avoid the use of hazardous products. Use environmentally friendly products where practical.

1.3 DISPOSAL OF WASTES

.1 Do not bury rubbish and waste materials on site unless approved by Engineer.

.2 Fires and burning of rubbish on site are not permitted.

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

.4 All wastes materials must be disposed at an approved landfill site. The Contractor is responsible for obtaining permission from the operator of the landfill prior to disposing of wastes. The Contractor shall provide the Engineering with written permission from the operator of the landfill prior to final disposal of wastes.

1.4 POLLUTION CONTROL

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

.2 Prevent dust and debris from demolition operations and other extraneous materials from contaminating air beyond application area by providing temporary enclosures.

.3 Cover or wet down dry materials and rubbish to prevent blowing dust and debris.

.4 Contractor is to ensure all equipment is in good repair and no fuels or fluids are leaking from it. Equipment in disrepair will be removed from site. Basic petroleum spill clean-up equipment should be on site.

.5 No maintenance, beyond that of a required daily routine nature shall be performed on equipment while on site. No refueling to be completed within 30 m of a water body.

.6 No bulk storage of fuel or hazardous products will be permitted on site.

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.7 Work should be scheduled to avoid periods of heavy precipitation. Erosion control structures (temporary matting, geotextile filter fabric) are to be used, as appropriate, to prevent erosion and silt runoff during the construction phase.

.8 Construction waste material such as pre-treated wood must be disposed of in an appropriate manner and shall not be incinerated onsite. Construction waste material such as aluminum, steel, iron, etc should be recycled through a metal recycler.

.9 All exposed soil should be minimized by limiting the area that is exposed at any one time and by limiting the time that any one area is exposed. Stockpiled soil must be covered and/or dyked to prevent erosion or silt runoff from leaving the site.

.10 All spills or leaks should be promptly contained, cleaned up and reported to the CCG - Traffic Center at 709-772-2083 and notification given to the Project Officer handling the job.

.11 Any and all stipulations of federal, provincial, or municipal authorities must be strictly followed.

.12 During the constructional and operational phases of the project, limit or prohibit any activities on any of the surrounding wetland/bog (i.e. Heavy Equipment).

.13 During Constructional phase of the project, target areas for excavation should be limited to areas that are not considered a wetland/bog.

1.5 DRAINAGE

.1 Provide temporary drainage and pumping as necessary to keep excavations and site free from water at all times.

.2 Do not pump water suspected of containing suspended materials into waterways, sewer or drainage systems.

END OF SECTION

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Part 1 General

1.1 SECTION INCLUDES

.1 Inspection and testing, administrative and enforcement requirements.

.2 Tests and mix designs.

.3 Equipment and system adjust and balance.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 78 00 - Closeout Submittals.

1.3 INSPECTION

.1 Allow Engineer access to Work. If part of Work is in preparation at locations other than Place of Work, allow access to such Work whenever it is in progress.

.2 Give timely notice requesting inspection if Work is designated for special tests, inspections or approvals by Engineer or by inspection authority having jurisdiction.

.3 If Contractor covers or permits to be covered Work that has been designated for special tests, inspections or approvals before such is made, uncover such Work, have inspections or tests satisfactorily completed and make good such Work.

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

1.4 THIRD PARTY INSPECTIONS

.1 The Contractor shall have the tower painting inspected by a qualified NACE inspector prior to erection of the tower, If applicable. Testing reports to be submitted for review and approval prior to erection.

.2 The Contractor shall have a minimum of 4 concrete test cylinders taken by a qualified inspector at the tower base foundations. Testing reports to be submitted for review and approval prior to erection.

1.5 FOUNDATION INSPECTION

.1 The foundation placement is subject to inspection during the following project stages.

.1 Testing of rock bolts if applicable.

.2 Pre-pour inspection of rebar prior to concrete placement for waveguide bridge foundations and tower base footings.

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.3 Concrete placement

.4 Grouting

.2 The Contractor shall advise the Departmental Representative **ONE WEEK** in advance of these activities. Every effort shall be made to allow completion of these activities within one full day on site. The Departmental Representative shall have an independent testing firm obtain and test a minimum of three (3) concrete cylinders, per batch, as per the latest industry standards, for compressive strength for each tower base footing. An independent CSA certified testing firm shall conduct sampling and testing. This testing by the Departmental Representative does not relieve the Contractor of their responsibility for ensuring concrete quality assurance. Contractor to arrange and pay for the testing. Testing reports to be submitted for review and approval prior to erection.

1.6 COMPLETION INSPECTION

.1 A completion inspection is to be carried out by the Departmental Representative. The purpose of this inspection is to ensure that the work is completed as per the project specifications and industry standards. The completion inspection does not relieve the Contractor of his responsibility to execute the work in a quality fashion as per the project specifications and industry standards. The Contractor must ensure that his quality control personnel perform a complete inspection of the works prior to their crew leaving the site. It is expected that the contractor has made a thorough check of all bolts, hardware, TX lines and alignments as per requirements of CSA S37 - 18 standard or latest edition and reviewed the contract for full completion. The Contractor is to inform the Departmental Representative by letter that the installation is completed and is ready for inspection by the Departmental Representative. The Contractor shall have sufficient crew on site during the inspection to correct deficiencies noted by the Departmental Representative. Contractor to advise Departmental Representative ONE WEEK in advance to completion of the tower to permit scheduling of this inspection.

.2 The completion inspection will be the Departmental Representative's expense. All costs incurred by the Contractor during the acceptance inspection shall be at the Contractor's expense.

.3 All work must be completed and satisfactory prior to the Departmental Representative's completion inspection. Any deficiencies should be reported prior to the inspection teams' mobilization to site. **The Contractor will be responsible for the costs of all repeat completion inspections necessitated by work, which is considered by the Departmental Representative to be incomplete or deficient.**

.4 Any adjustments to the twist or alignment shall be made by Contractor in consultation with the Departmental Representative to ensure effects on signal coverage can be reviewed and monitored.

.5 After any adjustment measures are carried out to the tower, the Contractor shall, as required, under the direction of the Departmental Representative, re-orient any antennas.

1.7 POST ERECTION INSPECTION

.1 Not less than six (6) months and not more than one (1) year after the completion inspection, the Departmental Representative shall re-inspect the tower. The purpose of this

post erection inspection is to re-inspect the tower alignment, review satisfactory completion of any previously noted deficiencies and to conduct a general review of the tower condition. At this time the Contractor shall have a minimum crew of two present and carry out any adjustments necessary to ensure the structure meets the requirements of CSA S37- 18 standard. The post-erection inspection will be at the Departmental Representative's expense. All costs incurred by the Contractor during the Post Erection Inspection shall be at the Contractor's expense.

.2 Departmental Representative to advise Contractor at least **ONE WEEK** in advance of the post erection check in order to facilitate scheduling.

.3 Any adjustments to the twist or alignment shall be made by the Contractor in consultation with the Departmental Representative to ensure effects on signal coverage can be reviewed and monitored.

.4 After any adjustment measures that are carried out on the tower, the Contractor shall, as required, under the direction of the Departmental Representative, re-orient any antennas.

.5 Upon completion of the installation stage of the project the Contractor is to provide the Departmental Representative with a Conformance Certification Letter stating that the tower has been designed, fabricated and installed as per the Project Specifications.

1.8 INDEPENDENT INSPECTION AGENCIES

.1 Independent Inspection/Testing Agencies may be engaged by Engineer for purpose of inspecting and/or testing portions of Work. Cost of such services will be borne by Engineer.

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

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

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

1.9 ACCESS TO WORK

.1 Allow inspection/testing agencies access to Work, off site manufacturing and fabrication plants.

.2 Co-operate to provide reasonable facilities for such access.

1.10 PROCEDURES

.1 Notify appropriate agency and Engineer in advance of requirement for tests, in order that attendance arrangements can be made.

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.2 Submit samples and/or materials required for testing, as specifically requested in specifications. Submit with reasonable promptness and in an orderly sequence so as not to cause delay in Work.

.3 Provide labour and facilities to obtain and handle samples and materials on site. Provide sufficient space to store and cure test samples.

1.11 REJECTED WORK

.1 Remove defective Work, whether result of poor workmanship, use of defective products or damage and whether incorporated in Work or not, which has been rejected by Engineer as failing to conform to Contract Documents. Replace or re-execute in accordance with Contract Documents.

.2 Make good other Contractor's work damaged by such removals or replacements promptly.

.3 If in opinion of Engineer it is not expedient to correct defective Work or Work not performed in accordance with Contract Documents, Owner may deduct from Contract Price difference in value between Work performed and that called for by Contract Documents, amount of which shall be determined by Engineer.

1.12 TESTS AND MIX DESIGNS

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

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

1.13 EQUIPMENT AND SYSTEMS

.1 Submit adjustment and balancing reports for mechanical systems.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

□

Part 1 General

1.1 SECTION INCLUDES

.1 Office and sheds.

.2 Parking.

1.2 INSTALLATION AND REMOVAL

.1 Provide construction facilities in order to execute work expeditiously.

.2 Remove from site all such work after use.

1.3 CONSTRUCTION PARKING

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

.2 Provide and maintain adequate access to project site.

.3 If authorized to use existing roads for access to project site, maintain such roads for duration of Contract and make good damage resulting from Contractors' use of roads.

1.4 EQUIPMENT, TOOL AND MATERIALS STORAGE

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

.2 Locate materials not required to be stored in weatherproof sheds on site in a manner to cause least interference with work activities.

1.5 SANITARY FACILITIES

.1 Provide sanitary facilities for work force in accordance with governing regulations and ordinances.

.2 Post notices and take such precautions as required by local health authorities. Keep area and premises in sanitary condition.

1.6 EXISTING SITE INFRASTRUCTURE

.1 Existing communications site to be protected from construction activities (dust and debris). Site shall remain in continuous operation except that shut down may be considered for periods, up to fifteen minutes, based on prior approval coordinated with Engineer. Exact times of shut down to be predetermined and necessitate Notice to Mariners.

.2 Engineer shall be notified 72 hours in advance of any planned power outages that will effect communications equipment.

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END OF SECTION

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Part 1 General

1.1 SECTION INCLUDES

.1 Barriers.

1.2 RELATED SECTIONS

.1 Section 01 52 00 - Construction Facilities.

1.3 INSTALLATION AND REMOVAL

.1 Provide temporary controls in order to execute Work expeditiously.

.2 Remove from site all such work after use.

1.4 DUST TIGHT SCREENS

.1 Provide dust tight screens or insulated partitions to localize dust generating activities, and for protection of workers, finished areas of Work and public.

.2 Maintain and relocate protection until such work is complete.

1.5 ACCESS TO SITE

.1 Access to the tower site is available as described in section 011100. When appropriate, maintain this access during the construction period. Contractor is responsible for providing their own site office and accommodations.

.2 The Departmental Representative must approve any temporary roads planned. A plan for remediation must be included.

.3 If authorized to use existing roads for access to the project site, maintain such roads for the duration of the Contract and make good damage resulting from Contractor's use of roads.

.4 Any damages as a result of Contractor's activities to existing roadways, property, and adjacent property shall be returned to original condition at Contractors expense.

1.6 POWER

.1 Power supply may not be available during the time of construction. The Contractor must provide and maintain power as required for the construction and temporary obstruction lighting.

.2 Connect to power supply in accordance with Canadian Electrical Code once the building power is provided by Departmental Representative.

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1.7 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 and any other applicable Federal or provincial requirements.

1.8 FIRE ROUTES

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

1.9 PROTECTION FOR OFF-SITE AND PUBLIC PROPERTY

.1 Protect surrounding private and public property from damage during performance of Work.

.2 Be responsible for damage incurred.

1.10 PROTECTION OF BUILDING FINISHES

.1 Provide protection for finished and partially finished building finishes and equipment during performance of Work.

.2 Provide necessary screens, covers, and hoardings.

.3 Confirm with Engineer locations and installation schedule 7 days prior to installation.

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

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

□

Part 1 General

1.1 SECTION INCLUDES

.1 Product quality, availability, storage, handling, protection, and transportation.

.2 Manufacturer's instructions.

.3 Quality of Work, coordination and fastenings.

.4 Existing facilities.

1.2 PRECEDENCE

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

1.3 REFERENCE STANDARDS

.1 Within text of each specifications section, reference may be made to reference standards. List of standards reference writing organizations is contained in Section 01 42 00 - References.

.2 Conform to these reference standards, in whole or in part as specifically requested in specifications.

.3 If there is question as to whether any product or system is in conformance with applicable standards, Engineer reserves right to have such products or systems tested to prove or disprove conformance.

.4 Cost for such testing will be born by Engineer in event of conformance with Contract Documents or by Contractor in event of non-conformance.

.5 Conform to latest date of issue of referenced standards in effect on date of submission of Tenders, except where specific date or issue is specifically noted.

1.4 QUALITY

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

.2 Defective products, whenever identified prior to completion of Work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility, but is precaution against oversight or error. Remove and replace defective products at own expense and be responsible for delays and expenses caused by rejection.

.3 Should any dispute arise as to quality or fitness of products, decision rests strictly with Engineer based upon requirements of Contract Documents.

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

.5 Permanent labels, trademarks and nameplates on products are not acceptable in prominent locations, except where required for operating instructions, or when located in mechanical or electrical rooms.

1.5 AVAILABILITY

.1 Immediately upon signing Contract, review product delivery requirements and anticipate foreseeable supply delays for any items. If delays in supply of products are foreseeable, notify Engineer of such, in order that substitutions or other remedial action may be authorized in ample time to prevent delay in performance of Work.

.2 In event of failure to notify Engineer at commencement of Work and should it subsequently appear that Work may be delayed for such reason, Engineer reserves right to substitute more readily available products of similar character, at no increase in Contract Price or Contract Time.

1.6 STORAGE, HANDLING AND PROTECTION

.1 Handle and store products in manner to prevent damage, adulteration, deterioration and soiling and in accordance with manufacturer's instructions when applicable.

.2 Store packaged or bundled products in original and undamaged condition with manufacturer's seal and labels intact. Do not remove from packaging or bundling until required in Work.

.3 Store products subject to damage from weather in weatherproof enclosures.

.4 Store cementitious products clear of earth or concrete floors, and away from walls.

.5 Keep sand, when used for grout or mortar materials, clean and dry. Store sand on wooden platforms and cover with waterproof tarpaulins during inclement weather.

.6 Store sheet materials, lumber and aluminium siding on flat, solid supports and keep clear of ground. Slope to shed moisture.

.7 Store and mix paints in heated and ventilated room. Remove oily rags and other combustible debris from site daily. Take every precaution necessary to prevent spontaneous combustion.

.8 Remove and replace damaged products at own expense and to satisfaction of Engineer.

.9 Touch-up damaged factory finished surfaces to Engineer's satisfaction. Use touch-up materials to match original. Do not paint over name plates.

1.7 SUBMITTALS

.1 Within five working days of written request by the Departmental Representative, submit following information for any and all materials and products proposed for use:

.1 Name and address of the manufacturer and suppliers.
.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.
.6 Conformance to application standards.

1.8 SUPPLY AND USE

.1 Use new material and equipment unless otherwise specified.

.2 Provide material and equipment of specified design and quality, performing to published ratings and for which replacement parts are readily available.

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

1.9 MANUFACTURES INSTRUCTIONS

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

.2 Prior to use of a product or material, notify Departmental Representative in writing of any conflict between these specifications and manufacturer's instructions. Departmental Representative will designate which document is to be followed.

1.10 CONFORMANCE

.1 When material or equipment is specified by standard or performance specifications, upon request of Departmental Representative, obtain from manufacturer an independent testing laboratory report stating that materials or equipment meets or exceeds specified requirements. Trace-ability of all materials is to be performed

1.11 SUBSTUTUTION

.1 Departmental Representative is not obligated to consider any substitutes or changes after contract award. Contractor is responsible for all costs associated with reviewing requested changes.

.2 Proposals for submission after Contract Award must include all documentation and information required as part of this contract and statements of respective cost differences of items originally specified and proposed substitutions.

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

.4 Amounts of credits arising from approval of substitutions will be determined by the Departmental Representative and the Contract Sum will be reduced accordingly. No substitutions will be permitted without prior written approval from Departmental Representative.

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1.12 TRANSPORTATION

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

.2 Transportation cost of products supplied by Owner will be paid for by Engineer. Unload, handle and store such products.

1.13 MANUFACTURER'S INSTRUCTIONS

.1 Unless otherwise indicated in specifications install or erect products in accordance with manufacturer's instructions. Do not rely on labels or enclosures provided with products. Obtain written instructions directly from manufacturers.

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

.3 Improper installation or erection of products, due to failure in complying with these requirements, authorizes Engineer to require removal and re-installation at no increase in Contract Price or Contract Time.

1.14 QUALITY OF WORK

.1 Ensure Quality of Work is of highest standard, executed by workers experienced and skilled in respective duties for which they are employed. Immediately notify Engineer if required Work is such as to make it impractical to produce required results.

.2 Do not employ anyone unskilled in their required duties. Engineer reserves right to require dismissal from site, workers deemed incompetent or careless.

.3 Decisions as to standard or fitness of Quality of Work in cases of dispute rest solely with Engineer, whose decision is final.

1.15 CO-ORDINATION

.1 Ensure cooperation of workers in laying out Work. Maintain efficient and continuous supervision.

.2 Be responsible for coordination and placement of openings, sleeves and accessories.

1.16 CONCEALMENT

.1 In finished areas, conceal pipes, ducts and wiring in floors, walls and ceilings, except where indicated otherwise.

.2 Before installation, inform Engineer if there is interference. Install as directed by Engineer.

1.17 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.

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.2 Perform remedial work by specialists familiar with materials affected. Perform in a manner to neither damage nor put at risk any portion of Work.

1.18 LOCATION OF FIXTURES

.1 Consider location of fixtures, outlets, and mechanical and electrical items indicated as approximate.

.2 Inform Engineer of conflicting installation. Install as directed.

1.19 FASTENINGS

.1 Provide metal fastenings and accessories in same texture, colour and finish as adjacent materials, unless indicated otherwise.

.2 Prevent electrolytic action between dissimilar metals and materials.

.3 Use non-corrosive hot dip galvanized steel fasteners and anchors for securing exterior work, unless stainless steel or other material is specifically requested in affected specification Section.

.4 Space anchors within individual load limit or shear capacity and ensure they provide positive permanent anchorage. Wood, or any other organic material plugs are not acceptable.

.5 Keep exposed fastenings to a minimum, space evenly and install neatly.

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

1.20 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. 316 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.

1.21 PROTECTION OF WORK IN PROGRESS

.1 Prevent overloading of any part of building. Do not cut, drill or sleeve any load bearing structural member, unless specifically indicated without written approval of Engineer.

.2 Protect, relocate or maintain existing active services. When services are encountered, cap off in manner approved by authority having jurisdiction. Stake and record location of capped service.

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END OF SECTION

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Part 1 General

1.1 SECTION INCLUDES

.1 Progressive cleaning.

.2 Final cleaning.

1.2 RELATED SECTION

.1 Section 01 74 19 - Construction/Demolition Waste Management And Disposal.

.2 Section 01 77 00 - Closeout Procedures.

1.3 PROJECT CLEANLINESS

.1 Maintain Work in tidy condition, free from accumulation of waste products and debris, other than that caused by Owner or other Contractors.

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

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

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

.5 Provide and use clearly marked separate bins for recycling. Refer to Section 01 74 19 - Construction/Demolition Waste Management And Disposal.

.6 Remove waste material and debris from site at end of each working day.

.7 Dispose of waste materials and debris at designated dumping areas on Crown property.

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

.9 Provide adequate ventilation during use of volatile or noxious substances. Use of building ventilation systems is not permitted for this purpose.

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

.11 Schedule cleaning operations so that resulting dust, debris and other contaminants will not fall on wet, newly painted surfaces nor contaminate building systems.

1.4 FINAL CLEANING

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

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

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

.4 Remove waste products and debris other than that caused by Owner or other Contractors.

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

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

.7 Remove stains, spots, marks and dirt from electrical and mechanical fixtures, walls, ceilings and floors.

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

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

.10 Remove dirt and other disfiguration from exterior surfaces.

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

.12 Under no circumstances will burning of construction refuse be allowed on the Departmental Representative's site. Remove all waste materials from the site to an approved dumping area as designated by local authority.

.13 If the Contractor fails to clean up the site and restore to an acceptable condition, the Departmental Representative shall initiate completion of the work and deduct for same from monies due to the Contractor.

END OF SECTION

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Part 1 General

1.1 STORAGE, HANDLING AND PROTECTION

.1 Store, materials to be reused, recycled and salvaged in locations as directed by Engineer.

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

.3 Protect, stockpile and store salvaged items.

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

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

.6 Support affected structures. If safety of building is endangered, cease operations and immediately notify Engineer.

.7 Protect surface drainage, mechanical and electrical from damage and blockage.

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

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

.1 On-site source separation is recommended.

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

.3 Provide waybills for separated materials.

1.2 DISPOSAL OF WASTES

.1 Do not bury rubbish or waste materials.

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

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

1.3 USE OF SITE AND FACILITIES

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

.2 Maintain security measures established by existing facility.

1.4 SCHEDULING

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

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Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 APPLICATION

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

3.2 CLEANING

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

.2 Clean-up work area as work progresses.

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

3.3 CANADIAN GOVERNMENTAL DEPARTMENTS CHIEF RESPONSIBILITY FOR THE ENVIRONMENT

.1 Schedule E - Government Chief Responsibility for the Environment

Province	Address	General Inquires	Fax
Nova Scotia	Department of Environment, Barrington Tower 1894 Barrington Street Suite 1800 PO Box 442 Halifax, NS B3J 2P8	(902)-424-3600	(902)-424-0569

END OF SECTION

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Part 1 General

1.1 SECTION INCLUDES

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

1.2 RELATED SECTIONS

.1 Section 01 78 00 - Closeout Submittals.

1.3 INSPECTION AND DECLARATION

.1 Contractor's Inspection: Contractor and all Subcontractors shall conduct an inspection of Work, identify deficiencies and defects, and repair as required to conform to Contract Documents.

.1 Notify Engineer in writing of satisfactory completion of Contractor's Inspection and that corrections have been made.

.2 Request Consultant's Inspection.

.2 Consultant’s Inspection: Consultant and Contractor will perform inspection of Work to identify obvious defects or deficiencies. Contractor shall correct Work accordingly.

.3 Completion: submit written certificate that following have been performed:

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

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

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

.4 Operation of systems have been demonstrated to Owner's personnel.

.5 Work is complete and ready for Final Inspection.

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

.5 Declaration of Substantial Performance: when Owner and Consultant consider deficiencies and defects have been corrected and it appears requirements of Contract have been substantially performed, make application for certificate of Substantial Performance.

.6 Commencement of Lien and Warranty Periods: date of Owner's acceptance of submitted declaration of Substantial Performance shall be date for commencement for warranty period and commencement of lien period unless required otherwise by lien statute of Place of Work.

.7 Final Payment: When Owner and Consultant consider final deficiencies and defects have been corrected and it appears requirements of Contract have been totally performed, make application for final payment.

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.8 Payment of Holdback: After issuance of certificate of Substantial Performance of Work, submit an application for payment of holdback amount in accordance with general conditions.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

□

Part 1 General

1.1 SECTION INCLUDES

.1 As-built, samples, and specifications.

.2 Equipment and systems.

.3 Product data, materials and finishes, and related information.

.4 Operation and maintenance data.

.5 Spare parts, special tools and maintenance materials.

.6 Warranties and bonds.

1.2 RELATED SECTIONS

.1 Section 01 45 00 - Quality Control.

.2 Section 01 77 00 - Closeout Procedures.

.3 Section 01 79 00 - Demonstration and Training.

1.3 SUBMISSION

.1 Submit a copy of 'As-Built' drawings for approval by the Engineer.

.2 Prepare instructions and data using personnel experienced in maintenance and operation of described products.

.3 Copy will be returned after final inspection, with Engineer's comments.

.4 Revise content of documents as required prior to final submittal.

.5 Two weeks prior to Substantial Performance of the Work, submit to the Engineer, final copies of operating and maintenance manuals in English.

.6 Ensure spare parts, maintenance materials and special tools provided are new, undamaged or defective, and of same quality and manufacture as products provided in Work.

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

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

.9 Pay costs of transportation.

1.4 FORMAT

.1 Organize data in the form of a digital instructional manual.

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.2 When multiple manuals are used, correlate data into related consistent groupings. Identify contents of each file.

.3 Cover: Identify each file with type or title 'Project Record Documents'; list title of project and identify subject matter of contents.

.4 Arrange content by Section numbers and sequence of Table of Contents.

.5 Text: Manufacturer's data, or typewritten data.

.6 Drawings: provide with CAD files.

1.5 CONTENTS - EACH VOLUME

.1 Table of Contents: provide title of project;

.1 date of submission; names,

.2 addresses, and telephone numbers of Contractor with name of responsible parties;

.3 schedule of products and systems, indexed to content of volume.

.2 For each product or system:

.1 list names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.

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

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

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

.6 Training: Refer to Section [01 79 00 - Demonstration and Training].

1.6 AS-BUILTS AND SAMPLES

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

.1 Contract Drawings.

.2 Specifications.

.3 Addenda.

.4 Change Orders and other modifications to the Contract.

.5 Reviewed shop drawings, product data, and samples.

.6 Field test records.

.7 Inspection certificates.

.8 Manufacturer's certificates.

□

.2 Store record documents and samples in field office apart from documents used for construction. Provide files, racks, and secure storage.

.3 Label record documents and file in accordance with Section number listings in List of Contents of this Project Manual. Label each document "PROJECT RECORD" in neat, large, printed letters.

.4 Maintain record documents in clean, dry and legible condition. Do not use record documents for construction purposes.

.5 Keep record documents and samples available for inspection by Engineer.

1.7 RECORDING ACTUAL SITE CONDITIONS

.1 Record information on set of black line opaque drawings, and in copy of Project Manual, provided by Engineer.

.2 Provide felt tip marking pens, maintaining separate colours for each major system, for recording information.

.3 Record information concurrently with construction progress. Do not conceal Work until required information is recorded.

.4 Contract Drawings and shop drawings: legibly mark each item to record actual construction, including:

.1 Measured depths of elements of foundation in relation to finish first floor datum.

.2 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.

.3 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.

.4 Field changes of dimension and detail.

.5 Changes made by change orders.

.6 Details not on original Contract Drawings.

.7 References to related shop drawings and modifications.

.5 Specifications: legibly mark each item to record actual construction, including:

.1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items.

.2 Changes made by Addenda and change orders.

.6 Other Documents: maintain manufacturer's certifications, inspection certifications, field test records, required by individual specifications sections.

1.8 EQUIPMENT AND SYSTEMS

.1 Each Item of Equipment and Each System: include description of unit or system, and component parts. Give function, normal operation characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.

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.2 Panel board circuit directories: provide electrical service characteristics, controls, and communications.

.3 Include installed colour coded wiring diagrams.

.4 Operating Procedures: include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.

.5 Maintenance Requirements: include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

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

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

.8 Include sequence of operation by controls manufacturer.

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

.10 Provide installed control diagrams by controls manufacturer.

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

.12 Additional requirements: As specified in individual specification sections.

1.9 MATERIALS AND FINISHES

.1 Building Products, Applied Materials, and Finishes: include product data, with catalogue number, size, composition, and colour and texture designations.

.2 Instructions for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.

.3 Moisture-protection and Weather-exposed Products: include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.

.4 Additional Requirements: as specified in individual specifications sections.

1.10 SPARE PARTS

.1 Provide spare parts, in quantities specified in individual specification sections.

.2 Provide items of same manufacture and quality as items in Work.

.3 Deliver to site; place and store.

□

.4 Receive and catalogue all items. Submit inventory listing to Engineer. Include approved listings in Maintenance Manual.

.5 Obtain receipt for delivered products and submit prior to final payment.

1.11 MAINTENANCE MATERIALS

.1 Provide maintenance and extra materials, in quantities specified in individual specification sections.

.2 Provide items of same manufacture and quality as items in Work.

.3 Deliver to site; place and store.

.4 Receive and catalogue all items. Submit inventory listing to Engineer. Include approved listings in Maintenance Manual.

.5 Obtain receipt for delivered products and submit prior to final payment.

1.12 SPECIAL TOOLS

.1 Provide special tools, in quantities specified in individual specification section.

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

.3 Deliver to site; place and store.

.4 Receive and catalogue all items. Submit inventory listing to Engineer. Include approved listings in Maintenance Manual.

1.13 STORAGE, HANDLING AND PROTECTION

.1 Store spare parts, maintenance materials, and special tools in manner to prevent damage or deterioration.

.2 Store in original and undamaged condition with manufacturer's seal and labels intact.

.3 Store components subject to damage from weather in weatherproof enclosures.

.4 Store paints and freezable materials in a heated and ventilated room.

.5 Remove and replace damaged products at own expense and to satisfaction of Engineer.

1.14 WARRANTIES AND BONDS

.1 Separate each warranty or bond with index tab sheets keyed to Table of Contents listing.

.2 List subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

.3 Obtain warranties and bonds, executed in duplicate by subcontractors, suppliers, and manufacturers, within ten days after completion of the applicable item of work.

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.4 Except for items put into use with Owner's permission, leave date of beginning of time of warranty until the Date of Substantial Performance is determined.

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

.6 Co-execute submittals when required.

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

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

□

Approved: 2011-06-30

Part 1 General

1.1 REFERENCE STANDARDS

.1 The design and installation of concrete shall be in accordance with the latest version of the referenced standards and codes.

.1 Design, install and reinforce foundations to CAN/CSA 3-A23.1-94 except where specified otherwise.

.2 Perform formwork and cast-in-place concrete work to CAN/CSA 3-A23.1-94, except where specified otherwise.

.3 Perform reinforcing work to CAN/CSA 3-A23.1-94 and welding of reinforcing to CSA W186-1970, except where specified otherwise.

.4 Cure and protect concrete work to CAN/CSA-A23.1-94, except where specified otherwise

1.2 TEST REPORTS

.1 Contractor to facilitate execution to allow testing and sampling procedures to be performed in accordance with CSA A23.2-00 by Departmental Representative. Concrete cylinders shall be tested for each tower foundation.

.2 Confirmation of air content and slump shall be obtained for each load of concrete delivered to the project. The Contractor shall be responsible for the proper completion of the concrete. All costs associated with the testing of concrete supplied to the project shall be the responsibility of the Contractor.

.3 If inspection or test results indicate that concrete materials do not meet the requirements of this specification, such materials shall be rejected and removed from the site. The Contractor shall be responsible for all costs, including testing and additional Engineering inspections associated with concrete removal and replacement.

.4 The Contractor shall notify the Departmental Representative at least **ONE WEEK** prior to placing concrete. Notification shall be in writing with a copy to the Departmental Representative.

.5 Contractor to arrange and pay for all testing. Testing reports to be submitted for review and approval prior to erection.

Part 2 Products

2.1 MATERIALS

.1 Lumber: plywood and wood formwork materials to CSA CAN-A23-94.

.2 Reinforcing steel: Grade 400 MPa, deformed bars to CSA G30.12 unless indicated otherwise.

.3 Cement: to CSA A5-93, normal (type 10), sulphate resistant (type 50).

.4 Water, fine aggregates, normal weight coarse aggregates: CSA A23.

.5 Chemical admixtures: to CSA A266.2-1973.

.6 Non-shrink grout: premixed compound consisting of non-metallic aggregate, cement, and water reducing and plasticizing agents capable of developing minimum compressive strength of 50 Mpa (7000 psi) at 28 days.

2.2 MIXES

.1 Except where indicated or specified otherwise use concrete mix designed to produce minimum compressive cylinder strength at 28 days of 30 Mpa for tower foundations.

.2 Slump, unless noted otherwise, shall be 75mm +/-25mm.

.3 All concrete exposed to exterior temperatures and weather in its final use shall contain an air-entraining agent. Total air content to be as specified in CSA Standard A23, for the particular size of aggregate being used. The air-entraining agent shall be compatible with the water reducing agent.

.4 The maximum size of coarse aggregate shall be 40mm.

.5 If the air temperature is 5 C° or less, the temperature of the concrete, at the time of placing, shall be between 15° C and 30° C.

Part 3 Execution

3.1 WORKMANSHIP

.1 Ensure that reinforcement and inserts are not disturbed during concrete placement.

.2 Do not place concrete against any surface which is less than 5° C. Remove all snow and ice before placing.

3.2 FORMWORK

.1 Design all formwork in accordance with CSA Standard A23.

.2 Withdraw all nails and thoroughly clean and repair all form materials before reusing.

.3 Provide a 20mm chamfer on all exposed corners.

.4 Take all precautions necessary to maintain the safety of the structure before removing the forms. Pedestal forms to remain in place a minimum of 48 hours. **All formwork is to be completely removed.**

3.3 REINFORCEMENT

.1 Clean all reinforcement of any loose scale, dirt, or other coatings which would destroy or reduce the bond. Reject bars with kinks or bends not shown on the drawings. Thoroughly clean all forms before installing reinforcement. Fabricate. Detail and install all reinforcing steel as per Reinforcing Institute of Canada “Manual of Standard Practice” latest edition.

.2 Do not field cut, bend or displace any reinforcement to permit placing weldments or anchor bolts either before or after concrete is placed unless approval is given by the Departmental Representative.

.3 All reinforcement shall have a minimum of 75mm concrete cover.

3.4 JOINTS

.1 Construct all joints as detailed on the drawings.

.2 Clean the face of the joints of dirt and then saturate with water before placing new concrete.

3.5 GROUTING OF BASE PLATES

.1 Use In-Pact pre-blended non-shrink dry pack grout as manufactured by C.C. Chemicals Ltd. or approved equal. All grout should be installed according to the manufacturer's instructions.

.2 Edges of grout should be tapered off at 45° to give a neat transition between base plates and concrete pedestals.

3.6 CURING AND PROTECTIONS OF CONCRETE

.1 Provide effective means of maintaining the temperature of concrete in place at a minimum of 10° C and a maximum of 30° C for three days after placing. When the mean daily temperature is forecasted to be less than 5° C, provide protection for newly placed concrete by means of suitable enclosures or raised coverings, insulation and heat.

.2 Insulation must be protected to prevent loss of effectiveness due to.

.3 The use of calcium chloride to accelerate curing is prohibited.

3.7 PLACEMENT OF CONCRETE

.1 Consolidation of concrete should be performed by internal or immersion type vibration. Consolidation of the concrete by rods or shovels will not be permitted.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 133613 – Steel Towers

1.2 REFERENCE STANDARDS

.1 American National Standards Institute/National Association of Architectural Metal Manufacturers (ANSI/NAAMM)

.1 ANSI/NAAMM MBG 531-[00], Metal Bar Grating Manual.

.2 ASTM International

.1 ASTM A53/A53M-[07], Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.

.2 ASTM A307-[07b], Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

.3 ASTM A325M-[09], Standard Specification for Structural Bolts, Steel, Heat Treated, 830 MPa Minimum Tensile Strength [Metric].

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.40-[97], Anti-corrosive Structural Steel Alkyd Primer.

.2 CAN/CGSB-1.181-[99], Ready-Mixed Organic Zinc-Rich Coating.

.4 CSA International

.1 CSA G40.20/G40.21-[04(R2009)], General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.2 CAN/CSA G164-[M92(R2003)], Hot Dip Galvanizing of Irregularly Shaped Articles.

.3 CSA W59-[03(R2008)], Welded Steel Construction (Metal Arc Welding).

.5 Health Canada / Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.6 National Association of Architectural Metal Manufactures (NAAMM)

.1 AMP 510-[92], Metal Stair Manual.

.7 National Research Council Canada (NRC)

.1 National Building Code of Canada [2015](NBC).

.8 The Society for Protective Coatings (SSPC)

.1 Systems and Specifications Manual, Volume 2, 2008 Edition.

□

Part 2 Products

2.1 SYSTEM DESCRIPTION

.1 Design Requirements: Metal stair system shall wrap around exterior faces of the tower and shall lead to a working platform at the top of the tower. A self-closing metal half gate shall be located at the top and bottom of the stairway system. The contractor supplied drawings shall include necessary details for the layout and installation of the metal stairs, handrails and gates. Stairway system design and layout will be submitted to Departmental Representative for approval.

.2 Design metal stair, balustrade, gates and landing construction and connections to National Building Code of Canada (NBC) vertical and horizontal live load requirements.

.3 Detail and fabricate stairs to NAAMM Metal Stairs Manual.

2.2 MATERIALS

.1 Steel sections: to CSA G40.20/G40.21 Grade 300 W.

.2 Steel plate: to CSA G40.20/G40.21, Grade 260 W

.3 Floor plate: to CSA G40.20/G40.21, Grade 260 W.

.4 Steel pipe: to ASTM A53/A53M, standard weight, schedule 40 seamless black.

.5 Steel tubing: to CSA G40.20/G40.21

.6 Metal bar grating: to ANSI/NAAMM MBG 531

.7 Welding materials: to CSA W59.

.8 Bolts: to ASTM A307.

.9 High strength bolts: to ASTM A325M.

2.3 FABRICATION

.1 Fabricate in accordance with NAAMM, Metal Stair Manual.

.2 Weld connections where possible, otherwise bolt connections. Countersink exposed fastenings, cut off bolts flush with nuts. Make exposed connections of same material, colour and finish as base material on which they occur.

.3 Accurately form connections with exposed faces flush:

.1 Make mitres and joints tight.

.2 Make risers of equal height.

.4 Grind or file exposed welds and steel sections smooth.

.5 Shop fabricate stairs in sections as large and complete as practicable.

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2.4 PLATE/GRATING STAIRS

.1 Form treads from 6mm thick by 1200mm wide steel plate to profile indicated, and secure to stringers with L 35 x 35 x 5mm supports. Form landings from 6mm thick steel plate, reinforced by L 55 x 55 x 6mm spaced at 1200mm on centre.

.2 Form steel grating treads and landings from metal bar grating to profile indicated and secure to stringers and supports as indicated. Form landings of steel grating and reinforce as required.

.3 Form stringers from MC 310 x 15.8.

2.5 PIPE/TUBING BALUSTRADES

.1 Construct balusters and handrails from steel pipe.

.2 Cap and weld exposed ends of balusters and handrails.

.3 Terminate at abutting wall with end flange.

2.6 BAR BALUSTRADES

.1 Construct bar balustrades as follows:

.1 Balusters: 25 x 25mm bar.
.2 Top rail: 30 x 10mm bar.
.3 Bottom rail: 25 x 10mm bar.
.4 Pickets: 12 x 12mm bar at 100mm on centre.

.2 Fabricate supports for balustrade from 38 x 38mm steel tubing with both ends capped and welded.

.3 Weld balustrades to stringers as indicated.

2.7 FINISHES

.1 Galvanizing: hot dipped galvanizing with zinc coating 600 g/m2to CAN/CSA-G164.

Part 3 Execution

3.1 INSTALLATION OF STAIRS

.1 Install in accordance with NAAMM, Metal Stair Manual.

.2 Install plumb and true in exact locations, using welded connections wherever possible to provide rigid structure. Provide anchor bolts, bolts and plates for connecting stairs to structure.

.3 Do welding work in accordance with CSA W59 unless specified otherwise.

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.4 Touch up shop primer to bolts, welds, and burned or scratched surfaces at completion of erection.

3.2 INSTALLATION OF HANDRAIL

.1 Apply handrails in accordance with manufacturer's printed instructions, using recommended tools.

.2 Make joints and mitres neat, tight and inconspicuous. Remove surplus material from joint. Provide solid return at exposed ends of handrail.

3.3 CLEANING

.1 Perform cleaning as soon as possible after installation to remove construction and accumulated environmental dirt.

.2 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

3.4 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by metal stairs and ladders installation.

END OF SECTION

□

Part 1 General

1.1 CODES AND STANDARDS

.1 Work in this section relates to the design, supply and installation of the self-support structure.

.2 The design, supply and erection of the tower shall be in accordance with the latest version of the following codes and standards

- CSA-S37-18	Antennas, Towers and Antenna Supporting Structures
- CSA B33.4	Galvanized Steel Tower Bolts and Nuts
- ASTM A325	High Strength Bolts for Structural Steel Joints
- CSA CAN3-A23.3	Design of Concrete Structures
- CSA W59	Welded Steel Construction
- CAN/CSA-G40.20	General Requirements for Rolled or Welded Structural Quality Steel
- CAN/CSA-G40.21	Structural Quality Steels
- CAN/CSA-G164	Hot Dip Galvanizing of Irregularly Shaped Articles
- CAN/CSA-S16.1	Limit States Design of Steel Structures
- CAN/CSA-B72	Installation of Lightning Rods
- CAN/CSA-C22.1	Canadian Electrical Code, Part 1
- CAN/CSA-G4	Steel Wire Rope for General Purpose and Mine Hoisting and Mine Haulage
- CSA-CAN3-G12	Zinc Coated Steel Wire Strand
- CSA W47.1	Certification of Companies for Fusion Welding of Steel Structures
- W47.1S1-M	Supplement No.1-M1989 to W47.1-1983
- W59-	Welded Steel Construction (Metal-Arc Welding)
- Z259.2.-M	Fall Arresting Devices, Personnel Lowering Devices and Life Lines
- Z259.1	Fall Arresting Safety Belts and Lanyards for the Construction and Mining Industries

- Canada Labour Code
- Health and Welfare Canada Limits of Exposure to Radio-Frequency Fields at Frequencies from 10 kHz-300 kHz, Safety Code 6
- Nova Scotia Occupational Health & Safety Act and Regulations
- National Building Code of Canada – 2010
- Transport Canada Standard TP382 – Standards Obstruction Markings
- Canadian Coast Guard Safety Requirements
- SSPC (The Society of Protective Coatings)
- Transport Canada CAR Standard SOR/96-433

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Part 2 Products

2.1 GENERAL REQUIREMENTS

.1 All steel CSA G40.21M – 350W u/n. Preference shall be given to the use of structural steels with improved resistance to brittle fracture. A36 modified steel is not acceptable. All materials to be used in the tower shall be new and in accordance with the requirements of CSA Standard S37-18.

.2 Use of material sections less than 5 mm in thickness will not be permitted on primary or secondary structural members. Sections used for attachment or support of auxiliary facilities may be permitted subject to review by the Departmental Representative.

.3 Hollow sections will not be permitted on primary or secondary structural members which include tower legs, horizontals and diagonals.

2.2 AUXILLARY FACILITIES

.1 The following facilities shall be considered to be an integral part of the tower contract and shall be supplied and erected as such. In mounting any of these auxiliary facilities, care shall be taken that the structural members of the tower are not weakened by the drilling of holes or any other means.

.2 Stairway – The tower shall be equipped with a stairway system complete with a CSA approved handrails and guards. The stairway shall be a separate assembly bolted to the tower and shall conform to the latest version of NAAMM and NBC 2010. Stairway design and layout will be submitted to Departmental Representative for approval.

.3 Transmission Line Supports – Line hangers shall be supplied and installed to support the transmission lines along the height of the tower as required. All TX lines to be supplied and installed by Owner. Location of line hangers will be submitted to Departmental Representative for approval.

.4 Ice Protection:

.1 All horizontal runs of transmission lines shall be protected from falling ice in a manner approved by the Departmental Representative.

.2 All obstruction lights shall be protected by ice shields if applicable.

2.3 WAVEGUIDE BRIDGE

.1 Tower design to include a waveguide bridge assembly as required to elevate and protect (from falling Ice, etc.) transmission lines from the tower base point to the building transmission line entrance. The waveguide bridges shall be supplied and installed as per approved design drawings. Waveguide bridge to be approximately 15m in length.

.2 This ice protection shall incorporate a peaked roof of solid plate construction located above the standard channel support for the waveguides, cables and conduit. Design must allow easy access to TX lines without removal of bridge hardware.

.3 Transmission lines must be protected by the Waveguide Bridge at all times.

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.4 The Waveguide Bridge must be independent of and not directly connected to the tower structure or the building.

.5 The waveguide bridge can be supported on a post located in the center or two sides of the assembly, except the support closest to the building which must consist of two posts located on the outside of the assembly.

.6 The waveguide bridge shall be designed to carry all initial and proposed waveguides, cables and conduits as indicated on the antenna and transmission line schedule.

.7 The waveguide shall be supported on cable hangers connected to a trapeze style support system of stainless steel threaded rod or galvanized bar hangers and two levels of horizontal trapeze angles suitable and elevated to run directly into the waveguide window.

.8 The Contractor shall provide a suitable adjustable plate extension to the bridge to protect the lines between the bridge and the building and the bridge and the tower. This plate must taper to the full width of the waveguide window or waveguide ladder on the tower.

.9 Unistrut or Cantruss sections are not acceptable for use on the waveguide bridge or the tower itself.

Part 3 Execution

3.1 DESIGN

.1 The tower shall be designed in accordance with CSA S37-18 to support all antennas, attachments, etc as indicated.

.2 The tower should have a maximum serviceability response (tilt and/or twist) of less than 2.0 degrees under working loads. Tower to be designed to require no torsion resistors.

.3 The tower foundations shall be designed in accordance with CSA S37-18 to support all antennas, attachments, etc as indicated.

.4 Design Ice Load: the tower shall be designed with loading consideration of 50 mm of radial ice on all exposed surfaces, including members, all attachments, and antenna components. 50mm shall be the valued considered as the reference ice thickness, $\mathbf{t_i}$ as per CSA S37-18.

.5 Design Wind Load: Use Site Specific Wind Data contained in Appendix B.

.6 Radar Loading Requirements: Use Radar Loading requirements contained in Appendix D.

.7 The loading imposed on the tower by transmission lines and auxiliary lines – feeder lines, attached to it shall be based on the actual dimensions of the lines as determined from the manufacturer’s specifications.

.8 Shielding of the transmission lines by the tower members, other feeders or attachments may be considered. When feeder lines are mounted on the inside of one face of the tower, shielding of the leeward lines may be considered, following the procedures outlined in

"User's Guide – NBC 2010 – Structural Commentaries (Part 4 of Division B)" Commentary I, Figure I-28 Poles, rods and wires.

.9 Loading from auxiliary facilities and attachments such as stairs, fall arrest rails, feeder line supports, etc. must be considered in a similar fashion as that of the transmission lines and feeders outlined above.

.10 Design to include a waveguide bridge assembly as required to elevate and protect (from falling Ice etc.) transmission lines from the tower base point to the building transmission line entrance.

.11 The foundation designs shall be based on the conditions contained in the Geotechnical Report once provided.

.12 The Design Engineer accepting responsibility for the tower foundations shall:

.1 Have approved a minimum of ten (10) towers of similar nature in the previous three (3) years.

.2 Be registered or eligible for registration with the Association of Professional Engineers and Geoscientists of Nova Scotia.

.3 Seal all drawings issued that relate to the tower.

3.2 CONNECTIONS

.1 Connections in the shop may be bolted or welded. All site connections shall be bolted.

.2 Make all welded connections in conformance with CSA Standard W59.1. Use only low hydrogen electrodes or processes of equivalent rating. All weld designs shall be clearly indicated on the design drawings.

.3 Make all bolted connections with high strength bolts clearly marked A325 conforming to A.S.T.M. Standard Specification A325. Place a hardened washer in under the bolt element (nut or bolt head) turned in tightening the bolt. Tighten all bolts by the turn of the nut method as specified in CSA Standard S16.

.4 Power wrenches may be used in installing bolts, provided they are of the adjustable type capable of cutting-out at a pre-selected torque value.

.5 After the tower has been complete, check all bolted connections, including those on miscellaneous metal work, and retighten all loose bolts. Exercise care that bolts adequately tightened are not subjected to additional rotation of the turned element. All damaged nuts or bolts to be replaced.

3.3 WORKMANSHIP

.1 General: Workmanship and finish throughout shall be equal to the best modern practice for this class construction. All members shall be in accordance with the drawings and shall be straight and true as per CSA S37-18. All like parts shall be interchangeable. All punched holes must be accurately located so that the structure can be erected with a minimum of "drifting". The ends of members shall be clipped as required to facilitate assembly. In any bending or reworking of any material, methods employed shall ensure that the physical properties of the material are not impaired.

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.2 Marking: Each separate member has already been distinctly identified by a number assigned to that member. Each member has been clearly marked with its member number to facilitate erection and traceability. All like parts have the same number.

.3 Punching: Punching shall be done by methods designed to ensure accuracy. The center of any hole shall, in no case, be displayed more than1.5mm from its position shown on the drawings. Plugging or welding mis-punched holes will not be allowed. Punches and dyes shall be sharp and true and all punch holes shall be round, true to size, and free from ragged edges and burrs. Where applicable, punching performed on bent members, shall be done after bending to avoid distortion of holes.

.4 Welding: All welding shall be performed in accordance with CSA Standard W59 latest revision and shall be undertaken by a fabricator fully approved by the Canadian Welding Bureau to the requirements to CSA Standard W47, latest revision. Provide copy of CWB Certification to Departmental Representative.

.5 Handling of Material: Materials shall be handled and stored in the plant and on the job site in such a manner that no damage shall be done to the materials of any existing building or structure. Special care shall be taken to ensure that galvanizing, priming, or painting is not damaged during handling and erection of materials. Storage of materials on the site will be the responsibility of the Contractor.

3.4 GALVANIZING

.1 Galvanizing applied to structural members is to have a minimum mass of Zinc coating of 610 g/m² (2 oz/ft²) equivalent to a thickness of 87 μm (3.40 mils). Galvanizing applied to bolts, nuts and threaded fasteners is to have a minimum mass of Zinc coating of 460 g/m² (1.5 oz/ft²) equivalent to a thickness of 65 μm (2.54 mils).

.2 The Contractor shall field paint all steel members of the tower where the galvanized finish has been scrapped or chipped during erection in the field. This shall be done using Zinkrich paint, as supplied by the Zinkrich Company, 42 Broadway, New York, New York, U.S.A. or Galvicon or an approved equal. Steel members that have a slightly damaged finish shall be given three coats of Zinkrich Paint applied according to the manufacturer's printed instructions. If applicable.

.3 Contractor shall warranty all galvanizing work for a period of not less than three (3) years.

3.5 ERECTION

.1 The tower shall be erected in a manner that will not bend, scrape, distort, or injure the component parts of the galvanizing. **Upon award of contract, Contractor is to provide a detailed Erection Plan to include the use of gin poles, winches, cranes and erection equipment.**

.2 The use of iron sledges for hammering or driving any members will not be tolerated. All hammering is to be done with wooden mauls or hammers of plastic, lead or other soft material.

.3 Every failure of the material to join together properly shall be reported to the Departmental Representative.

□

.4 Upon completion of erection, the tower shall be inspected by the Contractor for member damage. Any damaged or missing items, including nuts, bolts, etc., shall be replaced.

.5 The Contractor shall be responsible to ensure that no members of the tower are over stressed during erection. Any members damaged during erection shall be replaced. The Contractor shall be responsible for any damages done to the work of others, or to adjoining structures and property during erection.

.6 The Contractor shall use a three-transit set up to complete final adjustment of vertical alignment and twist and to ensure it meets the requirements of CSA S37-18 for vertical alignment and twist.

.7 Contractor is responsible for establishing temporary obstruction lighting in accordance with Transport Canada requirements, if applicable.

3.6 ELECTRICAL BONDING

.1 Special care shall be taken to ensure continuity of required electrical connections and proper bonding of electrical conduits, etc., upon initial assembly and throughout antenna structure life when subjected to salt spray conditions in coastal installation.

END OF SECTION

□

Part 1 General

1.1 GENERAL

.1 The Contractor shall be responsible for the design, supply and installation of a complete permanent continuous grounding system for the new Radar tower system. The design shall consider existing site topography and soil/rock conditions and is subject to approval by the Departmental Representative. All rods shall be “Copperclad” or approved equal, 19 mm diameter x 3000 mm long driven vertically.

.2 Contractor shall locate and connect the tower grounding system to the main existing underground building perimeter grounding grid.

.3 Contractor shall be responsible for installing all new external grounding for tower, wave guide bridging and cable entry.

.4 The main external buried ground grid impedance to true earth shall be less than 10 ohms.

.5 In rock conditions, the Contractor shall propose products and systems which shall attain the desired protection. This must be clearly shown on design drawings. All above ground runs of conductor must be securely attached to the rock with clips at spaces not more than 3 m, and covered with a berm of soil which is in turn covered with stones.

Part 2 Products

2.1 MATERIALS

.1 Ground and Connecting Conductors:

.1 Use bare copper wire for all below grade applications and tinned copper for all above grade applications.

.2 The main external buried ground grid shall consist of a minimum of 2/0 AWG, 19 strand bare conductors of soft drawn copper.

.3 Connections from the base of the tower to the main external buried ground grid shall be a minimum of 2/0 AWG, 19 strand bare conductors of copper.

.4 Connections from buildings, equipment enclosures, shelters and storage tanks to the main buried ground grid shall be a minimum of 2/0 AWG, multi-stranded bare conductors of soft drawn copper.

.5 The connection from the waveguide ground bus bar to the main external buried ground grid shall be a minimum of 2/0 AWG multi-stranded conductors of soft drawn copper.

.6 The connection from the main interior ground bus bar to the main external buried ground grid shall be a minimum of 2/0 AWG multi-stranded conductors of soft drawn copper.

.7 Connections from the main interior ground bus bar to secondary bus bars and equipment cabinets shall be a minimum of 2/0 AWG multi-stranded conductors of soft drawn copper.

.8 The combined resistance of the conductors and associated connectors shall not exceed 0.5 ohms.

.9 The connections that lead off of the buried ground grid and are not buried shall be a minimum 2/0 AWG tinned copper multi-stranded wire

.2 Ground rods shall be copper-coated steel rods measuring 19 mm in diameter and 3 m in length.

.3 Ground Bus Bars:

.1 Ground bus bars shall be a minimum of 6.4 mm (1/4 in) thick, consisting of soft copper with sets of two non-threaded holes per connection. These holes shall have a diameter of 9.53 mm (3/8 in) and shall be spaced 25.4 mm (1 in) apart. The bus bar length, bus bar width and total number of connections shall be determined by the quantity of ground connections required for the specific site.

.2 Bus bars shall be installed with one ground conductor attached directly to the bus bar with a thermit weld commonly referred to as a pigtail.

.3 All ground bus bars shall be mounted on fiberglass insulators rated at 2700 volts (indoor continuous rating) which shall be mounted on steel stand-off mounting brackets.

.4 All thermit connectors shall be of the exothermic type requiring a mold unless otherwise noted on the drawings.

.5 Compression Connectors:

.1 Tower ground bus bar.

.2 All compression connectors specified in this standard shall be of the type requiring a linesman's type Y35 hand operated hydraulic compression.

.3 Low-force compression connectors as may be acceptable for the interconnections within an equipment cabinet shall not be covered by this standard.

.4 A compression connection shall be installed as per the manufacturer's instructions and shall not be used to connect to more than one conductor per compression operation unless specified by the manufacturer.

.5 External ground bus bar.

.6 Bolted Connectors:

.1 The use of bolted connectors shall not normally be acceptable for the connections covered by this standard.

.2 A notable exception shall be where a bolted connector forms an integral part of a compression connector. For example, compression connectors used to connect equipment cabinet ground conductors to flat bus bars incorporate an integral bolted connector.

.7 Earth enhancing compounds shall be considered for use at sites where the main external buried ground grid impedance to true earth cannot be reduced.

.8 Additions to the standard buried grid:

.1 The addition of counterpoises or earth enhancing compounds shall be considered for those sites where the ground impedance cannot be achieved by other means. All such additions shall be approved by the design engineer prior to construction.

.2 Counterpoises shall consist of buried conductors installed radially outward from the site to a maximum length of 30 m and a minimum burial depth of 1.5 m.

.9 All buried ground grid conductors shall be installed at 400 mm below finished grade and shall not be routed in or through cable trough. If this depth is not practical, consideration should be given to encasing the ground grid conductors in concrete.

.10 Buried Ground Connectors:

.1 All buried ground connectors shall be of the thermit type and shall be installed at 400 mm below finished grade

.2 Buried ground connectors shall not be incased in concrete unless required as part of a building foundation or if the depth requirement cannot be achieved.

.11 Connecting to Non-C.C.G. Ground Grids: The main external C.C.G. buried ground grid shall be connected to each and every other buried ground grid on the same site using a minimum of 2/0 AWG (10.16 mm), 19 strand bare conductors of soft drawn copper.

.12 Lightning rods:

.1 A lightning rod shall be installed such that the rod is at least 2 m higher than the structure and any antenna mounted on top of the structure. The base of the lightning rod shall be connected to the tower.

.2 A ground conductor shall be connected to the lightning rod using a thermit connector and to the tower at a minimum spacing of 3 m using bolted connectors. This conductor shall be connected directly to the main external buried ground grid using a thermit connector.

.13 Towers shall be connected to the buried ground grid at each corner of the tower from the lowest point on the tower above any mechanical tower hinge

.14 Ground conductor installation details

.1 All ground conductors shall be installed to avoid sharp bends, excess loops, and shall be routed to minimize the distance to ground

.2 Since lightning surges are composed of a wide spectrum of frequencies, copper braid should be considered for applications requiring short connections to irregular surfaces and because of its superior high frequency characteristics. Copper braid should also be considered for use to connect ground across mechanical hinges and movable joints.

.15 Waveguide grounding:

.1 All waveguide and coaxial cables connecting to antennas on towers shall be connected to the tower and any external horizontal support, such as a waveguide bridge, using the waveguide or cable manufacturer’s ground kit and instructions. These connections shall be installed at the top of the tower, the bottom of the tower and at every 90o bend, with a minimum spacing of 60 m or the manufacturer’s specification, whichever is less.

.2 Hanger kits shall not be used as a substitute for grounding kits.

.3 All waveguide and coaxial cables entering a C.C.G. facility shall also be connected to an external ground immediately before entering the building.

.16 Triax Cable Grounding: The outer and inner shields of triax cables, used for power line carrier (PLC), entering a C.C.G. facility shall not be connected to an external ground immediately before entering the building. The outer and inner shields shall both be grounded at either the entrance to a screen room if used, or the PLC cabinet if a screen

room is not used. If a screen room is used, the triax cable shall be terminated at the screen room wall and coaxial cable shall be used internal to the screen room. In either case, the outer shield for triax cables shall only be grounded at one place as detailed above. This assumes that lightning protection is provided in both the CVT and LMU box and that the triax is routed entirely underground.

.17 Main external ground bus bar:

.1 The main external ground bus bar shall be located on the exterior wall directly below the antenna cable entrance to the building.

.2 It is expected that lightning surges shall be more likely to enter a building through a cable from a tower than from a power distribution line. The objective of the above is to provide the shortest route to ground for any such surge using a combination of shielding and surge arrestors at the building point of entry.

.18 Waveguide ground bus bar:

.1 A waveguide ground bus bar shall be located just below the waveguide bridge on the outside of the building. A dedicated ground shall connect this bus bar to the main external buried ground grid. All connections to this bus bar shall be routed external to the building. There shall be no direct connection between this bus bar and the main ground bus bar.

.2 This bus bar is required to accommodate standard waveguide grounding kits which do not allow a direct thermit connection to the main external buried ground grid. If waveguide grounding kits that allow direct thermit connections become available, these should be considered for use rather than using a bus bar.

Part 3 Execution

3.1 STANDARDS OF ACEPTANCE

.1 Ground rods and lightning rods:

.1 C.L.M DN6CC10

.2 L.C.A. 7510

.3 Slater 9450

.2 Cadweld Thermit connectors manufactured by ERICO Products Inc.

.3 Compression Connectors use Bundy Hyground Compression System.

3.2 GROUND RODS

.1 Grounding layout shall be approved by Departmental Representative prior to installation. Refer to grounding schedule and layout contained in Appendix E.

.2 All ground rods shall be buried vertically at an angle of not more than 30o from vertical such that the top of the rod is installed at 400 mm below finished grade.

.3 All ground rods shall be directly connected to the basic ground grid using thermit connectors.

.4 Ground rods shall not be incased in concrete unless required as part of a building foundation or if the depth requirement cannot be achieved.

.5 The minimum number and spacing of ground rods shall be site specific such as to reduce the ground grid impedance to that specified in section 5.2

.6 Ground rods which cannot be driven vertically shall be placed in a 76 mm diameter drilled hole, filled with a Bentonite and water mixture. The procedure for placing the ground rod in Bentonite is as follows.

.1 Drill 76mm hole in rock, 3m deep.

.2 Pour water 1/3 height of the hole.

.3 Insert ground rod.

.4 Add Bentonite power in hole, alternating with water.

3.3 CONNECTIONS

.1 Before making a ground system connection, remove all paint, foreign matter or dirt.

3.4 MEASUREMENT OF GROUND RESISTANCE

.1 The Contractor shall measure the resistance to ground at a point near the tower base and the transmission line entrance to the building. A report with readings shall be submitted to the Departmental Representative.

END OF SECTION

Part 1 General

1.1 DEFINITIONS

.1 Only two excavation classes will be recognised, rock excavation and common excavation.

.2 Rock excavation is defined as excavation of materials from solid masses of igneous, sedimentary or metamorphic rock, which, prior to its removal, was integral with its partner mass, and boulders or rock fragments having individual volume in excess of 1 cubic metre.

.3 Rock excavation is defined as excavation of materials from solid masses of igneous, sedimentary or metamorphic rock, which, prior to its removal, was integral with its partner mass, and boulders or rock fragments having individual volume in excess of 1 cubic metre.

1.2 REQUIREMENTS OF REGULATORY AGENCIES

.1 The Contractor shall adhere to Municipal, Provincial and Federal Codes where blasting is required. The Contractor to provide a minimum of **ONE-WEEK** notice to Departmental Representative prior to any blasting operation.

.2 The Contractor shall adhere to Municipal, Provincial and Federal requirements relating to the safety of excavations and protection of workmen.

1.3 MEASUREMENT

.1 The Contractor shall make his own computations of the amount and nature of all excavations required.

.2 If soil conditions are inconsistent with the reported conditions indicated in the Geotechnical reports or drawings, report this immediately to the Departmental Representative.

1.4 EXISTING CONDITIONS

.1 Before commencing work, verify location of buried services on and adjacent to site.

Part 2 Products

2.1 MATERIALS

.1 Granular Backfill: Pit run natural or blend sand or gravel consisting of clean hard durable particles free from clay lumps, cementation or organic material, having less than 10% by mass passing a #0.075mm sieve, capable of being compacted to the degree specified herein and meeting the approval of the Departmental Representative.

.2 Common Backfill: selected materials from excavation, suitable to the Departmental Representative for the use intended, free from frozen materials, cinders, ashes, sods, organic materials, refuse and other deleterious substances

Part 3 Execution

3.1 SHORING AND BRACING

.1 Contractor is responsible for ensuring that all excavation work is performed in strict accordance with all Federal, Provincial and Municipal regulations. Provide and set all shoring, bracing, etc. necessary to prevent the caving in of excavating sides. Shoring shall be placed so as to be independent of all foundations and shall remain in place until forms have been and approval given to proceed with backfilling.

3.2 PUMPING AND DRAINAGE

.1 Provide all pumping and drainage required to control ground and surface water during excavation and construction of sub grade work.

3.3 EXCAVATION

.1 Strip top soil from within limits of excavation and stockpile as directed for spreading after backfilling.

.2 Excavate to at least the depth shown on the drawings and to a width sufficient to perform the work properly.

.3 Bottoms of all excavations shall be level, kept free of water and cleaned of all loose material and debris before concrete is poured. All foundations shall rest on undisturbed earth or rock.

.4 Should the bearing capacity at levels indicated be found inadequate by the Departmental Representative, the Departmental Representative may order the excavation to be carried down to a proper bearing. Such work shall be classified as additional work and cost thereof shall be determined on the basis of unit price quoted. Bearing levels are to be verified by Departmental Representative prior to proceeding with work.

.5 When excavations are carried down to a greater depth than shown on the drawings without the Departmental Representative’s written approval, the foundations shall be carried down to the excavated depth at the Contractor’s expense. The method of deepening the foundation must be approved by the Departmental Representative.

3.4 ROCK EXCAVATION

.1 All rock excavations shall conform to alignments, profiles, and cross sections shown on the drawings. Carefully scale down all slopes and remove all rock, boulders and fragments, either on or outside the excavated area, liable to roll or slide down the side slopes of cut sections.

.2 Excavated rock shall be disposed off the site or as directed by the Departmental Representative.

3.5 BLASTING

.1 Blasting operations shall be undertaken only with the explicit written permission of the Departmental Representative. Blasting will only be considered when a machine operated buster cannot be used.

.2 The supply, transportation, storage and use of all explosives and accessory equipment used for blasting shall be in accordance with regulations of the authority having

jurisdiction. The Contractor shall be responsible for all necessary precautions and cost to prevent damage to surroundings, including responsibility for arrangements, and all costs involved in temporary removal and replacement of utilities.

3.6 BACKFILLING

.1 Do not proceed with backfilling operations until the Departmental Representative has inspected and approved work in place. Provide **48 hours** notice to the Departmental Representative.

.2 Backfill spaces excavated and not occupied by parts of substructure or other permanent works with specified material placed up to the surface or surrounding ground.

.3 Place backfill materials in uniform layers not exceeding 200mm loose thickness and simultaneously on sides of structure so that loading is equalized.

.4 Compact each layer to following percentages of corrected maximum dry density in accordance with ASTM D698-78.

.1 Common Backfill 95%

.2 Granular Backfill 100%

.5 Place backfill so as to prevent the accumulation of water around foundation.

3.7 RESTORATION

.1 Upon completion of work dispose of any spoils neatly on the site by the tower base, “feathering-out” excess materials.

.2 Replace top-soil over excavated areas.

.3 Restore areas affected by equipment outside the area of work to the condition which existed prior to commencement of work.

.4 Remove surplus material and debris from the site to an area authorized for such disposition by those authorities having jurisdiction.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This section covers the design and installation of anchors to rock for transfer of shear and tension foundation loads.

1.2 Design

.1 The minimum number of rock bolts to be installed at one leg foundation shall not be less than four. Alternatively single rock bolts in certain applications may be approved by the Departmental Representative provided there is a comprehensive testing program implemented by the Contractor in accordance with the requirements of this section.

Part 2 Products

2.1 ROCK BOLTS (ANCHORS)

.1 Rock bolts shall be Williams Rock Bolts with expanding shield or approved equivalent. The shield shall be designed to provide even bearing around the hole and to develop the full ultimate tensile strength of the bolt. The shell type to suit rock conditions indicated in provided Geotechnical Report. Two nuts shall be supplied and installed to secure the anchor weldment. The second nut shall act as a locking nut and be of adequate quality for that purpose.

2.2 GROUT

.1 Use Grout recommended by Rock Bolt Manufacturer. Grout shall be high early strength expanding type, with expansion of 3% to 4% prior of the gel stage. Grout shall have a minimum compressive strength of 40 MPa.

Part 3 Execution

3.1 HOLES

.1 Drill holes to the diameter and length recommended by the rock bolt manufacturer for the bolt diameter to be used. Take care to ensure diameter is accurate and the hole is straight. Clean the hole before inserting the bolt.

.2 Tap bolt into position taking care not to damage the threaded end. Set expansion shield torquing bolt to value recommended by the manufacturer.

.3 Testing shall be carried out by the Contractor according to the manufacturer's instructions, and in the presence of the Departmental Representative. Establish a test procedure with the Departmental Representative prior to testing. Note that some bolt installations may, as part of the installation process, require tensioning of the bolt. This may constitute the required load test if approved by the Departmental Representative.

.4 The contractor shall accurately record torqueing and tension values for each bolt, along with the duration of the test. This information shall be submitted to the Departmental Representative for review.

.5 Any bolt slippage shall be reported to the Departmental Representative immediately and a plan submitted for resolution.

.6 The Contractor shall provide written confirmation of recent calibration of the jacking system from an independent testing firm.

.7 The Contractor shall provide conversion charts issued by the jack manufacturer to convert pressure indicated to pounds of tension force.

3.2 GROUTING

.1 Insert flexible grout tube to the bottom of the drill hole. Pump in grout (mixed in accordance with the manufacturer's instruction), slowly withdrawing the grout tube while maintaining pressure on the grout pump until grout is visible at the surface. Grouting to be conducted in presence of the Departmental Representative. Adequate notice of at least 5 days to be provided for inspection.

3.3 PROTECTION

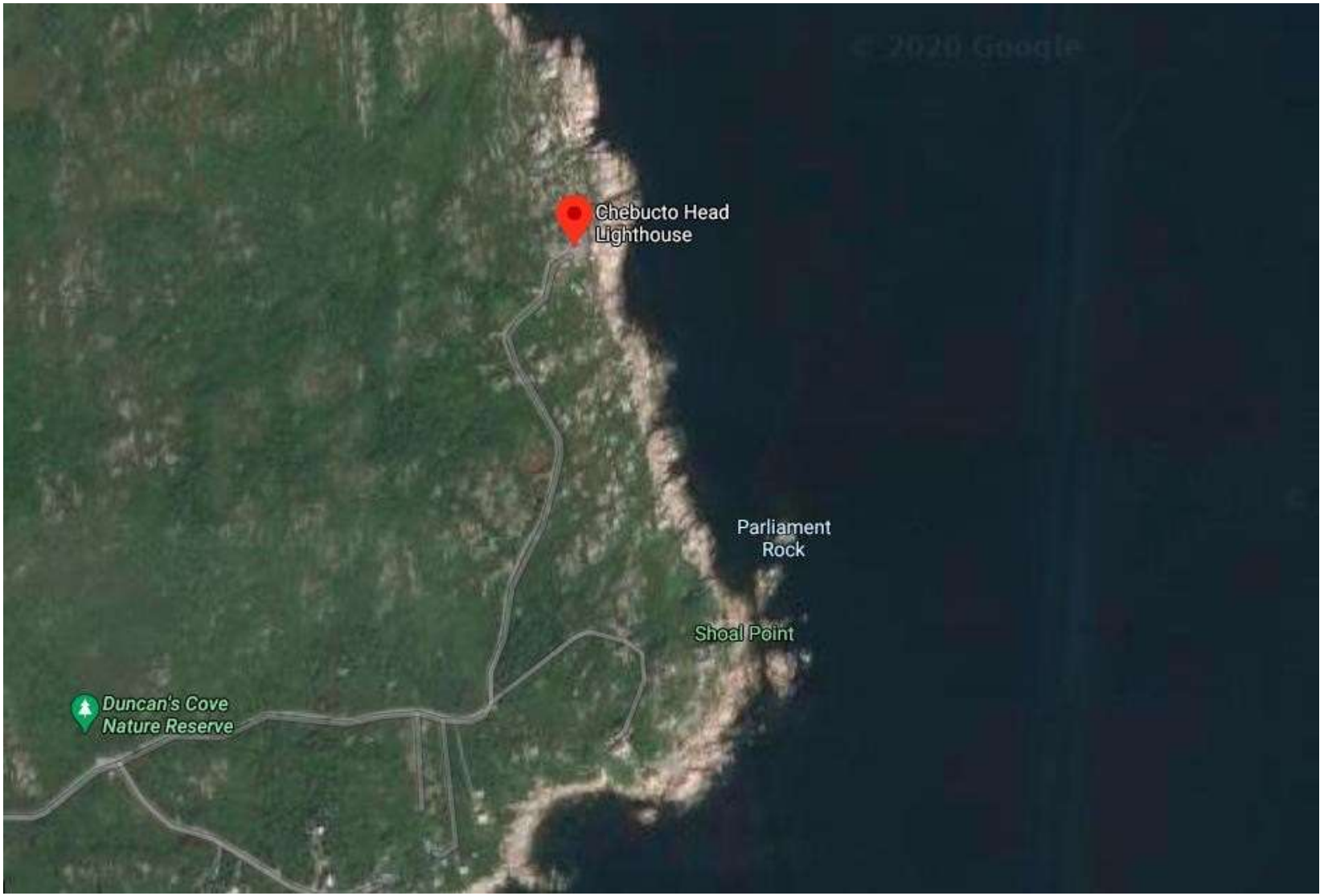
.1 Thoroughly protect the rock bolts above and below grade (minimum of 600 mm) by hot dip galvanizing to the requirements of CAN/CSA-S37-18 and the standards specified therein. In addition, when the bolt is backfilled and below grade, apply a heavy bituminous, corrosion resistant compound.

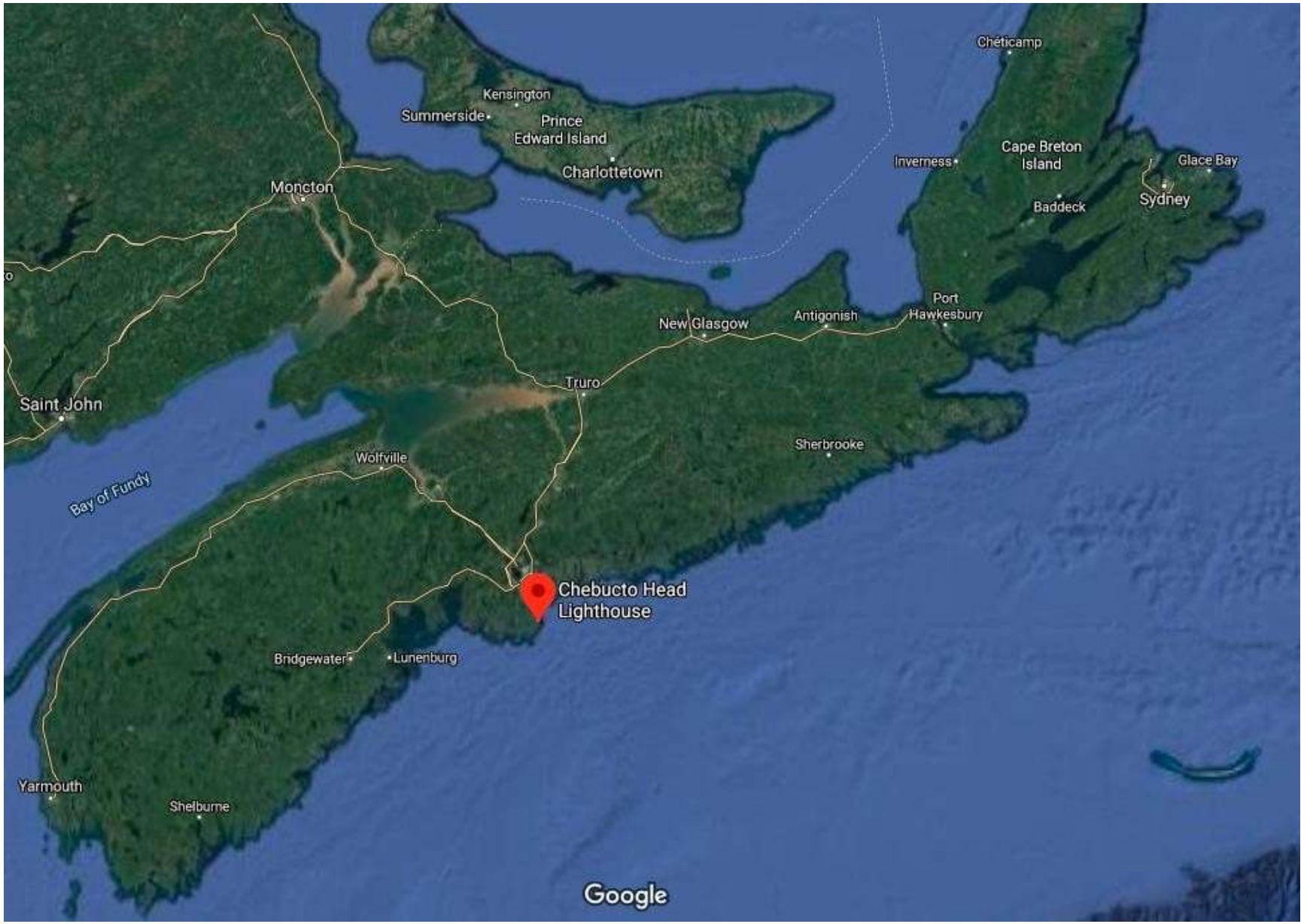
.2 Follow manufacturer's instructions with regard to curing and protection prior to any backfilling of the anchor.

END OF SECTION

Appendix A

Site Location


© 2020 Google
Chebucto Head Lighthouse
Parliament Rock
Shoal Point
Duncan's Cove Nature Reserve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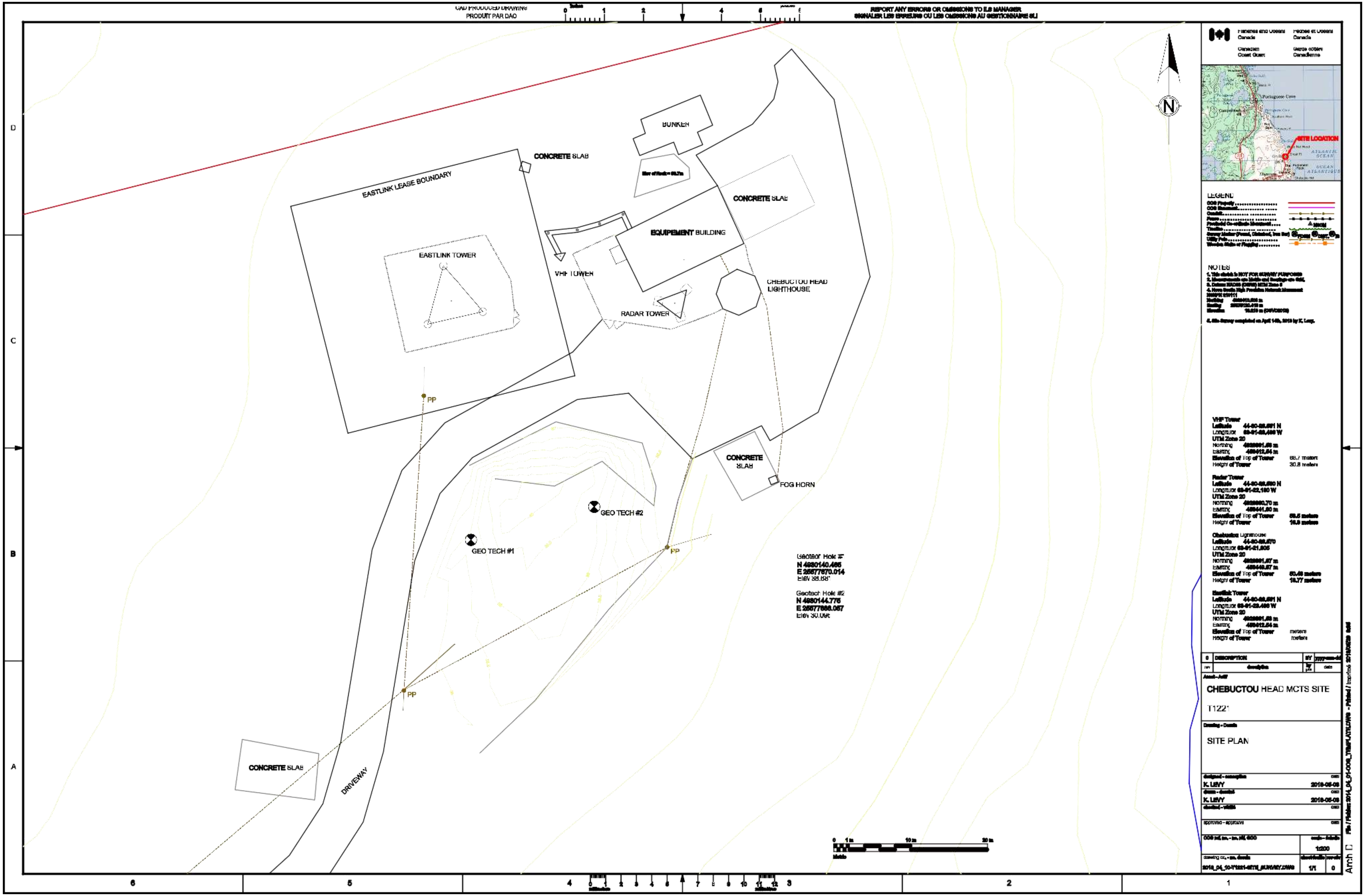
Kensington
Summerside
Prince
Edward Island
Charlottetown
Inverness
Cape Breton
Island
Glace Bay
Sydney
Baddeck
Moncton
Port
Hawkesbury
New Glasgow
Antigonish
Truro
Saint John
Sherbrooke
Wolfville
Bay of Fundy
Chebucto Head
Lighthouse
Bridgewater
Lunenburg
Yarmouth
Shelburne
Google

Appendix B

Layout of Existing Site


CAD PRODUCED DRAWING
PRODUIT PAR DAO
BUNKER
CONCRETE SLAB
EASTLINK LEASE BOUNDARY
EASTLINK TOWER
VHF TOWER
EQUIPEMENT BUILDING
CONCRETE SLAB
CHEBUCTOU HEAD LIGHTHOUSE
RADAR TOWER
PP
CONCRETE SLAB
FOG HORN
GEO TECH #2
GEO TECH #1
PP
PP
CONCRETE SLAB
DRIVEWAY
Fisheries and Oceans Canada
Pêches et Océans Canada
Canadian Coast Guard
Garde côtière Canadienne
SITE LOCATION
LEGEND
NOTES
VHF Tower
Radar Tower
Lighthouse
Eastlink Tower
UTM Zone 20
Elevation of Top of Tower
Height of Tower
CHEBUCTOU HEAD MCTS SITE
T1221
SITE PLAN
K. LEVY
K. LEVY
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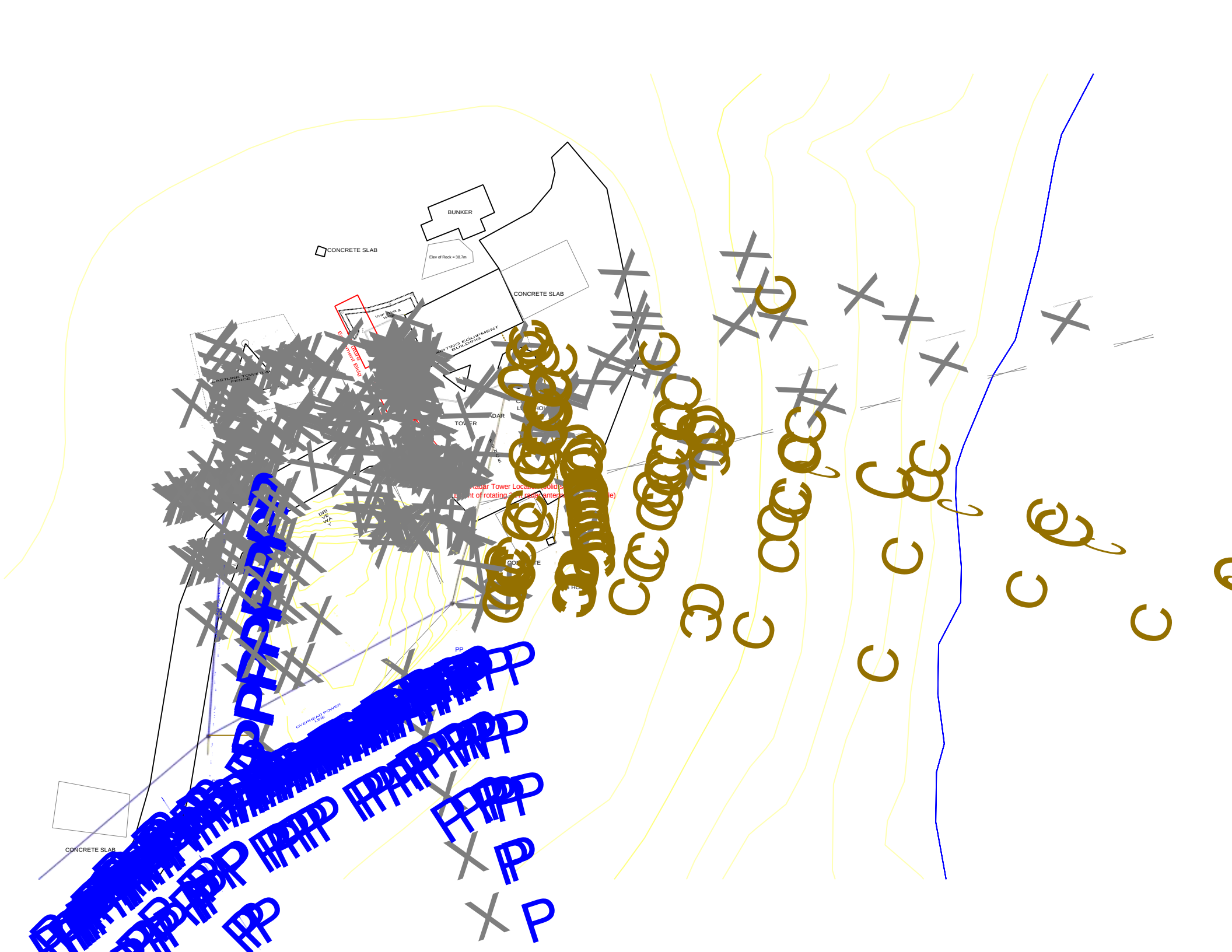
1/1
0
Arch D

Appendix C

Proposed Site Layout


BUNKER
CONCRETE SLAB
Elev of Rock = 38.7m
CONCRETE SLAB
EXISTING EQUIPMENT BUILDING
CASTLINE TOWER & FENCE
TOWER
DRIVEWAY
OVERHEAD POWER LINE
CONCRETE SLAB
PP

Appendix D

Site Photos

	Aerial view of site looking from southeast.
	Overhead view of site from Google Earth. Scale approximate. Red star marks location of planned new radar tower
	View of site looking north. From left to right: CCG VHF Tower, Equipment Building, Radar Tower and Lighthouse. Red outline indicates planned location of new radar tower. Red outline is a square 6m x 6m.

	Close up view of site looking north. From left to right: CCG VHF Tower, Equipment Building and one leg of Radar Tower. Red outline indicates planned location of new radar tower. Red outline is a square 6m x 6m.
	Wide view of site looking north. From left to right, Eastlink Tower, CCG VHF Tower, Equipment Building, Radar Tower and Lighthouse.
	View of site looking south from within fenced compound of Equipment Building. Planned location of new Radar Tower in central area of picture.

	View of site looking west towards driveway. Note overhead power and communication lines. Eastlink Tower, CCG VHF Tower and Radar Tower on right side of picture.
	View of site parking area looking southwest. Note overhead power and communication lines. Foghorn on left side of picture and edge of Lighthouse on right side of picture.
	View of site parking area looking north. Lighthouse and Equipment Building on left side of picture, large concrete slab in center of picture.

	View of site from north side looking south. From left to right: Lighthouse, Equipment Building, Radar Tower, CCG VHF Tower and Eastlink Tower.
	View of driveway into site looking northwest. Eastlink Tower on right side of picture. Note overhead power and communication lines.
	View of road into site looking north. Eastlink Tower, CCG VHF Tower, Radar Tower and Lighthouse on right side of picture. Note overhead power and communication lines.

Appendix E

Radar Antenna Unit Loading Requirements

Appendix E

New Radar Scanner Unit

Mechanical & Serviceability Specifications

Maximum Loads in Operational & Survival Modes
(measured at bottom surface of pedestal)

Condition	Load	Value
	Weight (kg)	400
Max	Downward vertical force (N)	23,320
Max	Upward vertical force (N)	20,846
Operational	Cyclic downward vertical force (N)	15,363
Operational	Cyclic upward vertical force (N)	9,867
Survival	Horizontal force (N)	14,130
Operational	Cyclic horizontal force (N)	4,890
Survival	Overturning moment (N m)	10,865
Operational	Cyclic overturning moment (N m)	5,390
Max	Starting torque (N m)	1,930
Operational	Cyclic torque (N m)	1,645

Survival values at wind speed of 75 m/s with antenna free rotating.

Antenna rotates 20 to 60 RPM in operational mode.
Frequency of cyclic load in operational mode is 0.66 to 2 Hz.

Weight of antenna included.

Load safety factor of 1.5 included. (Naturally occurring loads – Eurocode)

Serviceability Requirement: Maximum torsion (twist) of scanner unit about vertical axis in operational mode is 0.10 degrees. Maximum tilt not specified.

1. All dimensions are typical
2. denotes centre of gravity
3. Lifting method, see page 5
4. Varianttable, see page 2

D

315

410

1100

C

NOTE 3

NOTE 3

1110

6560

712

56

WAVEGUIDE FLANGE
154 IEC PBR 100

B

SWING RADIUS:
3280

637

A

MATERIAL
-

GENERAL TOLERANCE

CHANGE ORDER/REVISION

REVISION	J	J1	H	H1	H2
CO NO.	73984	74125	67324	69179	72733
APVD	MDN	MDN	JGN	JONP	JONP
CM					

PREP MSI
APVD CAK
DATE OF INITIAL 040526

CHKD KHA
CM
DATE OF THIS 2018-10-05

Terma A/S
Hovmarken 4
DK-8520 Lystrup
Denmark

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PROJECTION

REVISION STATUS OF PAGES (OTHER THAN)

PAGE NO.

REVISION

RELEASE

TITLE

RELEASE

Antenna System, 21', HG

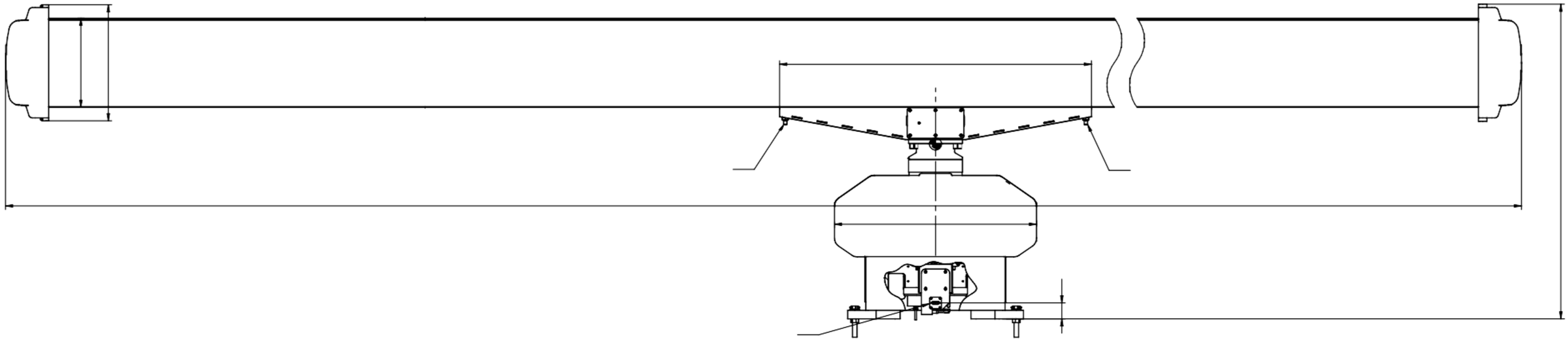
Cage Code R0567

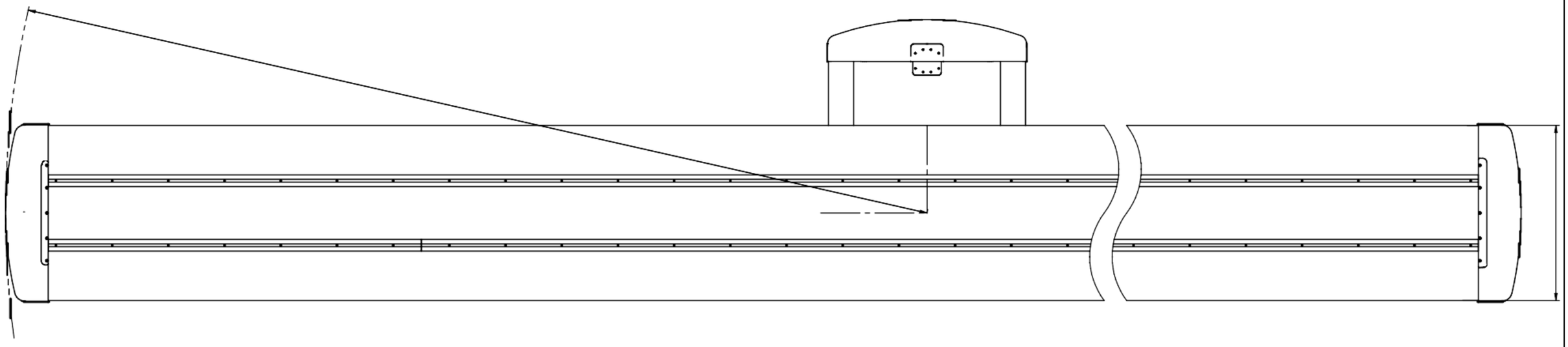
DOCUMENT NO.

259460-ZD

REV J1

PAGE 1 OF 7

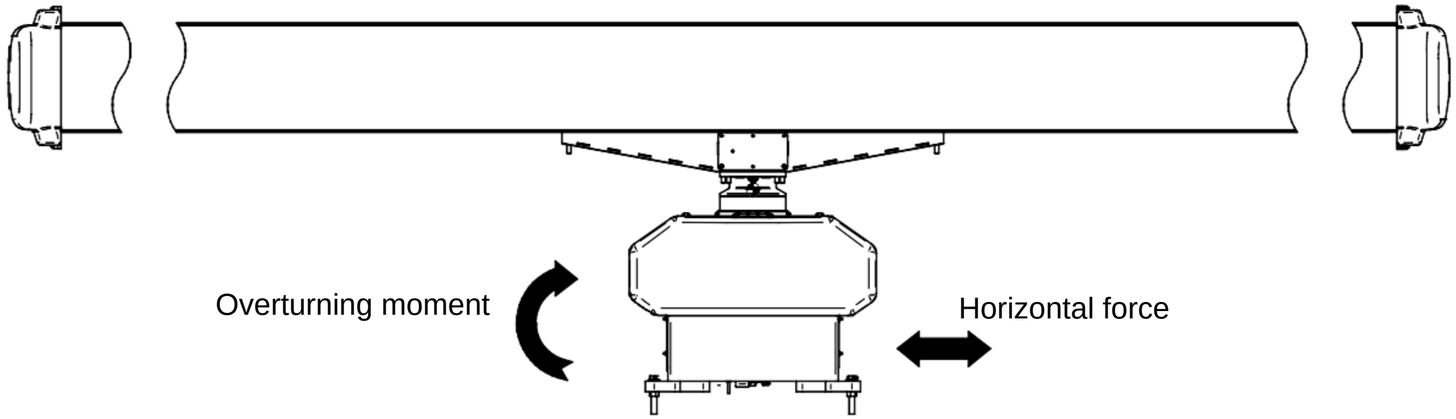


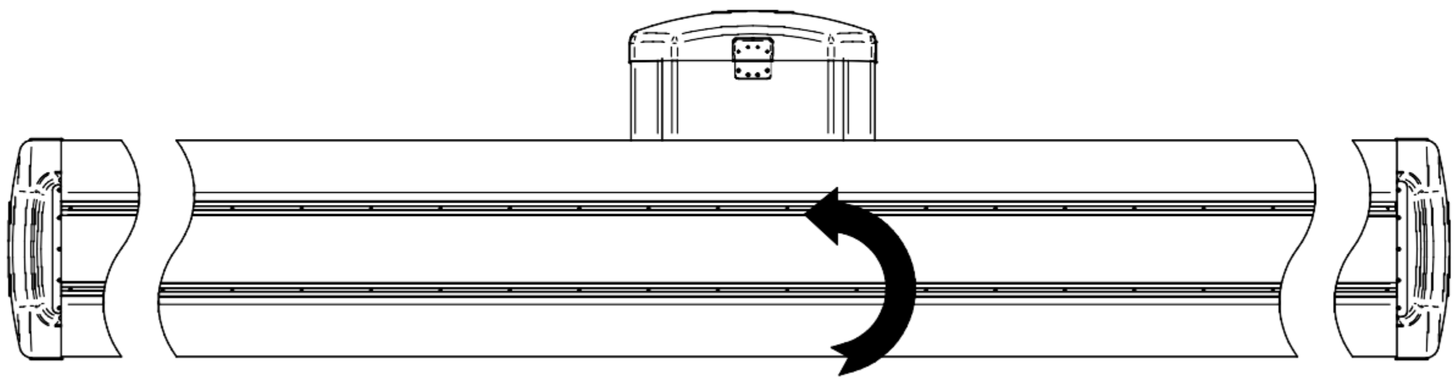


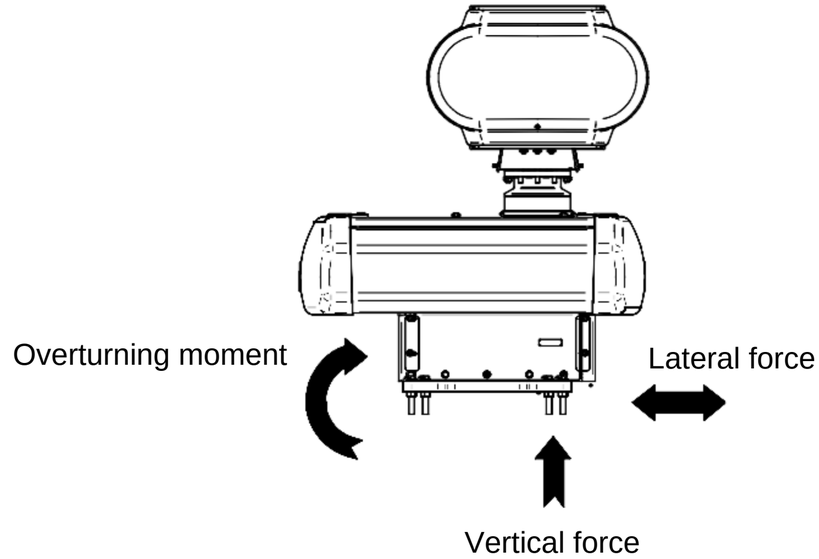
TERMA

TABLE 2							
Loads 21' HG antenna							
Motor	**Variant**	**Load**	**Reference**	**Condition**	**Unit**	**Value**	**Frequency (Hz) of load (between 20 to 60 RPM)**
2.2kW and 4.0 kW	21'HG	Starting torque	Axis of rotation	Max	Nm	1930	-
		Cyclic torque	Axis of rotation	Max, operational	Nm	1645	0.66 to 2
		Cyclic horizontal force	Bottom surface of pedestal	Max, operational	N	4890	0.66 to 2
		Cyclic vertical force	Bottom surface of pedestal	Max / min operational	N	+9867 / -15363	0.66 to 2
		Cyclic overturning moment	Bottom surface of pedestal	Max, operational	Nm	5390	0.66 to 2
		Horizontal force	Bottom surface of pedestal	Survival, Free rotating	N	14130	-
		Overturning moment	Bottom surface of pedestal	Survival, Free rotating	Nm	10865	-
		Vertical force	Bottom surface of pedestal	Max +/-	N	+20846 / -23320	-

Operational values are max values
Survival values at wind speed of 75m/s and antenna stopped
All loads are at bottom surface
Weigth of antenna included
Load safety factor of 1.5 included (Naturally occurring loads - Eurocode)







TITLE	DOCUMENT NO.	REV	
Antenna System, 21', HG	259460-ZD	J1	

D

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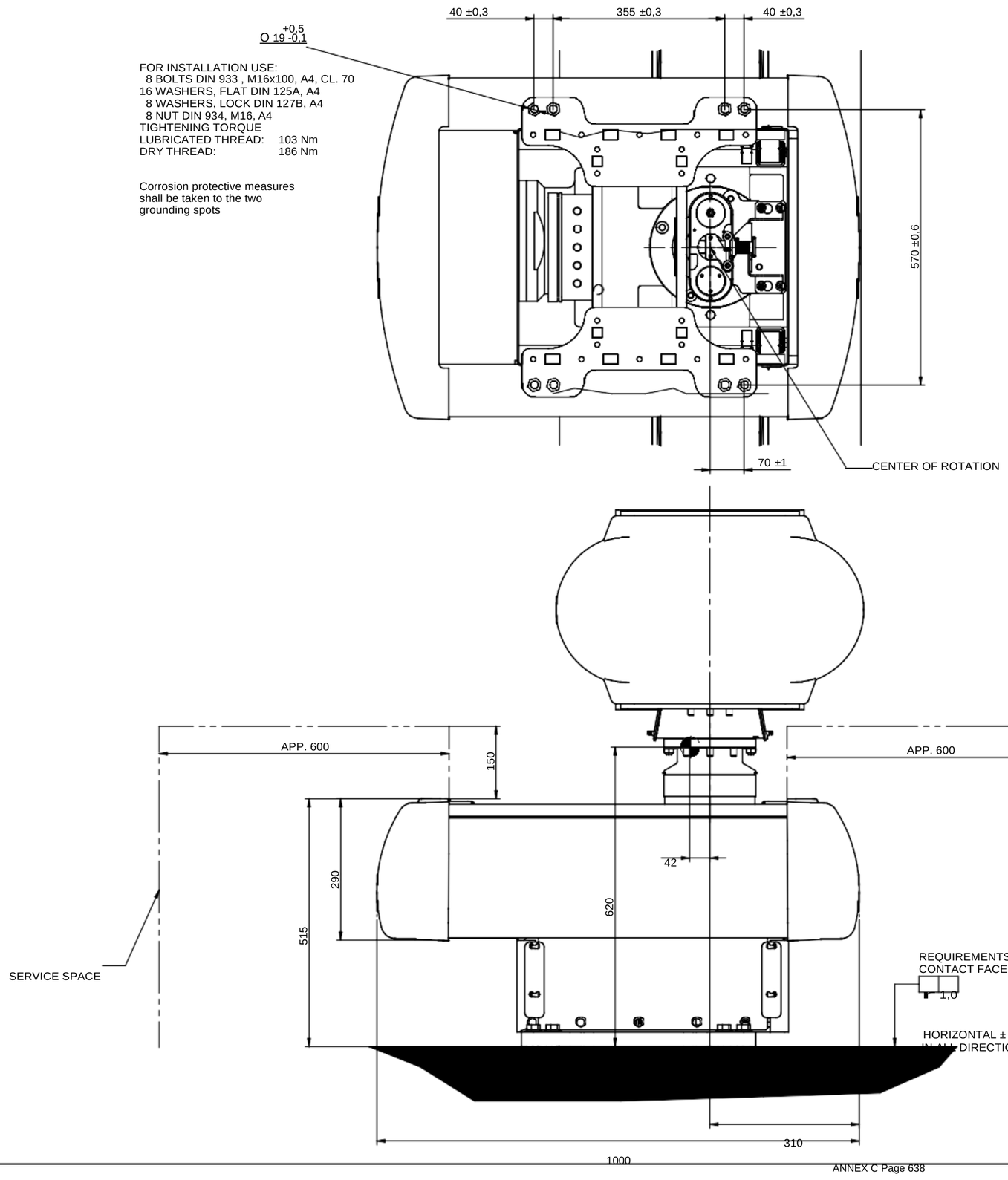


FOR INSTALLATION USE:
8 BOLTS DIN 933 , M16x100, A4, CL. 70
16 WASHERS, FLAT DIN 125A, A4
8 WASHERS, LOCK DIN 127B, A4
8 NUT DIN 934, M16, A4
TIGHTENING TORQUE
LUBRICATED THREAD: 103 Nm
DRY THREAD: 186 Nm

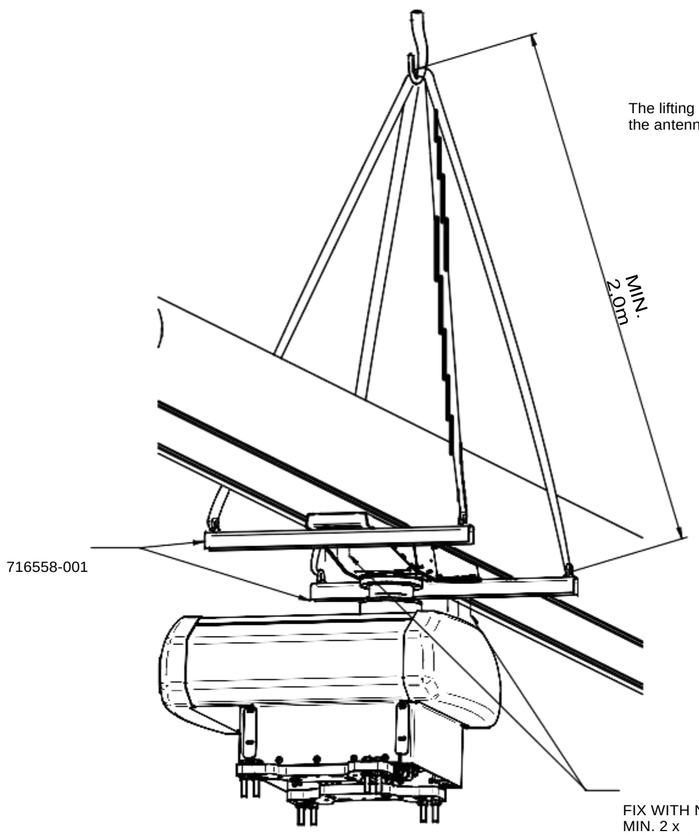
Corrosion protective measures
shall be taken to the two
grounding spots

Mounting interface materials and fasteners shall be, galvanically, compatible
with aluminium (recommended potential diff. < 0,25V).
If this is not possible, proper isolation and coating/surface treatment
of critical areas must be performed.
Stainless steel fasteners are acceptable.

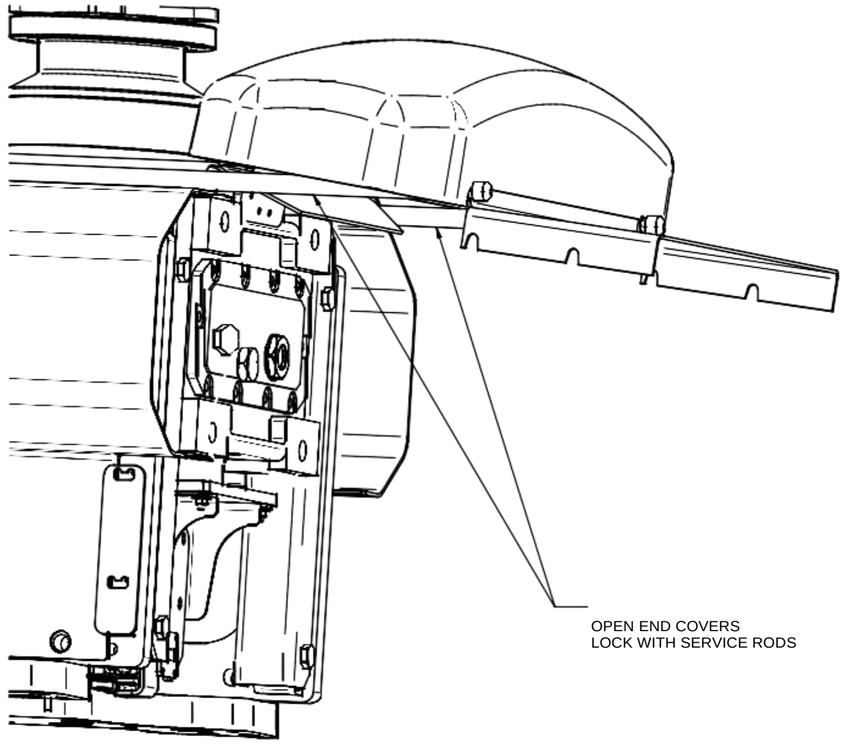
Lifting Instruction for
variant -931 see page 6

LIFTING INSTRUCTIONS

- USE LIFTINGYOKES
  TERMA PART NO.:716558-001
- MOUNT LIFTING YOKES AS
  SHOWN, AND FASTEN WITH NUTS
- MINIMUM SLING LENGTH: 2,0m
- REMOVE LIFTING YOKES
  AFTER MOUNTING ANTENNA
- HANDBOOK DOC. 716558-HC



SERVICE



TITLE Antenna System, 21', HG

D
O

4 Product characteristics

4.1 Physical appearance

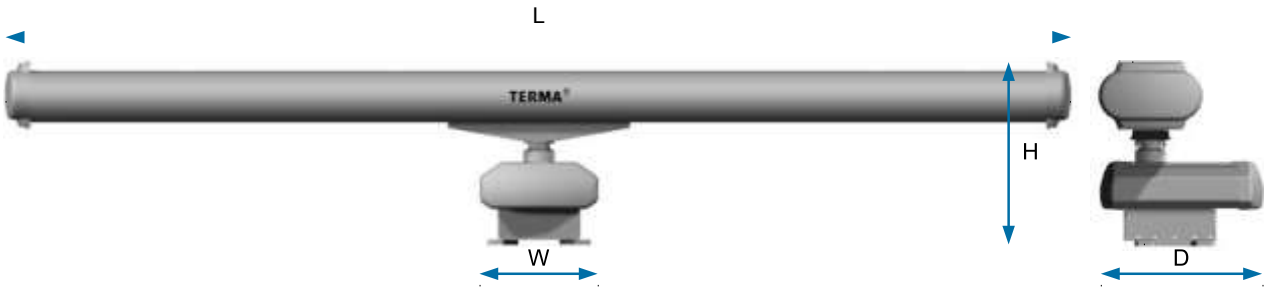


Figure 4.1 Mechanical dimensions

Table 4.1 Mechanical specifications

Mechanical construction	
Color	Silver grey RAL 7001 / White RAL 9010 (opt.) / Orange RAL 2009 (opt.)
Weight	Approx 400 kg
H x L x W x D (Height x Lenght x Width x Depth)	1110 x 6560 x 712 x 1000 mm
Swing radius	3300 mm

Packed for transport	
Weight incl. wooden crate	Approx 850 kg
H x L x D (Height x Lenght x Depth)	Approx 1560 x 6820 x 880 mm

Figure 4.2 Wooden transport crate

4.5 Turning Unit

The *Turning unit* includes the asynchronous motor, the gearbox, the encoder assembly and the terminal box. The encoder assembly consists of a rotary joint and up to two azimuth encoders (2nd redundant encoder is optional). Two encoders are standard on SMR antennas.

Figure 4.6 Turning unit

5 Interfaces

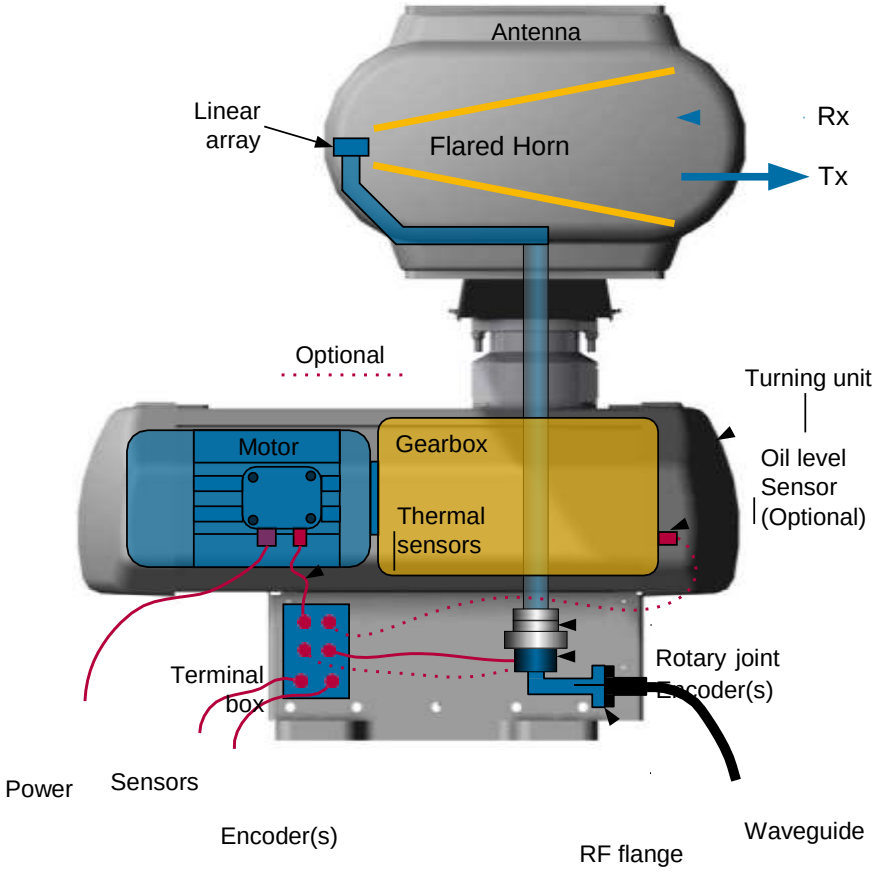


Figure 5.1 Schematic Interfaces

7 System considerations

7.1 Supporting structures

The tower requirements depend on the desired accuracy of the radar performance.

The load/forces from the antenna system can be found in doc. no. 259460-ZD.

Bending

Bending of the tower is normally insignificant to affect radar performance.

Azimuth torsion

In the azimuth direction, torsion will result in azimuth errors.

The azimuth error is calculated as follows:

$$Azimuth\ error\ [m] = \frac{2\pi}{360} R\varphi$$

Where R is the target distance in meters, and φ is the torsion angle in degrees.

Example: With a torsion angle of 0.2º, a target at a distance of 40 km gives an azimuth error of 140 m.

As a rule of thumb, the torsion must be below ¼ of the horizontal antenna beam width, in normal operational weather conditions. Most trackers will accept this.

Accuracy requirements may call for less tolerance.

Tilting

In stationary radar systems, the tilt of the platform on which the antenna is mounted, should be below 0.5º.

The picture shows a self-supporting conically shaped three-leg steel lattice tubular tower, which is excellent for radar antennas.

The antenna base plate may be mounted on a steel pedestal or directly on the tower construction.

Figure 7.1 Three-legged lattice tower

7.2 Lightning protection and grounding

The antenna system must be properly protected against lightning. 99% of all damage caused by lightning occurs due to overvoltage induced in the power supply and distributed to other parts of the system. To accommodate this problem, it is recommended to add surge arrestors to power supplies and galvanic connections penetrating the equipment cabins. The optimum solution is that the power supply is the only galvanic connection from the exterior and using fiber optic cables for all signal connections.

Figure 7.2 shows the recommended solution for lightning protection and grounding. If a lightning strikes the radar antenna mast, experience shows that it is extremely difficult to secure the high-energy power flow. If the lightning attractor rod(s) is isolated, it is imperative that the impedance for earth is smaller than for other paths; that is, there may be >100 kV potential at the top of the lightning conductor(s) and 0 V immediately next to it via the signal cables. In this situation, the energy is able to “jump”, causing serious problems.

In summary, the idea is to connect the system as effectively as possible to ensure that all components have the same potential in the event that lightning strikes and a Faraday’s cage must be established around the equipment cabin.

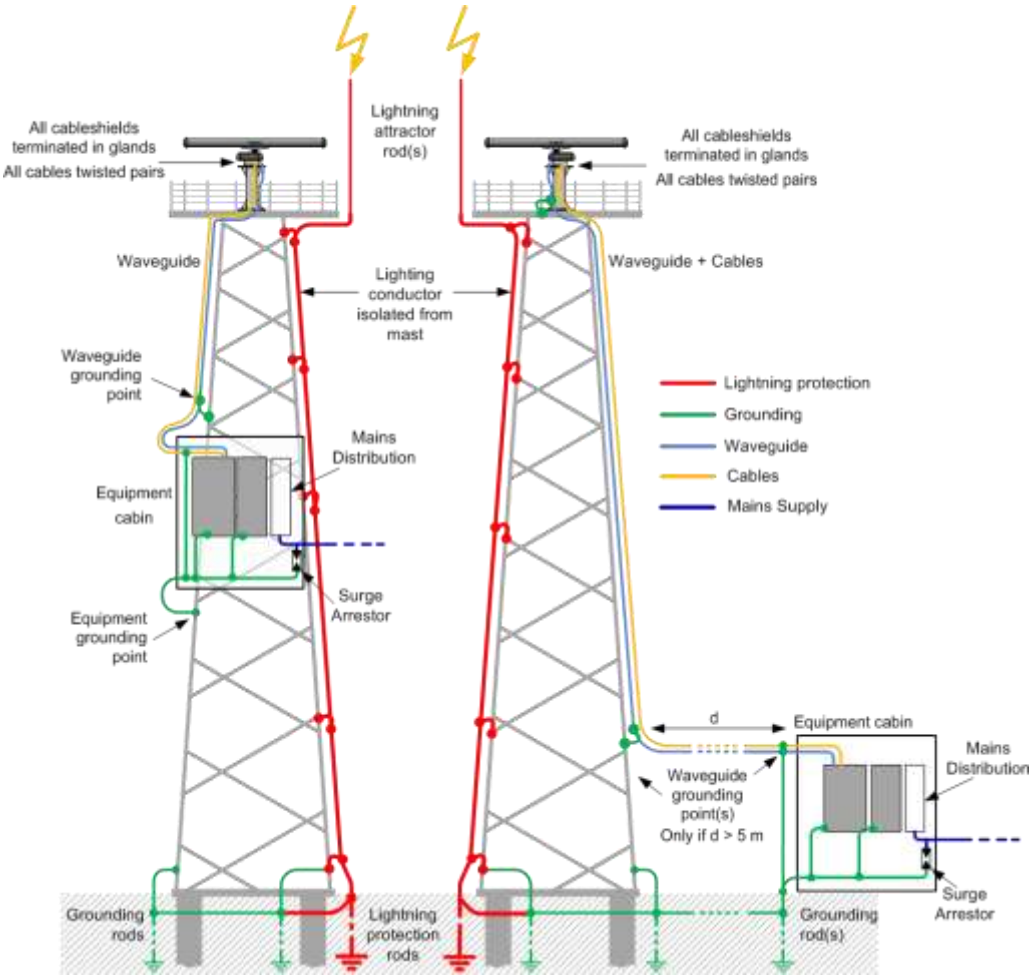
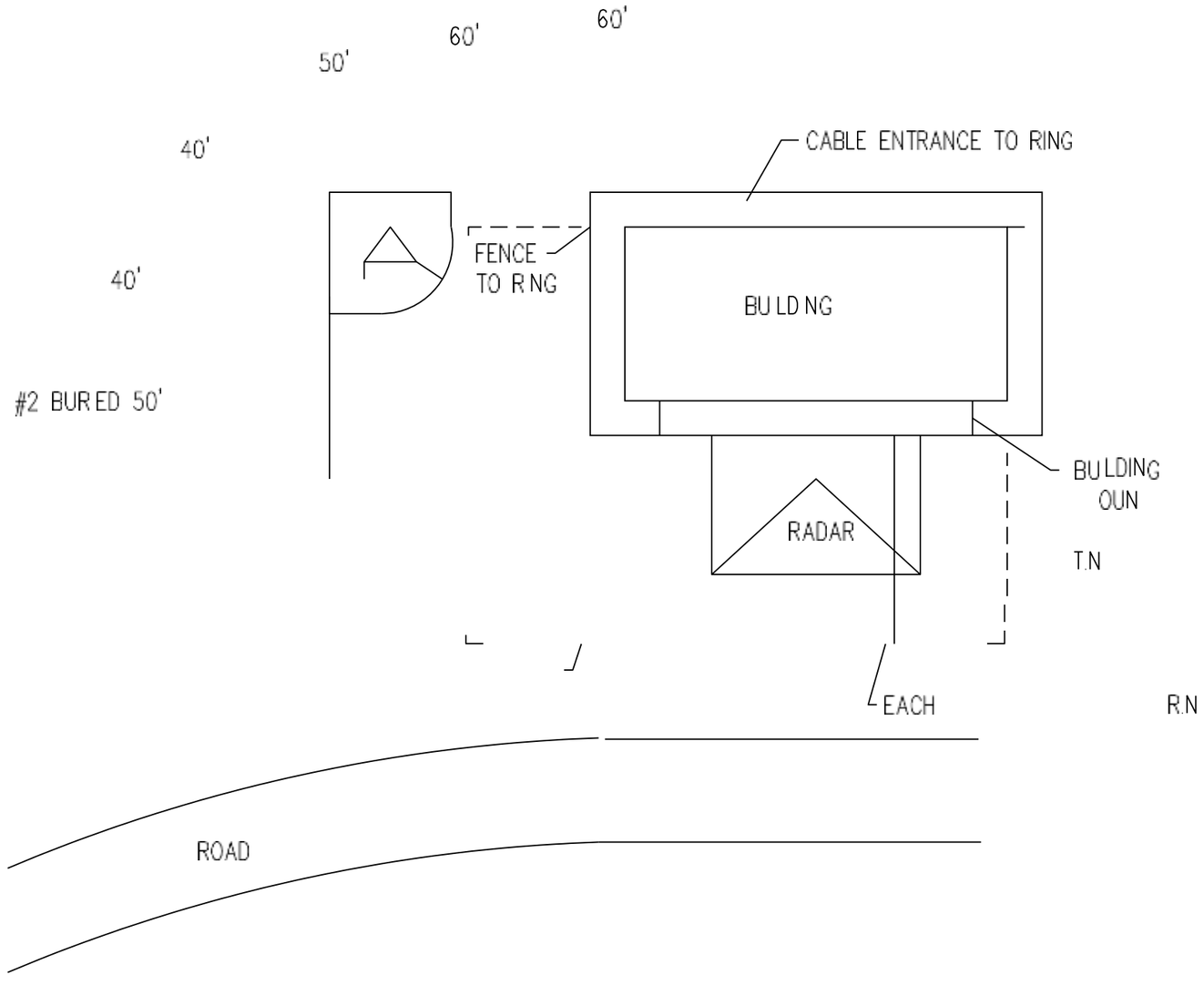


Figure 7.2 Lightning protection and grounding solution

Appendix F

Grounding Layout of Existing Site



A		ORIGINAL ISSUE			
NO.	LOC.	REVISION	DATE:	BY:	APPR.

CANADIAN COAST GUARD DEPARTMENT OF FISHERIES & OCEANS

Technical Support Service

Telecommunication & Electronic Workshop

CHEBUCTO HEAD, N.S.

TOWER GROUNDS

DETAILS

DATE:	DRAWN:	CHECKED	APPR.
OCT.19/05	J.M. MUISE		

SCALE:	REFERENCE:		DRAWING #:	SHT.
			MM092-302-DE	1 of 1

Appendix G

Wind Data

Chebucto Head, NS 36m Tower

Site-Specific 10-yr. Wind Pressure Report (V2.1 2016-01-04 Format)

Site Information:

Name: Chebucto Head, NS
Latitude: 44° 30' 27" N
Longitude: 63° 31' 23" W
Tower Height (m): 36
Elevation MSL (m): 20

Results:

Note: Following direction from the S37 Committee, Qe can no longer be provided.

Q_{nbc} (Pa):	430	$Q_{nbc} = 430(Z/10)^{0.2}$	V_{nbc} = 57.69 mph
Icing:	As per CAN/CSA S37-13		
Q_{Min} (Pa)	250	$Q_{Min} = 250(Z/10)^{0.2}$	V_{Min} = 43.99 mph

Wind Pressure Formula (for z in metres and result in Pa):

For Z ≤ 16.5 metres: $Q_h = 0.12919 \{[0.2667 e^{(-0.0417 z)} + 1.1357 \ln(z/0.1000) / \ln(z/0.0500)] 57.90\}^2 (z/10)^{0.200}$

For Z > 16.5 metres: $Q_h = 0.12919 \{[1 + 0.2667 e^{(-0.0417 z)}] 57.90\}^2 (z/10)^{0.200}$

Profile Formula General Form:

$$Q_h = 0.12919 \{[a_1 e^{(-a2 z)} + a_3 \ln(z/z_h) / \ln(z/z_{01})] v_{01}\}^2 (z/10)^{0.200}$$

Site Values of Coefficients:

For Z ≤ 16.5 metres: $a_1 = 0.2667, a_2 = 0.0417, a_3 = 1.1357, z_h = 0.1000, z_{01} = 0.0500, v_{01} = 57.90$ mph

For Z > 16.5 metres: $a_1 = 0.2667, a_2 = 0.0417, a_3 = 1.0000, z_h = 0.0500, z_{01} = 0.0500, v_{01} = 57.90$ mph

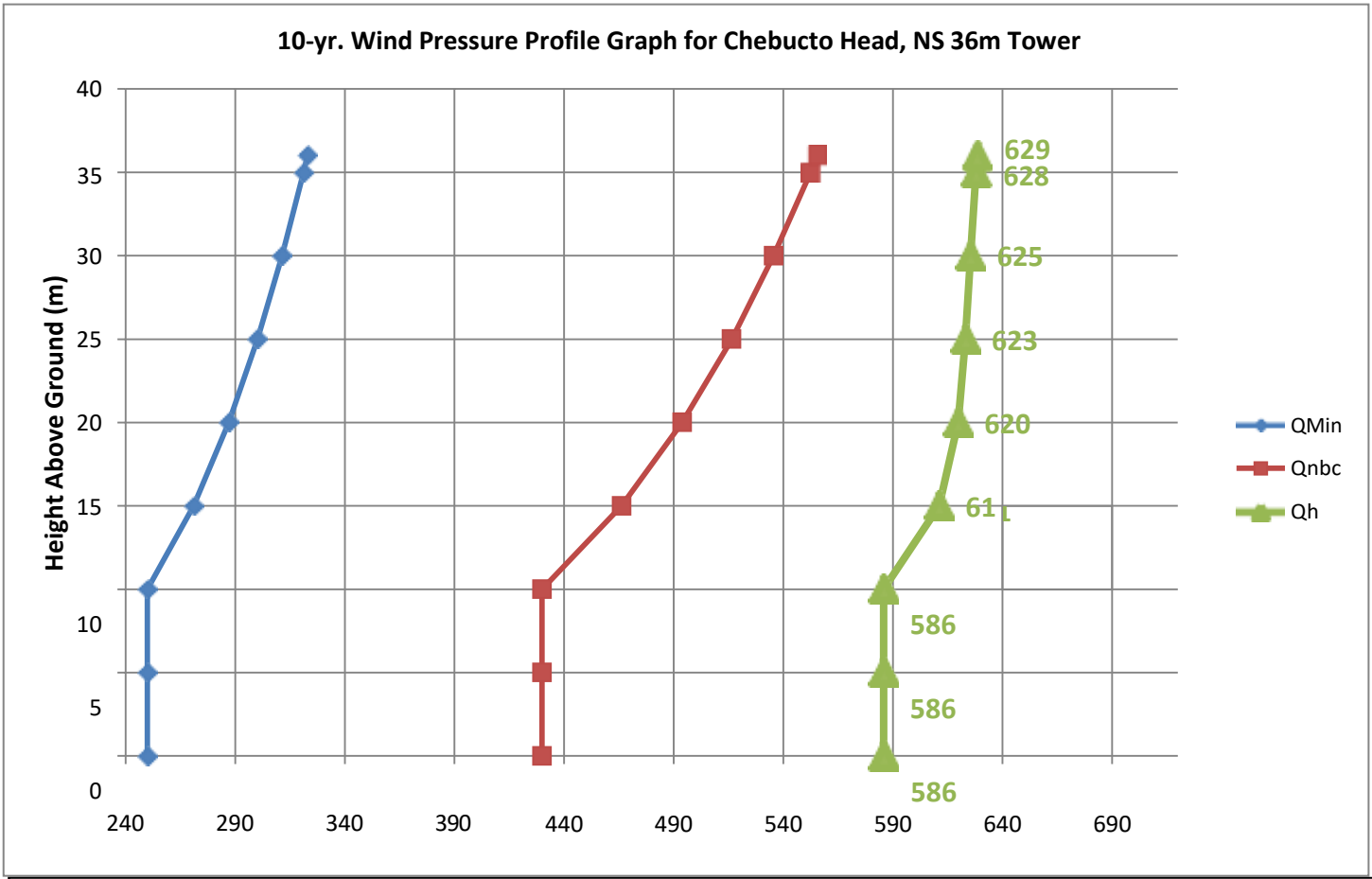
Definitions

Tower Height: Height of the tower from ground level at the base of the tower to the top of the structure.
Q_{nbc}: Regionally representative reference wind pressure at 10 m in the format of the National Building Code of Canada and the Q_{nbc} value is profiled with the $^2/_{10}$ power law.
Q_{Min}: Minimum reference wind pressure (320 Pa, 300 Pa, and 250 Pa for the 50-year, 30-year, and 10-year return periods respectively) profiled with the $^2/_{10}$ power law as per Section 5.4.1 of S37-13.

Wind Pressure Formula: Formula for the design wind pressure as a function of height. (Ref.: S37-13, 5.3.1)
Height (Z): the vertical distance (m) above ground level at the base of the tower.

Note: No wind pressure value less than 90% of the value at 10 m should be used for heights less than 10 m a.g.l.

These wind pressures were evaluated using a version of the methods described by Taylor and Lee (1984) "Simple Guidelines for Estimating Wind Speed Variations Due to Small Scale Topographic Features", Climatological Bulletin 18 2, using the Boyd (1969) analysis of thirty year return period wind speeds (which is also used for the National Building Code of Canada), modified by a technique described by Wieringa (1980) "Representativeness of Wind Observations at Airports" Bulletin of the American Meteorological Society, 61 9, as input data. The uncertainty in NBCC regionally representative reference wind pressures is about [+15%,-15%].



$\underline{Q_{nbc}}$ Profile: Regionally representative reference wind profiled with the $^2/_{10}$ power law.
$\underline{Q_{Min}}$ Profile: Minimum site-specific wind pressure (320 Pa, 300 Pa, and 250 Pa for the 50-year, 30-year, and 10-year return periods respectively) profiled with the $^2/_{10}$ power law.
Q_h Profile: The site-specific wind pressure profile directly from the Taylor and Lee (1984) simple guidelines.

Explanatory notes regarding the new report format and changes to calculation methods.

1. The most significant change from the previous versions of the reports is that the exponent used in the Q_h equation is no longer fixed at 0.2. The exponent now varies continuously from 0.2 for open terrain to 0.32 for closed terrain.
2. A new Q_{min} profile has been added to the graphs and it represents the minimum acceptable reference wind pressure profile. It starts with the minimum 10-metre reference wind pressure of 320 Pa for a 50-year return period as per section 5.4.1 of S37-13 and then uses the same $^2/_{10}$ power law formulation as the Q_{NBC} profile to generate the curve. The corresponding 10-metre reference wind pressures for the 10-year and 30-year return periods are 250 Pa and 300 Pa respectively.
3. Q_h will always be plotted even when they are less than Q_{Min}. This will allow designers to see how Q_h varies over the height of the tower. Also, in rough terrain and for taller towers, the Q_h profile might cross the Q_{Min} profile.
4. The coefficients for the Q_h equation will now always be given regardless of the Q_{NBC} or Q_{Min} values.
5. The wind speeds will be given for each of the 4 equations (Q_h, Q_{NBC}, or Q_{Min}) too.

Chebucto Head, NS 36m Tower

Site-Specific 30-yr. Wind Pressure Report (V2.1 2016-01-04 Format)

Site Information:

Name: Chebucto Head, NS
Latitude: 44° 30' 27" N
Longitude: 63° 31' 23" W
Tower Height (m): 36
Elevation MSL (m): 20

Results:

Note: Following direction from the S37 Committee, Qe can no longer be provided.

Q_{nbc} (Pa):	520	$Q_{nbc}=520(Z/10)^{0.2}$	V_{nbc} = 63.44 mph
Icing:	As per CAN/CSA S37-13		
Q_{Min} (Pa)	300	$Q_{Min}=300(Z/10)^{0.2}$	V_{Min} = 48.19 mph

Wind Pressure Formula (for z in metres and result in Pa):

For Z ≤ 16.5 metres: $Q_h = 0.12919\ \{[0.2667\ e^{(-0.0417\ z)} + 1.1357\ ln(z/0.1000) / ln(z/0.0500)]\ 63.36\}^2\ (z/10)^{0.200}$

For Z > 16.5 metres: $Q_h = 0.12919\ \{[1 + 0.2667\ e^{(-0.0417\ z)}]\ 63.36\}^2\ (z/10)^{0.200}$

Profile Formula General Form:

$$Q_h = 0.12919\ \{[a_1\ e^{(-a2\ z)} + a_3\ ln(z/z_h) / ln(z/z_{01})]\ v_{01}\}^2\ (z/10)^{0.200}$$

Site Values of Coefficients:

For Z ≤ 16.5 metres: $a_1 = 0.2667,\ a_2 = 0.0417,\ a_3 = 1.1357,\ z_h = 0.1000,\ z_{01} = 0.0500,\ v_{01} = 63.36$ mph

For Z > 16.5 metres: $a_1 = 0.2667,\ a_2 = 0.0417,\ a_3 = 1.0000,\ z_h = 0.0500,\ z_{01} = 0.0500,\ v_{01} = 63.36$ mph

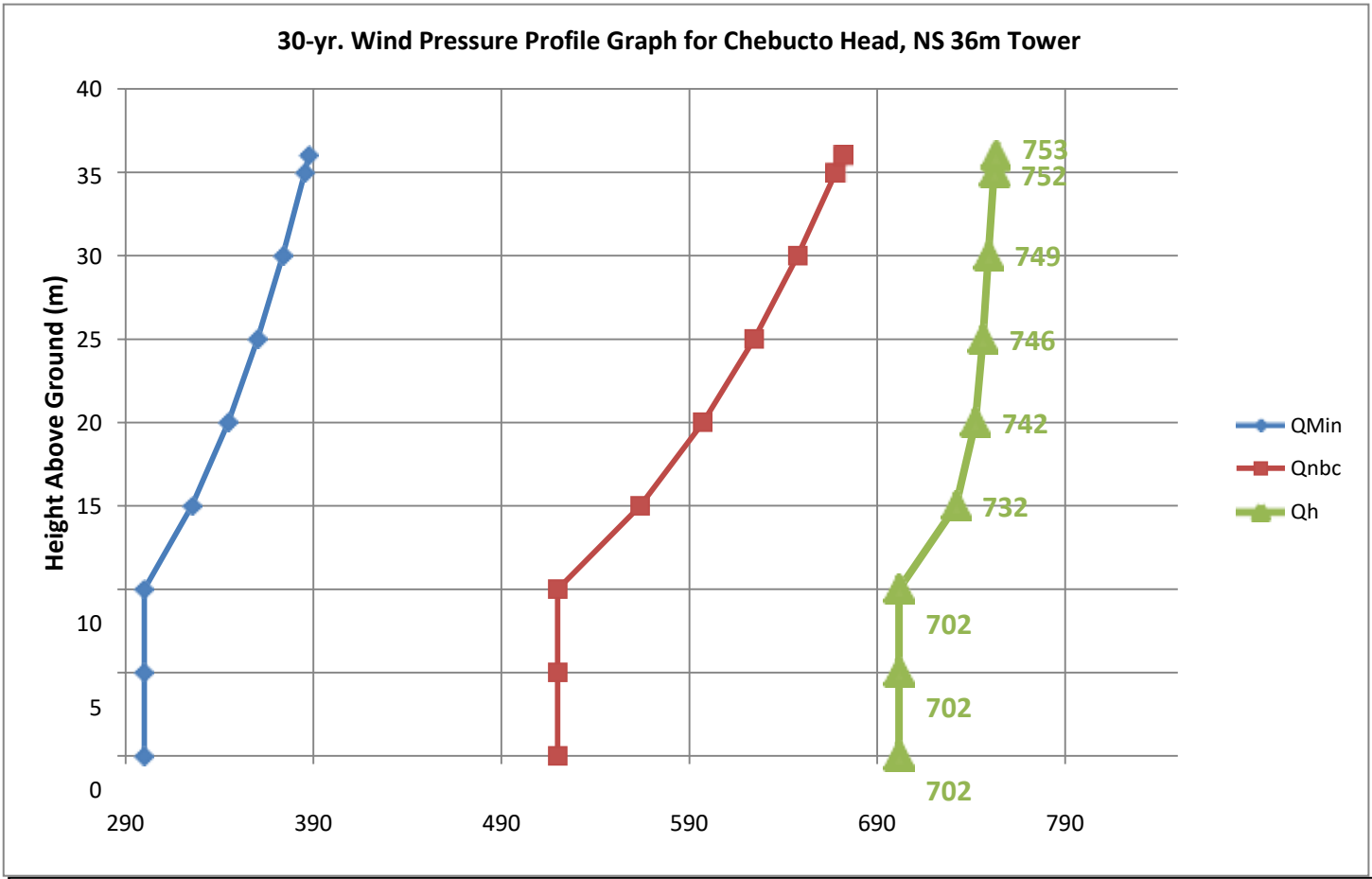
Definitions

Tower Height: Height of the tower from ground level at the base of the tower to the top of the structure.
Q_{nbc}: Regionally representative reference wind pressure at 10 m in the format of the National Building Code of Canada and the Q_{nbc} value is profiled with the $^2/_{10}$ power law.
Q_{Min}: Minimum reference wind pressure (320 Pa, 300 Pa, and 250 Pa for the 50-year, 30-year, and 10-year return periods respectively) profiled with the $^2/_{10}$ power law as per Section 5.4.1 of S37-13.

Wind Pressure Formula: Formula for the design wind pressure as a function of height. (Ref.: S37-13, 5.3.1)
Height (Z): the vertical distance (m) above ground level at the base of the tower.

Note: No wind pressure value less than 90% of the value at 10 m should be used for heights less than 10 m a.g.l.

These wind pressures were evaluated using a version of the methods described by Taylor and Lee (1984) "Simple Guidelines for Estimating Wind Speed Variations Due to Small Scale Topographic Features", Climatological Bulletin 18 2, using the Boyd (1969) analysis of thirty year return period wind speeds (which is also used for the National Building Code of Canada), modified by a technique described by Wieringa (1980) "Representativeness of Wind Observations at Airports" Bulletin of the American Meteorological Society, 61 9, as input data. The uncertainty in NBCC regionally representative reference wind pressures is about [+15%,-15%].



Q_{nbc} Profile: Regionally representative reference wind profiled with the $^2/_{10}$ power law.
Q_{Min} Profile: Minimum site-specific wind pressure (320 Pa, 300 Pa, and 250 Pa for the 50-year, 30-year, and 10-year return periods respectively) profiled with the $^2/_{10}$ power law.
Q_h Profile: The site-specific wind pressure profile directly from the Taylor and Lee (1984) simple guidelines.

Explanatory notes regarding the new report format and changes to calculation methods.

1. The most significant change from the previous versions of the reports is that the exponent used in the Q_h equation is no longer fixed at 0.2. The exponent now varies continuously from 0.2 for open terrain to 0.32 for closed terrain.
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3. Q_h will always be plotted even when they are less than Q_{Min}. This will allow designers to see how Q_h varies over the height of the tower. Also, in rough terrain and for taller towers, the Q_h profile might cross the Q_{Min} profile.
4. The coefficients for the Q_h equation will now always be given regardless of the Q_{NBC} or Q_{Min} values.
5. The wind speeds will be given for each of the 4 equations (Q_h, Q_{NBC}, or Q_{Min}) too.

Chebucto Head, NS 36m Tower

Site-Specific 50-yr. Wind Pressure Report (V2.1 2016-01-04 Format)

Site Information:

Name: Chebucto Head, NS
Latitude: 44° 30' 27" N
Longitude: 63° 31' 23" W
Tower Height (m): 36
Elevation MSL (m): 20

Results:

Note: Following direction from the S37 Committee, Qe can no longer be provided.

Q_{nbc} (Pa):	560	$Q_{nbc}=560(Z/10)^{0.2}$	V_{nbc} = 65.84 mph
Icing:	As per CAN/CSA S37-13		
Q_{Min} (Pa)	320	$Q_{Min} = 320(Z/10)^{0.2}$	V_{Min} = 49.77 mph

Wind Pressure Formula (for z in metres and result in Pa):

For Z ≤ 16.5 metres: $Q_h = 0.12919 \{[0.2667 e^{(-0.0417 z)} + 1.1357 \ln(z/0.1000) / \ln(z/0.0500)] 65.87\}^2 (z/10)^{0.200}$

For Z > 16.5 metres: $Q_h = 0.12919 \{[1 + 0.2667 e^{(-0.0417 z)}] 65.87\}^2 (z/10)^{0.200}$

Profile Formula General Form:

$$Q_h = 0.12919 \{[a_1 e^{(-a2 z)} + a_3 \ln(z/z_h) / \ln(z/z_{01})] v_{01}\}^2 (z/10)^{0.200}$$

Site Values of Coefficients:

For Z ≤ 16.5 metres: $a_1 = 0.2667, a_2 = 0.0417, a_3 = 1.1357, z_h = 0.1000, z_{01} = 0.0500, v_{01} = 65.87$ mph

For Z > 16.5 metres: $a_1 = 0.2667, a_2 = 0.0417, a_3 = 1.0000, z_h = 0.0500, z_{01} = 0.0500, v_{01} = 65.87$ mph

Definitions

Tower Height: Height of the tower from ground level at the base of the tower to the top of the structure.
Q_{nbc}: Regionally representative reference wind pressure at 10 m in the format of the National Building Code of Canada and the Q_{nbc} value is profiled with the $^2/_{10}$ power law.
Q_{Min}: Minimum reference wind pressure (320 Pa, 300 Pa, and 250 Pa for the 50-year, 30-year, and 10-year return periods respectively) profiled with the $^2/_{10}$ power law as per Section 5.4.1 of S37-13.

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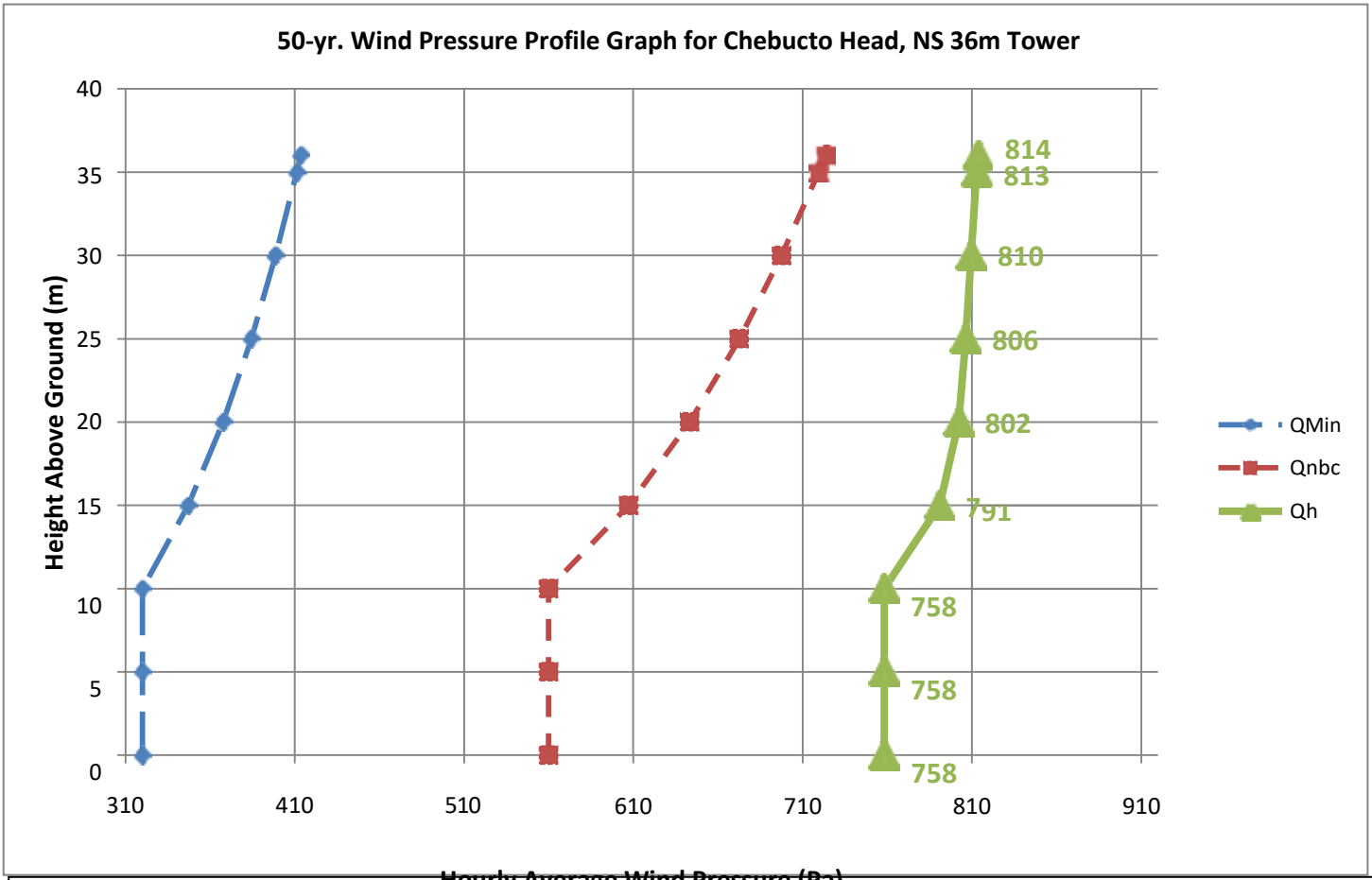
These wind pressures were evaluated using a version of the methods described by Taylor and Lee (1984) "Simple Guidelines for Estimating Wind Speed Variations Due to Small Scale Topographic Features", Climatological Bulletin 18 2, using the Boyd (1969) analysis of thirty year return period wind speeds (which is also used for the National Building Code of Canada), modified by a technique described by Wieringa (1980) "Representativeness of Wind Observations at Airports" Bulletin of the American Meteorological Society, 61 9, as input data. The uncertainty in NBCC regionally representative reference wind pressures is about [+15%,-15%].



Q_{nbc} Profile: Regionally representative reference wind profiled with the $^2/_{10}$ power law.
Q_{Min} Profile: Minimum site-specific wind pressure (320 Pa, 300 Pa, and 250 Pa for the 50-year, 30-year, and 10-year return periods respectively) profiled with the $^2/_{10}$ power law.
Q_h Profile: The site-specific wind pressure profile directly from the Taylor and Lee (1984) simple guidelines.

Explanatory notes regarding the new report format and changes to calculation methods.

1. The most significant change from the previous versions of the reports is that the exponent used in the Q_h equation is no longer fixed at 0.2. The exponent now varies continuously from 0.2 for open terrain to 0.32 for closed terrain.
2. A new Q_{min} profile has been added to the graphs and it represents the minimum acceptable reference wind pressure profile. It starts with the minimum 10-metre reference wind pressure of 320 Pa for a 50-year return period as per section 5.4.1 of S37-13 and then uses the same $^2/_{10}$ power law formulation as the Q_{NBC} profile to generate the curve. The corresponding 10-metre reference wind pressures for the 10-year and 30-year return periods are 250 Pa and 300 Pa respectively.
3. Q_h will always be plotted even when they are less than Q_{Min}. This will allow designers to see how Q_h varies over the height of the tower. Also, in rough terrain and for taller towers, the Q_h profile might cross the Q_{Min} profile.
4. The coefficients for the Q_h equation will now always be given regardless of the Q_{NBC} or Q_{Min} values.
5. The wind speeds will be given for each of the 4 equations (Q_h, Q_{NBC}, or Q_{Min}) too.

Appendix H

Geotechnical Report

Stantec Consulting Ltd.
102-40 Highfield Park Drive, Dartmouth NS B3A 0A3

May 22, 2018
File: 121621787

Reference: Proposed New Communication Tower - Project F6839-175605
Chebucto Head Lighthouse, Duncan's Cove, Nova Scotia
Geotechnical Investigation Report

INTRODUCTION

As requested, Stantec Consulting Ltd. has conducted a geotechnical investigation in support of the proposed communication tower noted above. Our work consisted of logging two boreholes near the planned tower base location and preparation of this report. This report contains all our findings and recommendations for site preparation, foundation design, and applicable rock engineering parameters. The work was conducted in accordance with our proposal of February 2, 2018.

SITE DESCRIPTION

The planned location of the new tower is the Canadian Coast Guard facility at Chebucto Head Road, Duncan's Cove, Nova Scotia. The facility and planned tower site are situated at the end of the road. The facility currently consists of multiple communication towers, a lighthouse, and an operations building.

The planned new tower location is southwest of the operations building/lighthouse. At the time we were on site, the tower location was clear of trees. Based on geological mapping, the site is situated over granitic bedrock of the Liscomb Complex, and overburden consists of a thin sandy till veneer.

FIELD PROCEDURES

The field program was conducted on March 29, 2018 and consisted of two boreholes, BH1 and BH2, near the tower base, supervised and logged by experienced Stantec geotechnical personnel. Detailed records of the conditions encountered, and samples obtained are attached.

The boreholes were put down at locations selected by Canadian Coast Guard personnel. The borehole locations were surveyed by Stantec personnel referencing site features.

SUBSURFACE CONDITIONS

The subsurface conditions encountered in the boreholes are described in detail on the borehole records and are summarized in the following paragraphs. All soil descriptions are in accordance with ASTM D-2487 and D-2488, using the Unified Soil Classification system.

Reference: Proposed New Communication Tower - Project F6839-175605
Chebucto Head Lighthouse, Duncan's Cove, Nova Scotia
Geotechnical Investigation Report

A layer of rootmat and topsoil, 0.2 metres thick, was encountered at the surface of both boreholes. At borehole BH02, the topsoil/rootmat was underlain by a 1 metre thick layer of brown silty clayey sand with gravel. Bedrock was encountered beneath the topsoil at borehole BH01and beneath the silty sand at BH02. The bedrock consisted of slightly weathered, fair to very good quality, white to pink granite with RQDs ranging from 40 to 97%.

No groundwater seepage was observed in the boreholes at the time of drilling. Groundwater levels will fluctuate seasonally, in response to precipitation events, and as a result of construction or grading activities.

DISCUSSION AND RECOMMENDATIONS

We currently understand the proposed communication tower will consist of a self-supported structure. Based on information from Canadian Coast Guard personnel and the conditions encountered, we expect the tower will be supported by concrete blocks or piers founded on, and anchored into, bedrock. Recommendations for site preparation and foundation design are provided in the following sections.

The tower foundation preparation will consist of stripping the overburden (rootmat, topsoil, silty clayey sand) down to bedrock, and excavating to the design bearing elevations. Temporary dewatering of excavations may be necessary if groundwater levels, at the time of construction, have risen to above proposed bearing elevations. Surface water should be directed away from excavations by means of diversionary ditches or swales. Bedrock removal will require the use of suitable hydraulic rock breaking equipment and/or blasting.

To provide a level working base for foundation formwork, consideration may be given to placing mudslabs at the foundation pier/block locations.

Spread footings on clean intact bedrock may be designed for a factored geotechnical bearing resistance at ULS of 1,500 kPa; associated settlement would be negligible.

Foundation bases should be provided with a minimum of 1.2 metres of soil cover, or the insulation equivalent, for frost protection. A reduced frost cover could be considered for foundations placed directly on clean intact bedrock, free of all loose fragments and soil seams which typically requires high pressure air/water system to achieve.

Foundation bases should be inspected, prior to formwork installation or concrete placement, by experienced geotechnical personnel to verify the design bearing pressures.

For anchors grouted into the granite bedrock, the upper 1.2 metres of rock should not be included in the calculation of anchor/socket length. We recommend a factored geotechnical resistance (tension) at ultimate limit states (ULS) of 600 kPa, which includes a resistance factor of 0.3, be used for the bond stress between the bedrock and the concrete or grout.

Reference: Proposed New Communication Tower - Project F6839-175605
Chebucto Head Lighthouse, Duncan's Cove, Nova Scotia
Geotechnical Investigation Report

For uplift loading, it will also be necessary to check the total pullout resistance of the anchors. The pullout resistance can be calculated as the weight of rock within a theoretical cone with a 60 degree apex at the bottom of the socket. A factor of 1.3 should be applied to the weight of cone analysis. Where theoretical cones of adjacent anchors overlap, the overlapping portion should be ignored in resistance calculations. A submerged unit weight of 15 kN/m^3 may be used for the bedrock.

CLOSURE

Use of this report is subject to the attached Statement of General Conditions. It is the responsibility of the Canadian Coast Guard, who is identified as "the Client" within the Statement of General Conditions, and its agents to review the conditions and to notify Stantec Consulting Ltd. should any of these not be satisfied. The Statement of General Conditions addresses the following:

- Use of the report
- Basis of the report
- Standard of care
- Interpretation of site conditions
- Varying or unexpected site conditions
- Planning, design or construction

This report was prepared by Mark Bochmann, P.Eng., and reviewed by Brian Grace, P.Eng. We trust that the information contained in this report is adequate for your present purposes. If you have any questions about the contents of the report or if we can be of any other assistance, please contact us at your convenience.

Yours truly,

STANTEC CONSULTING LTD.

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Attachments: Statement of General Conditions
Symbols and Terms Used on Borehole and Test Pit Records
Borehole Records BH01 and BH02
Figure No. 1, Borehole Locations

STATEMENT OF GENERAL CONDITIONS

USE OF THIS REPORT: This report has been prepared for the sole benefit of the Client or its agent and may not be used by any third party without the express written consent of Stantec Consulting Ltd. and the Client. Any use which a third party makes of this report is the responsibility of such third party.

BASIS OF THE REPORT: The information, opinions, and/or recommendations made in this report are in accordance with Stantec Consulting Ltd.'s present understanding of the site specific project as described by the Client. The applicability of these is restricted to the site conditions encountered at the time of the investigation or study. If the proposed site specific project differs or is modified from what is described in this report or if the site conditions are altered, this report is no longer valid unless Stantec Consulting Ltd. is requested by the Client to review and revise the report to reflect the differing or modified project specifics and/or the altered site conditions.

STANDARD OF CARE: Preparation of this report, and all associated work, was carried out in accordance with the normally accepted standard of care in the state or province of execution for the specific professional service provided to the Client. No other warranty is made.

INTERPRETATION OF SITE CONDITIONS: Soil, rock, or other material descriptions, and statements regarding their condition, made in this report are based on site conditions encountered by Stantec Consulting Ltd. at the time of the work and at the specific testing and/or sampling locations. Classifications and statements of condition have been made in accordance with normally accepted practices which are judgmental in nature; no specific description should be considered exact, but rather reflective of the anticipated material behavior. Extrapolation of in situ conditions can only be made to some limited extent beyond the sampling or test points. The extent depends on variability of the soil, rock and groundwater conditions as influenced by geological processes, construction activity, and site use.

VARYING OR UNEXPECTED CONDITIONS: Should any site or subsurface conditions be encountered that are different from those described in this report or encountered at the test locations, Stantec Consulting Ltd. must be notified immediately to assess if the varying or unexpected conditions are substantial and if reassessments of the report conclusions or recommendations are required. Stantec Consulting Ltd. will not be responsible to any party for damages incurred as a result of failing to notify Stantec Consulting Ltd. that differing site or sub- surface conditions are present upon becoming aware of such conditions.

PLANNING, DESIGN, OR CONSTRUCTION: Development or design plans and specifications should be reviewed by Stantec Consulting Ltd., sufficiently ahead of initiating the next project stage (property acquisition, tender, construction, etc), to confirm that this report completely addresses the elaborated project specifics and that the contents of this report have been properly interpreted. Specialty quality assurance services (field observations and testing) during construction are a necessary part of the evaluation of sub-subsurface conditions and site preparation works. Site work relating to the recommendations included in this report should only be carried out in the presence of a qualified geotechnical engineer; Stantec Consulting Ltd. cannot be responsible for site work carried out without being present.

SYMBOLS AND TERMS USED ON BOREHOLE AND TEST PIT RECORDS

SOIL DESCRIPTION

Terminology describing common soil genesis:

Rootmat	- vegetation, roots and moss with organic matter and topsoil typically forming a mattress at the ground surface
Topsoil	- mixture of soil and humus capable of supporting vegetative growth
Peat	- mixture of visible and invisible fragments of decayed organic matter
Till	- unstratified glacial deposit which may range from clay to boulders
Fill	- material below the surface identified as placed by humans (excluding buried services)

Terminology describing soil structure:

Desiccated	- having visible signs of weathering by oxidization of clay minerals, shrinkage cracks, etc.
Fissured	- having cracks, and hence a blocky structure
Varved	- composed of regular alternating layers of silt and clay
Stratified	- composed of alternating successions of different soil types, e.g. silt and sand
Layer	- > 75 mm in thickness
Seam	- 2 mm to 75 mm in thickness
Parting	- < 2 mm in thickness

Terminology describing soil types:
The classification of soil types are made on the basis of grain size and plasticity in accordance with the Unified Soil Classification System (USCS) (ASTM D 2487 or D 2488) which excludes particles larger than 75 mm. For particles larger than 75 mm, and for defining percent clay fraction in hydrometer results, definitions proposed by Canadian Foundation Engineering Manual, 4th Edition are used. The USCS provides a group symbol (e.g. SM) and group name (e.g. silty sand) for identification.

Terminology describing cobbles, boulders, and non-matrix materials (organic matter or debris):
Terminology describing materials outside the USCS, (e.g. particles larger than 75 mm, visible organic matter, and construction debris) is based upon the proportion of these materials present:

Trace, or occasional	Less than 10%
Some	10-20%
Frequent	> 20%

Terminology describing compactness of cohesionless soils:
The standard terminology to describe cohesionless soils includes compactness (formerly "relative density"), as determined by the Standard Penetration Test (SPT) N-Value - also known as N-Index. The SPT N-Value is described further on page 3. A relationship between compactness condition and N-Value is shown in the following table.

Compactness Condition	SPT N-Value
Very Loose	<4
Loose	4-10
Compact	10-30
Dense	30-50
Very Dense	>50

Terminology describing consistency of cohesive soils:
The standard terminology to describe cohesive soils includes the consistency, which is based on undrained shear strength as measured by *in situ* vane tests, penetrometer tests, or unconfined compression tests. Consistency may be crudely estimated from SPT N-Value based on the correlation shown in the following table (Terzaghi and Peck, 1967). The correlation to SPT N-Value is used with caution as it is only very approximate.

Consistency	Undrained Shear Strength		Approximate SPT N-Value
	kips/sq.ft.	kPa	
Very Soft	<0.25	<12.5	<2
Soft	0.25 - 0.5	12.5 - 25	2-4
Firm	0.5 - 1.0	25 - 50	4-8
Stiff	1.0 - 2.0	50 – 100	8-15
Very Stiff	2.0 - 4.0	100 - 200	15-30
Hard	>4.0	>200	>30

ROCK DESCRIPTION

Except where specified below, terminology for describing rock is as defined by the International Society for Rock Mechanics (ISRM) 2007 publication "The Complete ISRM Suggested Methods for Rock Characterization, Testing and Monitoring: 1974-2006"

Terminology describing rock quality:

RQD	Rock Mass Quality
0-25	*Very Poor Quality*
25-50	*Poor Quality*
50-75	*Fair Quality*
75-90	*Good Quality*
90-100	*Excellent Quality*

Alternate (Colloquial) Rock Mass Quality	
Very Severely Fractured	*Crushed*
Severely Fractured	*Shattered or Very Blocky*
Fractured	*Blocky*
Moderately Jointed	*Sound*
Intact	*Very Sound*

RQD (Rock Quality Designation) denotes the percentage of intact and sound rock retrieved from a borehole of any orientation. All pieces of intact and sound rock core equal to or greater than 100 mm (4 in.) long are summed and divided by the total length of the core run. RQD is determined in accordance with ASTM D6032.

SCR (Solid Core Recovery) denotes the percentage of solid core (cylindrical) retrieved from a borehole of any orientation. All pieces of solid (cylindrical) core are summed and divided by the total length of the core run (It excludes all portions of core pieces that are not fully cylindrical as well as crushed or rubble zones).

Fracture Index (FI) is defined as the number of naturally occurring fractures within a given length of core. The Fracture Index is reported as a simple count of natural occurring fractures.

Terminology describing rock with respect to discontinuity and bedding spacing:

Spacing (mm)	Discontinuities	Bedding
>6000	*Extremely Wide*	-
2000-6000	*Very Wide*	*Very Thick*
600-2000	*Wide*	*Thick*
200-600	*Moderate*	*Medium*
60-200	*Close*	*Thin*
20-60	*Very Close*	*Very Thin*
<20	*Extremely Close*	*Laminated*
<6	-	*Thinly Laminated*

Terminology describing rock strength:

Strength Classification	Grade	Unconfined Compressive Strength (MPa)
Extremely Weak	R0	<1
Very Weak	R1	1 – 5
Weak	R2	5 – 25
Medium Strong	R3	25 – 50
Strong	R4	50 – 100
Very Strong	R5	100 – 250
Extremely Strong	R6	>250

Terminology describing rock weathering:

Term	Symbol	Description
Fresh	W1	No visible signs of rock weathering. Slight discoloration along major discontinuities
Slightly	W2	Discoloration indicates weathering of rock on discontinuity surfaces. All the rock material may be discolored.
Moderately	W3	Less than half the rock is decomposed and/or disintegrated into soil.
Highly	W4	More than half the rock is decomposed and/or disintegrated into soil.
Completely	W5	All the rock material is decomposed and/or disintegrated into soil. The original mass structure is still largely intact.
Residual Soil	W6	All the rock converted to soil. Structure and fabric destroyed.

STRATA PLOT

Strata plots symbolize the soil or bedrock description. They are combinations of the following basic symbols. The dimensions within the strata symbols are not indicative of the particle size, layer thickness, etc.


Boulders
Cobbles
Gravel


Sand


Silt


Clay


Organics


Asphalt


Concrete


Fill


Igneous Bedrock


Meta-morphic Bedrock


Sedi-mentary Bedrock

SAMPLE TYPE

SS	Split spoon sample (obtained by performing the Standard Penetration Test)
ST	Shelby tube or thin wall tube
DP	Direct-Push sample (small diameter tube sampler hydraulically advanced)
PS	Piston sample
BS	Bulk sample
HQ, NQ, BQ, etc.	Rock core samples obtained with the use of standard size diamond coring bits.

WATER LEVEL MEASUREMENT


measured in standpipe, piezometer, or well


inferred

RECOVERY

For soil samples, the recovery is recorded as the length of the soil sample recovered. For rock core, recovery is defined as the total cumulative length of all core recovered in the core barrel divided by the length drilled and is recorded as a percentage on a per run basis.

N-VALUE

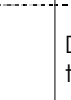
Numbers in this column are the field results of the Standard Penetration Test: the number of blows of a 140 pound (63.5 kg) hammer falling 30 inches (760 mm), required to drive a 2 inch (50.8 mm) O.D. split spoon sampler one foot (300 mm) into the soil. In accordance with ASTM D1586, the N-Value equals the sum of the number of blows (N) required to drive the sampler over the interval of 6 to 18 in. (150 to 450 mm). However, when a 24 in. (610 mm) sampler is used, the number of blows (N) required to drive the sampler over the interval of 12 to 24 in. (300 to 610 mm) may be reported if this value is lower. For split spoon samples where insufficient penetration was achieved and N-Values cannot be presented, the number of blows are reported over sampler penetration in millimetres (e.g. 50/75). Some design methods make use of N-values corrected for various factors such as overburden pressure, energy ratio, borehole diameter, etc. No corrections have been applied to the N-values presented on the log.

DYNAMIC CONE PENETRATION TEST (DCPT)

Dynamic cone penetration tests are performed using a standard 60 degree apex cone connected to 'A' size drill rods with the same standard fall height and weight as the Standard Penetration Test. The DCPT value is the number of blows of the hammer required to drive the cone one foot (300 mm) into the soil. The DCPT is used as a probe to assess soil variability.

OTHER TESTS

S	Sieve analysis
H	Hydrometer analysis
k	Laboratory permeability
γ	Unit weight
G_s	Specific gravity of soil particles
CD	Consolidated drained triaxial
CU	Consolidated undrained triaxial with pore pressure measurements
UU	Unconsolidated undrained triaxial
DS	Direct Shear
C	Consolidation
Q_u	Unconfined compression
I_p	Point Load Index (I_p on Borehole Record equals $I_p(50)$ in which the index is corrected to a reference diameter of 50 mm)

	Single packer permeability test; test interval from depth shown to bottom of borehole
	Double packer permeability test; test interval as indicated
	Falling head permeability test using casing
	Falling head permeability test using well point or piezometer

BOREHOLE RECORD

BH01

CLIENT **CANADIAN COAST GUARD** PROJECT No. **121621787**

LOCATION **CHEBUCTO HEAD, NOVA SCOTIA** BH SIZE **NQ**

DATES: BORING **2018/04/06** WATER LEVEL **Not Observed** DATUM **-**

DEPTH(m)	ELEVATION(m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY	SAMPLES N-VALUE OR-RQD %	OTHER TESTS
0		TOPSOIL Poor to good quality, slightly weathered, white to pink GRANITE bedrock -stainining and weathering on			NQ	1	79% mm	RQD 49%	
1		fracture surfaces							
2						7		NQ 2	
3									
								NQ 3	
4									
5								NQ 4	
6		End of borehole							

UNDRAINED SHEAR STRENGTH - kPa
20 40 60 80

WATER CONTENT & ATTERBERG LIMITS w_P w w_L

DYNAMIC PENETRATION TEST, BLOWS/0.3m

STANDARD PENETRATION TEST, BLOWS/0.3m
10 20 30 40 50 60 70 80 90

MBH 5/22/18

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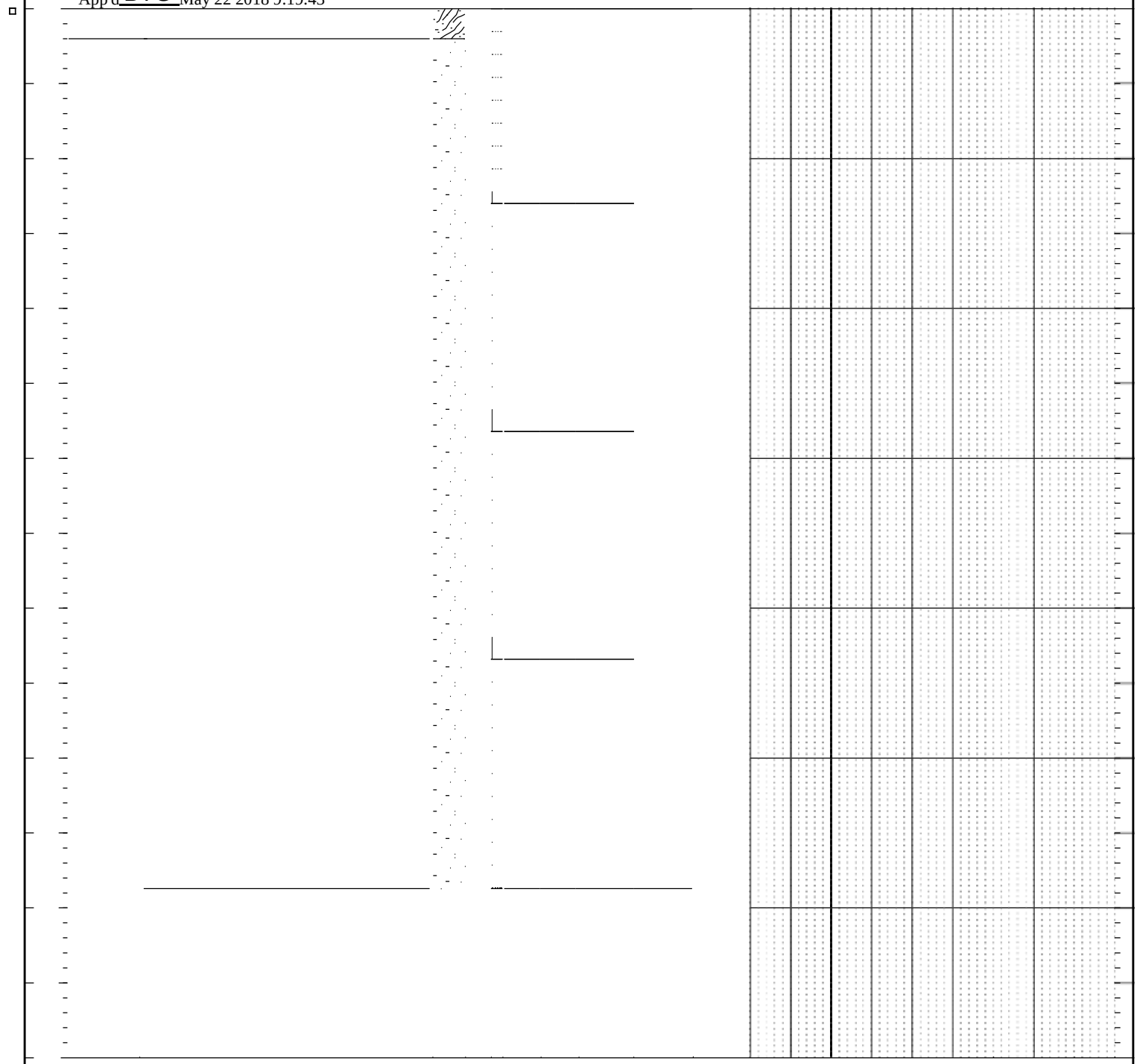
100% 82%

100%
40%

100% 90%

App'd BTG May 22 2018 9:19:43



BOREHOLE RECORD

BH02

CLIENT **CANADIAN COAST GUARD** PROJECT No. **121621787**

LOCATION **CHEBUCTO HEAD, NOVA SCOTIA** BH SIZE **NQ**

DATES: BORING **2018/04/16** WATER LEVEL **Not Observed** DATUM **-**

DEPTH(m)	ELEVATION(m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	RECOVERY mm	N-VALUE OR-RQD %	OTHER TESTS
0		TOPSOIL Very loose brown silty, clayey SAND with gravel			SS	1	150	4	
1		Excellent quality, fresh to slightly weathered, white to pink GRANITE bedrock -stainining and weathering on fracture surfaces			NQ	2	100%	RQD 92%	
2					NQ	3	97%	97%	
3									
4					NQ	4	7		
5					NQ	5			
6		End of borehole							

UNDRAINED SHEAR STRENGTH - kPa
20 40 60 80
WATER CONTENT & ATTERBERG LIMITS w_P w w_L
DYNAMIC PENETRATION TEST, BLOWS/0.3m
STANDARD PENETRATION TEST, BLOWS/0.3m
10 20 30 40 50 60 70 80 90

MBH 5/22/18

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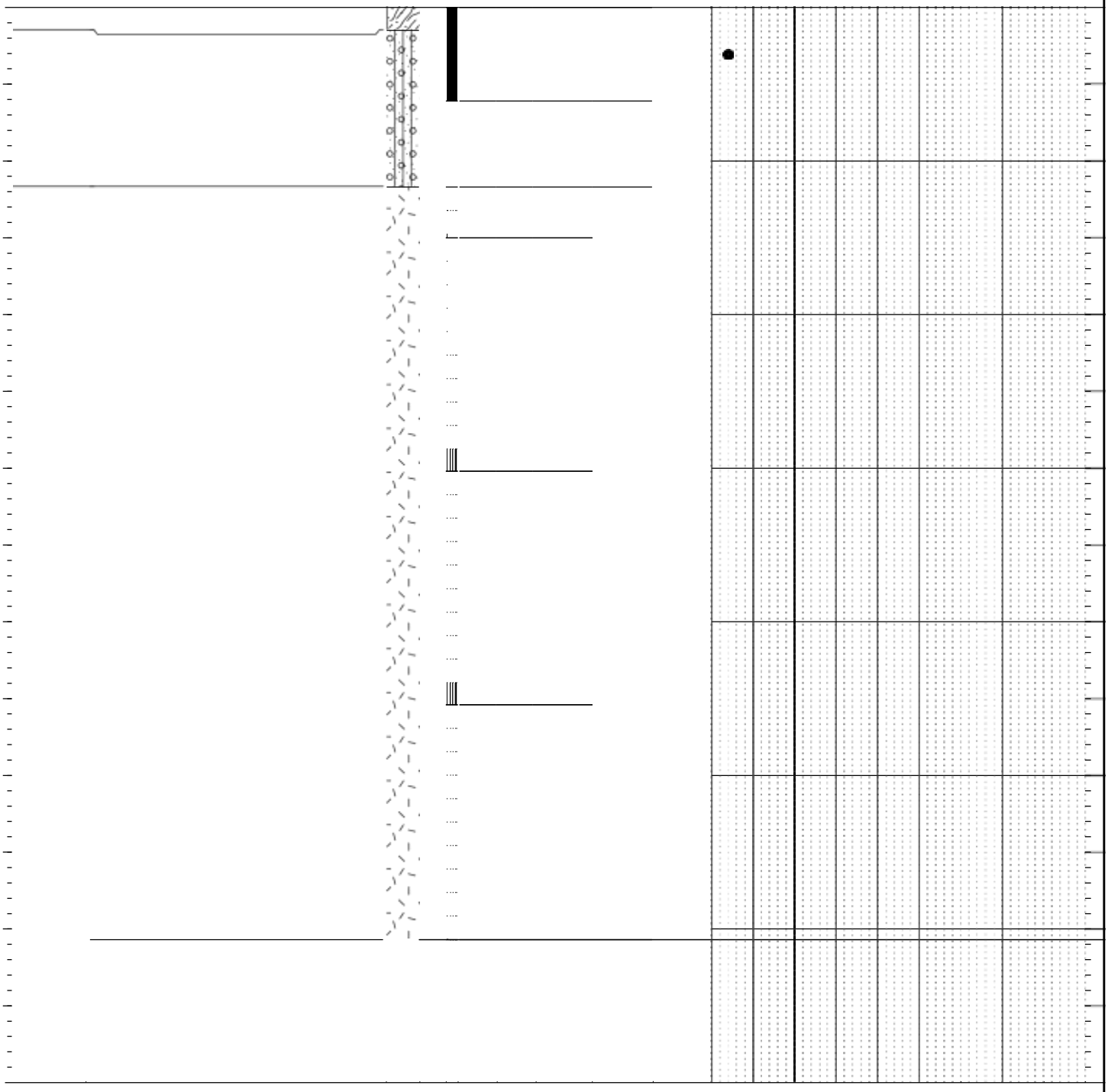
100% 93%

100% 95%

App'd BTG May 22 2018 9:19:44



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Legend

BOREHOLE

0 10 20 40m
BAR SCALE
1:1000

Notes

AERIAL IMAGE FROM ZOOM EARTH.

CANADIAN COAST GUARD, PROPOSED VHF TOWERS
DUNCANS COVE, NOVA SCOTIA
COG COMMUNICATIONS FACILITY (CHEBUCTO HEAD ROAD)

BOREHOLE LOCATIONS

ORIGINAL SHEET - ISO A3