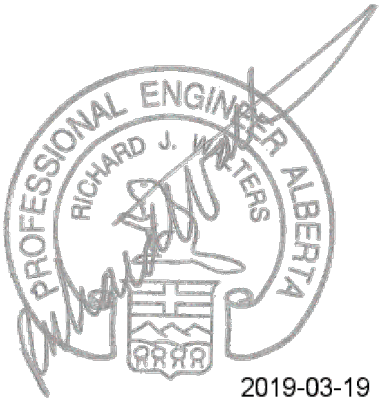
PUBLIC SERVICES AND PROCUREMENT CANADA

FUEL TANK REMOVAL AND REPLACEMENT

YA HA TINDA RANCH, BANFF NATIONAL PARK, AB

R.089703.008

MARCH 2019



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APEGA Permit to Practice # 3979

Prepared by EGE Engineering Ltd. and Associated Engineering Alberta Ltd.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Entire Specification - All areas of common work.

.2 The installation must meet the Petroleum Tank Manufactures Association of Alberta (PTMAA).

1.2 DEFINITIONS

.1 Contractor: Firm or representative retained to conduct the Works as per this Specification.

.2 Departmental Representative: Person designated in the Contract, to act as the Owners Representative for the purposes of the Contract,

.3 Site: Property on which the Works will be conducted.

.4 Works: Scope of work as detailed and described in this Specification

1.3 WORK COVERED BY CONTRACT DOCUMENTS

.1 Title and description of Work: Fuel Tank Removal and Replacement, including the removal and replacement of the existing fuel storage and dispensing system and generator shed at the Ya Ha Tinda Ranch Site located approximately 65 km west of Sundre, Alberta.

.2 The Contractor must prove experience working with PTMAA and installations meeting PTMAA requirements.

.3 The work comprises all activities associated with: decommissioning and removal of the two existing aboveground storage tanks (ASTs); decommissioning and removal of the generator shed and all associated contents and appurtenances; supply and installation of two new ASTs and dispensing systems; and supply, installation and commissioning of new electrical distribution components.

.4 One indoor generator will be salvaged and one portable generator will be salvaged for reuse.

.5 The site will be restored to pre-deconstruction conditions or better.

.6 Mobilization and demobilization consists of preparatory work and operations including but not limited to, those necessary for the movement of personnel, equipment, supplies and incidentals to and from the project.

.7 Work includes:

.1 Adherence to all federal, provincial and municipal Laws, Regulations, Codes, Guidelines at a minimum.

.2 Permit Applications, including:

.1 Obtain all Municipal, Provincial and Federal permits, as required to complete the Work.

.2 PTMAA

.3 Management of Site Safety, including:

.1 Develop Site Specific Safety Plan.

.2 Coordinate and lead Pre-Job Safety Meeting and Daily On-Site Safety Meetings.

.3 Develop Spill Prevention and Spill Response Plans.

.4 Develop Emergency Response Plan.

.4 Site Preparation Activities, including:

.1 Areas of work should be identified prior to beginning work with the Departmental Representative and all work should remain within the established work boundaries.

.2 Maintain and protect all existing buildings, foundations, concrete pads, and existing monitoring wells to remain within the proposed work areas.

.3 Maintain and protect all overhead and underground utilities within the proposed work areas.

.5 Removal of the existing ASTs (5,000 L gasoline and 10,000 L diesel) and fuel dispensing/distribution systems, including:

.1 Work to be completed by a Certified Technician from the Province of AB. Certification must be submitted with bid.

.2 Transfer of useable product contained within the ASTs to the new fuel tanks and removal and disposal of all un-useable product and sludge to a licensed disposal facility. Waste manifests required to be submitted to the Departmental Representative.

.3 Removal of the ASTs, and all associated vent, fill and transfer piping, including all electrical and remote monitoring equipment.

.4 Destruction of the AST, and appropriate disposal of the tanks and all related infrastructure. Destruction certificates, pictures and waste manifests required to be submitted to the Departmental Representative.

.6 Supply, installation and commissioning of a new 5,000 litre aboveground gasoline fuel storage tank (AST) and 10,000 litre diesel AST, including:

.1 Structural foundation and concrete pad.

.2 Associated dispensing system and grounding

.3 Electrical services and remote monitoring equipment to support system operation.

.4 Impact protection.

.5 The installation must meet and be provided with the PTMAA checklist.

.6 Obtain PTMAA certification and site number before the site is considered substantially complete.

.7 Relocation of existing generators, including supply, installation and commissioning of new generator controls and a new generator granular storage pad.

.8 Underground connection to the power distribution. Addition of a power distribution point.

.9 Implementation of safety work zones, site Health and Safety Plan and Emergency Response Plan.

.10 Commissioning and pressure testing of the new AST system after the Owner has registered the system with Environment and Climate Change Canada (ECCC), and a registration number has been provided and installed on the tank.

.11 Demolition and removal of the existing generator building. The building is considered contaminated by diesel and must be removed safely.

.12 Demolition of the existing over head connection from the generator building to the over head distribution.

.8 Work by Others: Soil sampling by Departmental Representative.

1.4 CONTRACT METHOD

.1 Construct Work under lump sum price contract.

1.5 SITE LOCATION AND INFORMATION

.1 The Ya Ha Tinda Ranch (YHTR) is operated by PCA for wintering and training working horses used to patrol Canada's western National Parks. The YHTR covers a large area of natural grassland and mixed forest north of the Red Deer River, with a small developed area used to operate the working horse ranch. The developed part of the site is located at 4-24-32-12 W5M. The UTM (WGS84, Zone 11) coordinates for the center of the work area are E597846, N5734705. The site is accessible from a seasonal gravel road that has speed restrictions and requires regular maintenance.

.2 The site is comprised of an irregular shaped lot that is currently occupied by several buildings/structures, including: oil shed; generator shed; dry storage shed; helicopter fuel shed; log building; equipment shed; fire shed shop; blacksmith shop; barn; Quonset; bunkhouse; four residence units; a former log house used for historical displays; and a former outhouse.

.3 The property is surrounded by natural areas, including: Scalp Creek and natural area to the east; natural area and seasonal non-serviced camping area to the south; and natural area to the north and west.

.4 The local topography at the site slopes gently from north to south and is situated at an elevation of approximately 1,700 m above sea level. The nearest surface water body to the Property is Scalp Creek, located 200 m to the southwest.

.5 A Geotechnical Investigation report prepared by Morton & Jagodich, dated February 2018 is presented in Appendix A of the Specification.

.6 Based on the soil logs and soil descriptions provided in the Geotechnical Investigation report, the soils in the vicinity of the proposed work area consist of a 1.5 to 3.0 m thick sand that overlies a firm to very stiff clay till/clay soil. The clay till is underlain by a compact to dense gravel layer that in turn overlies very weak, highly weathered shale.

1.6 SITE EXAMINATION

.1 Contractor shall compare plans and specifications with existing conditions, to fully satisfy themselves as to all data and matters required for the completion of the contract.

.2 Failure of Contractor to acquaint them self fully with all available information concerning conditions affecting the work shall not relieve the Contactor of the responsibility for estimating the difficulties and costs of satisfactorily performing the work.

.3 Commencement of mobilization shall constitute acceptance of existing conditions, and verification of dimensions.

.4 Claims for additional costs will not be entertained with respect to conditions which would reasonably have been ascertained by an inspection of the site prior to mobilization.

1.7 WORK BY OTHERS

.1 Co-operate with other Contractors in carrying out their respective works.

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

1.8 COORDINATION

.1 Perform coordination of progress schedules, submittals, use of site, temporary facilities, and construction Work with progress of Work of other contractors.

1.9 CONSTRUCTION ORGANIZATION AND START UP

.1 Within 7 days after award, attend a meeting to discuss and resolve administrative procedures and responsibilities, as per Section 01 31 19 - Project Meetings.

.2 Departmental Representative, Owner, Contractor, major Subcontractors, field inspectors and supervisors to be in attendance, at a minimum at all meetings.

.3 Meeting agenda, as per 1.3.4 of Section 01 31 19 - Project Meetings.

.4 During construction, coordinate use of site and facilities through Departmental Representative.

.5 Coordinate field engineering and layout work with Departmental Representative.

1.10 SUBMITTALS

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

1.11 WORK SEQUENCE

.1 Construct Work in stages to accommodate overall project schedule.

1.12 CONTRACTOR USE OF PREMISES

.1 The Contractors use of the site shall be restricted to the identified work areas. There shall be no access to site buildings unless directed in writing by PCA.

.2 Execute work with least possible interference or disturbance to normal use of premises. Make arrangements with Departmental Representative to facilitate work as stated. Contractor to limit shutdown of the generators to a maximum of six hours (6 hrs) during system cross-over.

.3 The Contractor shall not unreasonably encumber site with materials or equipment or move stored products or equipment which interferes with PCA mandate and/or operations at the Site.

.4 Use of site shall comply with the environmental protection requirements of Section 01 35 43 - Environmental Procedures and the Environmental Protection Plan.

.5 The Contractor shall keep the roads clean of impacted soil and tracked mud from the excavations, and passable at all times. Contractor shall remove litter on a daily basis as directed by the Departmental Representative. If litter created by the Contactor's activities is not cleaned to the satisfaction of the Departmental Representative and upon notification, the Contractor refuses to improve road conditions, the Departmental Representative shall direct that this work be performed by others and the cost of the Work shall be borne by the Contractor. The Departmental Representative assumes no responsibility for any inconvenience or costs incurred due to road passage interruptions.

.6 Existing site access is from a seasonal gravel road that has speed restrictions and requires regular maintenance.

.7 Contractor will provide sanitary facilities for use by Contractor's personnel. Keep facilities clean.

.8 Remove or alter existing work to prevent injury or damage to portions of existing work which remain.

.9 Repair or replace portions of existing work which have been altered during construction operations to match existing or adjoining work, as directed in writing by Departmental Representative.

.10 At completion of construction operations, condition of existing work shall be equal to or better than that which existed before new work started.

1.13 DEPARTMENTAL REPRESENTATIVE

.1 PSPC will be represented at the site by the Departmental Representative.

1.14 ALTERATIONS, ADDITIONS OR REPAIRS TO EXISTING BUILDING

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

1.15 EXISTING SERVICES

.1 Establish location and extent of service lines in area of work before starting Work. Notify Departmental Representative of findings in writing. Where unknown services are encountered, immediately advise Departmental Representative and confirm findings in writing.

.2 Submit schedule to and obtain approval from Departmental Representative for any shut-down or closure of active service or facility including power, communications, water and external heating services. Adhere to approved schedule and provide minimum 24 hour notice to affected parties.

.3 Protect, relocate or maintain existing active services. When inactive services are encountered, cap off in manner approved by authorities having jurisdiction.

.4 Record locations of maintained, re-routed and abandoned service lines and provide information in writing to the Departmental Representative

1.16 WASTE DISPOSAL QUANTITIES

.1 Contractor to provide summary of all wastes disposed including quantities, disposal locations, and original scale tickets, as applicable. Waste quantities to be reconciled daily with the Department Representative, including the provision of original waste manifests.

1.17 DOCUMENTS REQUIRED

.1 Maintain at job site, one copy of each document as follows:

.1 Contract Drawings.
.2 Specifications.
.3 Addenda.
.4 Reviewed Shop Drawings.
.5 List of Outstanding Shop Drawings.
.6 Change Orders.
.7 Other Modifications to Contract.
.8 Field Test Reports.
.9 Copy of Approved Work Schedule.
.10 Health and Safety Plan and Other Safety Related Documents including Spill Prevention Plan and Spill Response Plan.
.11 Environmental Protection Plan.
.12 Restricted Activity Permits.
.13 Building Permit
.14 Other documents as specified.

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 ACCESS AND EGRESS

.1 Design, construct and maintain temporary "access to" and "egress from" the work areas in accordance with relevant Municipal, Provincial and Federal regulations.

.1 Existing site access is from a seasonal gravel road that has speed restrictions and requires regular maintenance.

1.2 USE OF SITE AND FACILITIES

.1 Execute work with least possible interference or disturbance to normal use of premises. Make arrangements with Departmental Representative to facilitate work as stated.

.2 Maintain existing services to surrounding facilities and provide for personnel and vehicle access.

.3 Contractor to provide sanitary facilities and will be responsible for upkeep of these facilities.

1.3 EXISTING SERVICES

.1 Maintain existing roads for personnel and vehicular traffic.

1.4 SPECIAL REQUIREMENTS

.1 Submit schedule in accordance with Section 01 32 16.07 - Construction Progress Schedule - Bar (GANTT) Chart.

.2 Ensure that Contractor personnel employed on site are familiar with and obey all site specific safety, fire, traffic and security requirements, where applicable.

.3 Keep within limits of work and avenues of ingress and egress.

.4 Erect and maintain vehicle barriers around the work area throughout the duration of the work.

.5 Where work is to be carried out on the adjacent leased properties, coordinate work with the property tenants, including access to and egress from their property.

.6 Contractor to outline site specific traffic control measures to be followed on site as part of their site layout plan.

1.5 BUILDING SMOKING ENVIRONMENT

.1 No smoking is permitted on site.

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 MEASUREMENT FOR PAYMENT

.1 For lump sum price item, Departmental Representative will calculate payment based on tendered price and Departmental Representative 's estimate of percentage of work item completed.

.2 Method of measurement to be used is detailed in the section of the specification covering each work item.

.3 Where a method of measurement for payment for a work item is not specified, payment for that item will be deemed to be included in another pay item or other pay items.

1.2 PROGRESS CLAIMS

.1 Contractor's Responsibilities:

.1 Submit progress claim to Departmental Representative within 5 working days after each month end. Claim to cover preceding month.

.2 Progress claim to show estimate of percentage of work completed against each item of Lump Sum Price Breakdown.

.3 Progress claim to include all labour and materials incorporated in Work and all materials stored at Site.

.4 Progress claim to include all agreed extras and deductions.

.5 Supply documentation to support claim for materials on site in the form of itemized lists or unpriced purchase orders showing quantities.

.6 Supply other evidence required by Departmental Representative, in support of progress claim.

.7 No claim may exceed 25% until the equipment is on site and bolted down.

.2 Departmental Representative 's Responsibilities:

.1 Review Contractor's claim, prepare Progress Payment Certificate and issue to Departmental Representative within 10 working days following receipt of Contractor's claim.

.2 Departmental Representative 's estimate of percentage of work completed will govern calculation of payment on all Progress Payment Certificates.

.3 Inform Contractor of amendments to claim by copy of Progress Payment Certificate.

1.3 CHANGE ORDERS

.1 Complete and promptly return all change price requests issued by Departmental Representative quoting unit and/or lump sum prices as requested. Include appropriate supporting documentation to verify prices.

.2 Do not proceed with work affected by price request until authorized to do so by Change Order.

.3 Make no change in Work unless Change Order issued. Change Order is only valid when signed by Departmental Representative and Contractor.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 NOT USED

END OF SECTION

Part 1 General

1.1 ADMINISTRATIVE

.1 Departmental Representative will schedule and administer pre-construction meeting upon Award.

.2 Departmental Representative to schedule and administer project meetings throughout the progress of the Work as needed.

.3 Representative of Contractor, Subcontractor and suppliers attending meetings will be qualified and authorized to act on behalf of party each represents.

.4 Departmental Representative and Contractor to meet weekly once work on site commences to discuss:

.1 Field observations, problems and conflicts.

.2 Problems which impede construction schedule.

.3 Corrective measures and procedures to regain projected schedule.

.4 Revision to construction schedule.

.5 Progress schedule during succeeding work period.

.6 Review proposed changes for affect on construction schedule and on completion date.

.7 Departmental Representative will take minutes and distribute weekly to Owner and Contractor.

1.2 PRECONSTRUCTION MEETING

.1 Within 15 days after award of Contract, attend a meeting of parties in contract to discuss and resolve administrative procedures and responsibilities.

.2 Departmental Representative, Owner, Contractor, major Subcontractors, field inspectors and supervisors will be in attendance.

.3 Departmental Representative to establish time and location of meeting and notify parties concerned minimum 5 days before meeting.

.4 Agenda to include:

.1 Appointment of official representative of participants in the Work.

.2 Schedule of Work: in accordance with Section 01 32 16.07 - Construction Progress Schedule - Bar (GANTT) Chart.

.3 Schedule of submission of shop drawings, samples, mock-ups, colour chips. Submit submittals in accordance with Section 01 33 00.

.4 Requirements for temporary facilities, site sign, offices, storage sheds, utilities, fences in accordance with Section 01 52 00 - Construction Facilities.

.5 Site security in accordance with Section 01 56 00.

.6 Change order process and procedure, approvals required, and administrative requirements.

.7 Health and safety requirements in accordance with Section 01 35 29.06 - Health and Safety Requirements.

.8 Environmental protection requirements in accordance with Section 01 35 43 - Environmental Procedures.

.9 Owner provided products.

.10 Record drawings and specifications in accordance with Sections 01 33 00 and 01 78 00.

.11 Take-over procedures, acceptance, warranties in accordance with Section 01 78 00.

.12 Monthly progress claims, administrative procedures, photographs, hold backs.

.13 Appointment of inspection and testing agencies or firms.

.14 Insurances, transcript of policies.

.15 Close out procedures and submittals in accordance with Sections 01 77 00 - Closeout Procedures and 01 78 00 - Closeout Submittals.

.16 Other business.

1.3 PROGRESS MEETINGS

.1 During course of Work and as required, Departmental Representative to schedule progress meetings as required.

.2 Contractor, major Subcontractors involved in Work and Departmental Representative are to be in attendance.

.3 Departmental Representative to notify parties minimum 48 hours prior to meetings.

.4 Agenda to include the following:

.1 Health and Safety update and review of HASP.

.2 Review of Work progress since previous meeting.

.3 Field observations, problems, conflicts.

.4 Problems which impede construction schedule.

.5 Corrective measures and procedures to regain projected schedule.

.6 Revision to construction schedule.

.7 Progress schedule, during succeeding work period.

.8 Review submittal schedules: expedite as required.

.9 Review proposed changes for affect on construction schedule and on completion date.

.10 Other business.

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 DEFINITIONS

.1 Activity: element of work performed during course of Project. Activity normally has expected duration, and expected cost and expected resource requirements. Activities can be subdivided into tasks.

.2 Bar Chart (GANTT Chart): graphic display of schedule-related information. In typical bar chart, activities or other Project elements are listed down left side of chart, dates are shown across top, and activity durations are shown as date-placed horizontal bars. Generally Bar Chart should be derived from commercially available computerized project management system.

.3 Baseline: original approved plan (for project, work package or activity).

.4 Construction Work Week: Sunday to Saturday, inclusive, will provide seven day work week and define schedule calendar working days as part of Bar (GANTT) Chart submission.

.5 Duration: number of work periods (not including holidays or other nonworking periods) required to complete activity or other project element. Duration is usually expressed as work days or work weeks.

.6 Milestone: significant event in project, usually completion of major deliverable.

.7 Project Schedule: planned dates for performing activities and the planned dates for meeting milestones. The project schedule is a dynamic, detailed record of tasks or activities that must be accomplished to satisfy Project objectives. Monitoring and control process involves using Project Schedule in executing and controlling activities and is used as basis for decision making throughout project life cycle.

.8 Project Planning, Monitoring and Control System: overall system operated by Departmental Representative to enable monitoring of project Work in relation to established milestones.

1.2 REQUIREMENTS

.1 Ensure Project Schedule is practical and remains within specified duration.

.2 Plan to complete Work in accordance with prescribed milestones and time frame.

.3 Schedule activity durations to a maximum of approximately 10 working days to allow for progress reporting.

.4 Ensure that it is understood that time of beginning, rate of progress, Interim Certificate and Final Certificate as defined times of completion are of the essence of this contract.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Submit to Departmental Representative within 5 working days of Award, Schedule as Bar (GANTT) Chart for planning, monitoring and reporting of project progress. Schedule to be discussed at pre-construction meeting.

1.4 PROJECT MILESTONES

.1 Project milestones form interim targets for Project Schedule.

.1 Participate in Preconstruction Meeting within 15 working days of award date.

.2 Complete preparatory Work including landfill acceptance, permitting, and health and safety within two weeks of award date.

1.5 PROJECT SCHEDULE

.1 Structure schedule to allow orderly planning, organizing and execution of Work as Bar Chart (GANTT).

.2 Ensure detailed Project Schedule includes as minimum milestone and activity types as follows:

.1 Award.

.2 All submittals as specified in Section 01 33 00 - Submittal Procedures including but not limited to Health and Safety Plan, Environmental Protection Plan including Spill Response and Spill Prevention Plan, Emergency Response Plan, and site layout drawings.

.3 Completion of utility locates.

.4 Mobilization.

.5 Installation of security fencing.

.6 Excavation.

.7 Construction of new structural concrete pad(s).

.8 Construction of new generator control building/structure.

.9 Installation and commissioning of new ASTs and generators.

.10 Final grading and surface restoration, including replacement of paved surfaces.

.11 Interim inspection.

.12 Deficiency corrections.

.13 Commissioning.

.14 Decommissioning and removal of existing ASTs.

.15 Demobilization.

.16 Deficiency corrections.

.17 Final inspection.

.3 Departmental Representative will review Project Schedule and return revised schedule within three working days.

.4 Revise schedule and resubmit within three working days.

.5 Accepted revised schedule will be used as baseline for updates.

1.6 PROJECT SCHEDULE REPORTING

.1 Update Project Schedule on regular basis reflecting activity changes and completions, as well as activities in progress and submit to Departmental Representative for review.

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

1.7 PROJECT MEETINGS

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

Part 2 Products

2.1 NOT USED

.1 Not used.

Part 3 Execution

3.1 NOT USED

.1 Not used.

END OF SECTION

Part 1 General

1.1 REQUIREMENTS INCLUDED

.1 Construction schedule complete with commissioning schedule.

.2 Shop drawings and product data.

.3 Samples.

.4 Operating and maintenance manuals.

.5 Record drawings.

.6 Progress photpgraphs.

.7 Certificates.

.8 PTMAA registration.

1.2 ADMINISTRATIVE

.1 Submit to Departmental Representative submittals listed below for review.

Table 1: Breakdown of Required Project Submittals and Submission Dates

Submittal Required	Submission Date
• Project Schedule - as per Section 01 32 16.07 - Construction Progress Schedule - Bar (GANTT) Chart.	• Five days following Contract Award.
• Health and Safety Plan (including Spill Response and Spill Prevention Plan, Emergency Response Plan and Training Certificates) - as per Section 01 35 29.06 - Health and Safety Requirements.	• Seven days following Contract Award.
• Environmental Protection Plan (including Non-hazardous Waste Disposal Plan, Erosion Control Plan and Sediment Control Plan) - as per Section 01 35 43 - Environmental Procedures.	• Seven days following Contract Award.
• Site Layout Drawings - as per Section 01 52 00 – Construction Facilities.	• Ten days prior to mobilization to site.
• Description of hazardous materials and notification of filing - as per Section 02 41 13 - Selective Demolition.	• As required, seven days prior to the start of construction.
• Source and samples of proposed backfill (Type 2 and Type 4) - as per Section 31 23 33.01 - Excavating, Trenching and Backfilling.	• Five days prior to the start of construction.
• Drawings, diagrams and/or details showing	• Five days prior to the

sequencing of demolition - as per Section 02 41 13 - Selective Demolition	start of construction.
• Utility locate clearance sheets - as per Section 31 23 33.01 - Excavating, Trenching and Backfilling.	• Five days prior to the start of construction.
• WHMIS MSDS - as per Section 02 81 01 - Hazardous Materials.	• Prior to the start of construction.
• Shop Drawings, Product Data and Samples - as per Section 01 33 00 - Submittal Procedures, and as outlined within the various sections of Division 02 - Existing Conditions, Division 03 - Concrete, Division 23 – HVAC, Division 26 - Electrical, Division 31 - Earthwork, Division 32 - Exterior Improvements and Division 33 - Utilities.	• As required prior to the start of construction and/or during construction.
• Site Health and Safety Inspection Reports - as per Section 01 35 29.06 - Health and Safety Requirements.	• Daily during construction.
• Incident and Accident Repots - as per Section 01 35 29.06 - Health and Safety Requirements.	• As required during construction.
• Written spill report - as per Section 02 81 01 - Hazardous Materials.	• Within 24 hours of incident.
• Originals of certified weigh bills, bills of lading, waste manifests and/or waste disposal receipts from authorized disposal sites and recycling facilities - as per Section 01 74 21 - Construction/Demolition Waste Management and Disposal and Section 02 41 13 - Selective Demolition.	• Weekly during construction.
• Tank serial numbers and other pertinent details on tank ID tags, copy of vapour removal test results and photos and affidavit of destruction - as per Section 02 65 00 - Aboveground Storage Tank Removals and Section 02 41 13 - Selective Demolition.	• Following tank decommissioning.
• Completed Environment Canada (EC) Storage Tank System Identification Form - as per Section 02 65 00 - Aboveground Storage Tank Removals.	• Following tank decommissioning.
• Third party test results of proposed backfill - as per Section 31 23 33.01 - Excavating, Trenching and Backfilling.	• Prior to delivery and start of backfilling.
• CSA certified equipment and material, test results of installed electrical systems and instrumentation, and permits and fees - as per Section 26 00 10 - Common Work Results -	• As required, during and upon completion of electrical Work.

for Electrical.	
• Manufacturer's field reports - as per Section 26 00 10 - Common Work Results - for Electrical.	• Within three days of review, verifying compliance of Work and electrical system and instrumentation testing.
• Name of Contractors commissioning agent, draft commissioning documentation and preliminary commissioning schedule - as per Section 01 91 13 - General Commissioning Requirements.	• Four weeks following Contract Award and a minimum of 14 days prior to commissioning.
• Design as-built drawings and information requirements identified in Schedule 2 of the STR - as per Section 01 91 13 - General Commissioning Requirements.	• Within 14 days of commencement of commissioning.
• Start-up documentation. - as per Section 01 91 13 - General Commissioning Requirements.	• Within 14 days of commencement of commissioning.
• Written maintenance program for fuel system - as per Section 01 91 13 - General Commissioning Requirements.	• Within 14 days of commencement of commissioning.
• Completed and approved commissioning documentation and standalone written records of all testing - as per Section 01 91 13 - General Commissioning Requirements.	• Within 5 days of commencement of commissioning.
• Complete list of equipment and listed data for proposed instruments and equipment - as per Section 01 91 13 - General Commissioning Requirements.	• Prior to the start of commissioning.
• Copies of Federal, Provincial and/or Municipal permits, applications and/or approvals, Waste Summary Report and digital photos of the Work - as per Section 01 78 00 - Closeout Submittals.	• Within one week following completion of the work.
• Four hard and electronic copies of the Operation and Maintenance Manual - as per Section 01 73 03 - Execution Requirements.	• Within two weeks following completion of the work.

.2 Submit promptly and in orderly sequence to not cause delay in Work. Failure to submit as detailed in specification is not considered reason for extension of Contract Time and no claim for extension by reason of such default will be allowed.

.3 Do not proceed with Work affected by submittal until review is complete.

.4 Review submittals prior to submission to Departmental Representative. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and co-ordinated with the requirements of the

Specifications. Submittals not stamped, signed, dated and identified as to specific project will be returned without being examined and considered rejected.

.5 Notify Departmental Representative, in writing at time of submission, identifying deviations from requirements of Specifications stating reasons for deviations.

.6 Verify field measurements and affected adjacent Work is co-ordinated.

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

.8 Contractor's responsibility for deviations in submission from requirements of Specifications is not relieved by Departmental Representative review.

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

1.3 CONSTRUCTION SCHEDULE

.1 Prepare schedule in the form of a horizontal bar chart.

.2 Provide a separate bar for each trade or operation. Show proposed progress of all activities for main work items and subtrades of Contract. Where applicable, indicate labour, construction crews, plant and equipment to be employed. Show delivery dates of major pieces of equipment.

.3 Provide horizontal time scale identifying the first work day of each week.

.4 Submit an electronic copy of initial schedules within 5 days after award of Contract.

.5 Department representative will review schedule and return reviewed comments within 3 days after receipt.

.6 Resubmit finalized schedule within 3 days after return of reviewed copy Electronic copy).

.7 Distribute emails of the finalized schedule to:

.1 Job site office.

.2 Departmental Representative.

.8 Instruct recipients to report to Contractor, within 10 days, any problems anticipated by the timetable shown in the schedule.

.9 Revise and resubmit schedule and work plan within 5 days after notification by Departmental Representative that previously reviewed schedule is not being met. Show changes in operations proposed to complete construction work within Contract Time.

.10 If during course of work, Contract Time is extended, correct construction schedule and work plan to show revised commencement and completion dates of affected parts of work.

.11 No progress payment will be approved until receipt of a schedule acceptable to the Departmental Representative.

1.4 SHOP DRAWINGS AND PRODUCT DATA

.1 The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by Contractor to illustrate details of a portion of Work.

.2 Electronic shop drawings submission is acceptable.

.3 Detail all shop drawings using the metric system. Prepare to a drafting standard equivalent to Contract drawings

.4 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been co-ordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.

.5 Departmental Representative will review Contractor's shop drawings and/or product data and provide comments to Contractor within 3 days after receipt of such. Contractor to revise submittals where required and resubmit to Departmental Representative 3 days after receipt of comments from Departmental Representative.

.6 Adjustments made on shop drawings by Departmental Representative are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Departmental Representative prior to proceeding with Work.

.7 Make changes in shop drawings as Departmental Representative may require, consistent with Contract Documents. When resubmitting, notify Departmental Representative in writing of revisions other than those requested.

.8 Departmental Representative will supply a Shop Drawing Review Stamp. Stamp all transparancies and copies of shop drawings submitted for review.

.9 Maintain a complete Shop Drawing Record showing the review status of all shop drawings on the work. Provide Departmental Representative with a copy of this record on a monthly basis or as requested by the Departmental Representative.

.10 Submittal submissions:

- .1 Submit electronic shop drawings and other submittals to Departmental Representative for review with a Submittal Transmittal Form as provided by Departmental Representative or in a form acceptable to Departmental Representative.
- .2 For each submittal or submittal package, type or print the appropriate information on the form to fully describe the submittal(s) being sent for review.
- .3 Number each transmittal form in sequential order, for record and tracking purposes.
- .4 Sign the form in the space provided to acknowledge Contractor review of the submittal(s).
- .5 Retain one photocopy of the form for filing and record purposes.
- .6 Forward the form and the accompanying submittal(s) to Departmental Representative.

.11 Submissions shall include:

.1 Date and revision dates.

.2 Project title and number.

.3 Name and address of:

.1 Subcontractor.

.2 Supplier.

.3 Manufacturer.

.4 Apply shop drawing stamp (electronic is acceptable), signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.

.5 Details of appropriate portions of Work as applicable:

.1 Fabrication.

.2 Layout, showing dimensions, including identified field dimensions, and clearances.

.3 Setting or erection details.

.4 Capacities.

.5 Performance characteristics.

.6 Standards.

.7 Operating weight.

.8 Wiring diagrams.

.9 Single line and schematic diagrams.

.10 Relationship to adjacent work.

.12 Submit electronic copies of product data sheets or brochures for requirements requested in specification Sections and as Departmental Representative may reasonably request where shop drawings will not be prepared due to standardized manufacture of product.

.13 Submittals will be returned with one or more of the following notations. Take action as noted:

.1 "REVIEWED" - Make and distribute additional copies as required for execution of Work.

.2 "REVISE & RESUBMIT" - Make the necessary revisions and resubmit revised drawings for review. Show the drawing number of the first such revised drawing and show the latest revision number applicable to the drawing by adding a suffix to the drawing number as - "REV. 1", "REV. 2", etc.

.3 "REVIEWED AS NOTED" - This notation indicates when Departmental Representative has provided notations on the shop drawings that must be incorporated into the goods or work. Make and distribute additional copies as required for execution of the work.

.4 "NOT REVIEWED" - This notation indicates when Departmental Representative has not reviewed the drawing. It may also be used in combination with the notation to revise and resubmit the drawing where Departmental Representative lacks sufficient information to complete the review and requires resubmitting the drawing for review after revision.

.5 Drawings will be marked "REVIEWED" together with the notation to "REVISE & RESUBMIT" when Departmental Representative requires Contractor to resubmit a revised drawing showing corrections made as a result of Departmental Representative's notations on the shop drawings. This procedure will not relieve Contractor of responsibility for errors or omissions in the shop drawings or of responsibility for meeting all requirements of Contract.

.6 Use only those shop drawings on the work that bear the "REVIEWED" notation.

.7 Do not revise shop drawings marked "REVIEWED" unless resubmitted to Departmental Representative for further review.

.8 Where more than one type of shop drawing has been specified for one item, e.g., wiring diagrams, layout details, and dimensional drawings, the shop drawings shall be submitted together, to enable Departmental Representative to review the drawings as a package.

.9 Catalogue pages or drawings applicable to an entire family or range of equipment will not be accepted as shop drawings unless they are clearly marked to show the pertinent data for the particular materials.

.10 Manufacturers' catalogues, manuals, or price lists will not be accepted as shop drawings. Such materials may be used as supplemental information to the shop drawings.

.11 Indicate the tag number of instruments and electrical device and clearly show the features and details applicable to the equipment being supplied.

.12 Determine which shop drawings have, in addition to those drawings specifically mentioned in the Contract, design elements requiring the seal of a Professional Engineer registered in the Province or Territory where the work is located, in accordance with the applicable provincial or federal engineering acts or other governing legislation. Seal such drawings before submitting them for review. Submit for review engineering calculations signed by the registered Professional Engineer responsible for the shop drawing design elements.

.13 Departmental Representative may deduct, from payments due to Contractor, costs of additional engineering work incurred if correct shop drawings are not submitted after one review by Departmental Representative.

.14 Review by Departmental Representative is for the sole purpose of ascertaining conformance with the general design concept. This review does not mean that Departmental Representative approves the detail design inherent in the shop drawings, responsibility for which remains with Contractor, and such review does not relieve Contractor of the responsibility for errors or omissions in the shop drawings or of the responsibility for meeting all requirements of the Contract Documents. Contractor is responsible for dimensions to be confirmed and correlated at the job-site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for coordination of the work of all sub-trades.

1.5 SAMPLES

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

.2 Deliver samples prepaid to Departmental Representative’s business address.

.3 Notify Departmental Representative in writing, at time of submission, of deviations in samples from requirements of Specifications.

1.6 OPERATING AND MAINTENANCE MANUALS

.1 Submit operating and maintenance manuals to Departmental Representative, per Section 01 78 23.

1.7 RECORD DRAWINGS

.1 Submit record drawings to Departmental Representative, per Section 01 78 00, upon completion of Work and prior to final inspection.

1.8 PROGRESS PHOTOGRAPHS

.1 On commencement of Work and at intervals thereafter, supply Departmental Representative with JPEG copies of three (3) different view photographs to indicate progress of Work. Take photographs from locations selected by Departmental Representative.

.2 On completion of the Work, or at time designated by Departmental Representative provide one (1) JPEG copy of each of colour photograph of various interior and exterior views selected by Departmental Representative.

.3 Submit progress photographs (in JPEG format) with monthly application for payment.

1.9 CERTIFICATES AND TRANSCRIPTS

.1 Immediately after award of Contract, submit Alberta Workers Compensation Board clearance letter and transcription of insurance.

1.10 FEES, PERMITS AND CERTIFICATES

.1 Provide authorities having jurisdiction with information requested.

.2 Pay fees and obtain certificates and permits required.

.3 Furnish certificates and permits.

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 REFERENCES

.1 Transportation Association of Canada Manual of Uniform Traffic Control Devices (MUTCD) for Streets and Highways (Latest Edition).

1.2 PROTECTION OF PUBLIC TRAFFIC

.1 Comply with requirements of Acts, Regulations and By-Laws in force for regulation of traffic or use of roadways upon or over which it is necessary to carry out Work or haul materials or equipment.

.2 Do not close any lanes of road without written approval of the Owner and/or the Departmental Representative. Before re-routing traffic, erect suitable signs and devices in accordance with instructions contained in Part D of MUTCD.

.3 Provide and maintain road access and egress to property fronting along Work under Contract and in other areas as indicated, unless other means of road access exist that meets approval of Departmental Representative:

1.3 INFORMATIONAL AND WARNING DEVICES

.1 Provide and maintain signs, flashing warning lights, and other devices required to indicate construction activities or other temporary and unusual conditions resulting from Project Work which requires road user response.

.2 Supply and erect signs, delineators, barricades and miscellaneous warning devices as specified in Part D, Temporary Conditions Signs and Devices, of the MUTCD.

.3 Place signs and other devices in locations recommended in the MUTCD.

.4 Meet with Departmental Representative prior to commencement of Work to prepare list of signs and other devices required for project. If situation on site changes revise list to written approval of Departmental Representative.

.5 Continually maintain traffic control devices in use by:

.1 Checking signs daily for legibility, damage, suitability and location. Clean, repair or replace to ensure clarity and reflectance.

.2 Removing or covering signs which do not apply to conditions existing from day to day.

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 REFERENCES

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

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

.1 Material Safety Data Sheets (MSDS).

.3 National Building Code 2015 (NBC):

.1 NBC 2015, Division B, Part 8 Safety Measures at Construction and Demolition Sites.

.4 National Fire Code 2015 (NFC):

.1 NFC 2015, Division B, Part 5 Hazardous Processes and Operations, subsection 5.6.1.3 Fire Safety Plan.

.5 Province of Alberta:

.1 Occupational Health and Safety Act, Revised 2012.

.2 Occupational Health and Safety Regulation.

.3 Alberta Workers Compensation Act (2000).

.4 Municipal statutes and authorities.

.6 Treasury Board of Canada Secretariat (TBS):

.1 Treasury Board, Fire Protection Standard April 1, 2010 www.tbs-sct.gc.ca/pol/doc-eng.aspx ?id=17316&section=text.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3 SAFETY PLAN

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

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

1.4 RESPONSIBILITY

.1 The "Prime Contractor" according applicable local jurisdiction, is responsible for health and safety of persons on site, safety of property on site and for protection of persons adjacent to site and environment to extent that they may be affected by conduct of Work.

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

.3 Should any unforeseen or peculiar safety-related factor, hazard, or condition become evident during performance of Work, and follow procedures in place for Employee's Right to Refuse Work in accordance with Acts and Regulations of Territory having jurisdiction. Advise Departmental Representative verbally and in writing.

1.5 SUBMITTALS

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

.2 Submit site-specific Health and Safety Plan for review by Departmental Representative and PSPC within seven days after date of Award 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 found in work plan.

.3 On-site contingency and Emergency Response Plan.

.4 Site control measures employed at site including site map, site Work zones, site communications, alerting means for emergencies, standard operating procedures or safe work practices, and identification of nearest medical assistance.

.5 Emergency response requirements addressing: pre-emergency planning, personnel roles, lines of authority and communication, emergency recognition and prevention, safe distances and places of refuge, site security and control, evacuation routes and procedures, decontamination procedures not covered under decontamination section, emergency medical treatment and first aid, emergency alerting and response procedures, critique of response and follow-up, PPE and emergency equipment, site topography, layout, prevailing weather conditions, and procedures for reporting incidents to local, provincial, or federal agencies.

.6 Procedures dealing with heat and/or cold stress.

.7 Spill containment program if waste material is generated, excavated, stored, or managed on site.

.8 First Aid Kit and location.

.9 Spill Response Plan.

.10 Spill Prevention Plan.

.11 First Aid Certificates as required by Alberta Occupational Health and Safety regulations.

.3 Submit electronic copy of Contractor's authorized representative's work site health and safety inspection reports to Departmental Representative.

.4 Submit copies of reports or directions issued by Federal and Provincial Health and Safety Inspectors. Submit verbal report immediately followed by a written report within 24 hours to the Departmental Representative.

.5 Submit copies of incident and accident reports. Submit verbal report immediately followed by a written report within 24 hours to the Departmental Representative.

.6 Submit Fire Safety Plan, specific to the work location, prior to commencement of work. The plan shall be coordinated with, and integrated into, the existing Emergency Procedures and Evacuation Plan in place at the site. Departmental Representative will provide National Park Emergency Procedures and Evacuation Plan. Deliver two copies of the Fire Safety Plan to the Departmental Representative not later than 14 days before commencing work.

.7 Submit Contractor's and Sub-contractors' Safety Communication Plan.

.8 Departmental Representative will review Contractor's site-specific Health and Safety Plan including on-site Contingency and Emergency Response Plan, Spill Prevention and Spill Response Plan and provide comments to Contractor within 5 days after receipt of plan. Revise plan as appropriate and resubmit plan to Departmental Representative 3 days after receipt of comments from Departmental Representative.

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

.10 Submit name of Health and Safety Coordinator and other personnel responsible for site safety and health.

.11 Submit resume of Health and safety Coordinator within 14 days of notice to Proceed.

.12 Submit records of Contractor's Health and Safety meetings when requested.

.13 Submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 02 81 01 - Hazardous Materials.

.14 Submit 1 copy of Contractor's authorized representative's work site health and safety inspection reports to Departmental Representative daily.

.15 Submit copies of orders, directions or reports issued by health and safety inspectors of the authorities having jurisdiction.

.16 Submit copies of incident and accident reports.

.17 Submit Workplace Safety and Insurance Board (WSIB)- Experience Rating Report.

1.6 FILING OF NOTICE

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

1.7 WORK PERMIT

.1 Obtain building and construction/demolition permits related to project prior to commencement of Work.

1.8 SAFETY ASSESSMENT

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

1.9 MEETINGS

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

1.10 PROJECT/SITE CONDITIONS

.1 Work at site will involve contact with:

.1 Combustible petroleum vapors and liquids

.2 Lead in paint.

.3 Storage tank waste materials and sludge.

.4 Benzene in fuel oil, paints and adhesives and sludge.

.5 Possible hot weather and wet conditions.

1.11 GENERAL REQUIREMENTS

.1 Ensure Health and Safety guidelines provide for safe and minimal risk for site personnel and minimize impact of activities involving contact with hazardous materials or hazardous wastes on general public and surrounding environment.

.2 Relief from or substitution for any portion or provision of minimum Health and Safety standards specified herein or reviewed site-specific Health and Safety Plan shall be submitted to Departmental Representative in writing.

1.12 COMPLIANCE REQUIREMENTS

.1 Comply with Alberta Occupational Health and Safety Act and Regulations

.2 Comply with Canada Labour Code, Canada Occupational Safety and Health Regulations.

1.13 RESPONSIBILITY

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

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

1.14 UNFORSEEN HAZARDS

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

.2 Follow procedures in place for Employees Right to Refuse Work as specified in the Occupational Health and Safety Act and Regulations for the Province of Alberta.

1.15 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 site-related working experience specific to activities associated with PHC impacted soil.

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

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

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

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

1.16 POSTING OF DOCUMENTS

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

1.17 CORRECTION OF NON-COMPLIANCE

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

.2 Provide Departmental Representative with written report of action taken to correct non-compliance of health and safety issues identified within 24 hours of such notice.

.3 Departmental Representative may stop Work if non-compliance of health and safety regulations is not corrected or at any time.

1.18 BLASTING

.1 Blasting or other use of explosives is not permitted.

1.19 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.

1.20 PERSONNEL HEALTH, SAFETY, AND HYGIENE

.1 Training: ensure personnel entering site are trained in accordance with specified personnel training requirements.

.2 Levels of Protection: establish levels of protection for each Work area based on planned activity and location of activity.

.3 Personal Protective Equipment:

.1 Furnish site personnel with appropriate PPE. Ensure that safety equipment and protective clothing is kept clean and maintained. Include requirements in Health and Safety Plan.

.4 Heat Stress/Cold Stress: implement heat stress, cold stress monitoring program as applicable and include in site-specific Health and Safety Plan.

.5 Emergency and First-Aid Equipment:

.1 Locate and maintain emergency and first-aid equipment in appropriate location onsite including first-aid kit to accommodate number of site personnel; portable emergency eye wash; two 9 kg ABC type dry chemical fire extinguishers.

.2 As minimum, provide on-site at all times when Work activities are in progress 1 first-aid technician holding at a minimum a Standard First Aid and CPR Level C certification recognized in Canada, as per Canada Labour Code and Alberta Occupational Health and Safety regulations. Provide proof of certification within 5 days of Award.

.6 Safety Meetings: conduct mandatory daily safety meetings for all personnel on site, Departmental Representative, and additionally as required by special or Work-related conditions; include refresher training for existing equipment and protocols, review ongoing safety issues and protocols, and examine new site conditions as encountered. Hold additional safety meetings on as-needed basis.

1.21 FIRE PROTECTION

.1 Provide and maintain temporary fire protection equipment during performance of Work required by governing codes, regulations and bylaws.

.2 Burning rubbish and construction waste materials is not permitted on site.

1.22 SITE CONTROL

.1 Meet specified requirements as indicated in Section 01 14 00 - Work Restrictions, Section 01 35 43 - Environmental Procedures, Section 01 52 00 - Construction Facilities, Section 01 74 11 - Cleaning and Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

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 DEFINITIONS

.1 Environmental Pollution and Damage: presence of chemical, physical, biological elements or agents which adversely affect human health and welfare; unfavourably alter ecological balances of importance to human life; affect other species of importance to humankind; or degrade environment aesthetically, culturally and/or historically.

.2 Environmental Protection: prevention/control of pollution and habitat or environment disruption during construction.

1.2 REFERENCES AND CODES

.1 Perform Works in accordance all applicable codes and standards including all amendments and other codes of Federal, Provincial, Municipal or local application, provided that in case of conflict or discrepancy more stringent requirements apply.

.2 Meet or exceed requirements of:

.1 Contract documents.

.2 Specified standards, codes and referenced documents.

.3 Meet or exceed the governing codes, standards and guidelines, and regulations applicable to Work and issued under the authority of the Government of Canada and Alberta as follows, latest edition, but not limited to:

.1 National Building Code of Canada, 2015.

.2 National Fire Code of Canada, 2015.

.3 Canada Labour Code Part 11- Occupational Health and Safety (R.S. 1985, c.L-2).

.4 CCME, Canadian Environmental Quality Guidelines, http://st-ts.ccme.ca/.

.5 Canadian Environmental Protection Act. (CEPA), 1999, c.33.

.6 Canadian Environmental Assessment Act (CEAA), (2012).

.7 Canada Labour Code (1985, c. L-2) – Canadian Occupational Health and Safety Regulations (SOR/86-304).

.8 Transportation of Dangerous Goods Regulation, *SOR/2001-286, Canada Gazette Part II, August 2001.*

1.3 WHMIS

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

1.4 REGULATORY REQUIREMENTS

.1 Perform work in accordance with the Canadian Environmental Protection Act.

.2 Provide erosion and sediment control in accordance to regulations of authorities having jurisdiction.

.3 Comply with Federal, Provincial, Municipal and local laws, ordinances, codes, and regulations when disposing of waste materials, debris, and rubbish.

.4 Work to meet or exceed minimum requirements established by Federal, Provincial, Municipal and local laws and regulations which are applicable.

.1 Contractor: responsibility for complying with amendments as they become effective.

.5 In event that compliance exceeds scope of work of conflicts with specific requirements of contract notify Departmental Representative immediately.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Submit Environmental Protection Plan for review by Departmental Representative within seven days after date of Award.

.3 Environmental Protection Plan must include comprehensive overview of known or potential environmental issues to be addressed during construction.

.4 Address topics at level of detail commensurate with environmental issue and required construction tasks.

.5 Include in Environmental Protection Plan:

.1 Names of persons responsible for ensuring adherence to Environmental Protection Plan.

.2 Names and qualifications of persons responsible for manifesting hazardous waste to be removed from site.

.3 Name and qualifications of person responsible for training site personnel.

.4 Work area plan showing proposed activity in each portion of area and identifying areas of limited use or non-use.

.1 Plan to include measures for marking limits of use areas and methods for protection of features to be preserved within authorized work areas.

.5 Erosion and sediment control plan identifying type and location of erosion and sediment controls to be provided, including monitoring and reporting requirements to assure that control measures are in compliance with erosion and sediment control plan, and Federal, Provincial and Municipal laws.

.6 Spill Control Plan including procedures, instructions, and reports to be used in event of unforeseen spill of regulated substance.

.7 Non-Hazardous solid waste disposal plan identifying methods and locations for solid waste disposal including clearing debris.

.8 Air pollution control plan detailing provisions to assure that dust, debris, materials, and trash, are contained on project site.

.9 Contaminant Prevention Plan identifying potentially hazardous substances to be used on job site; intended actions to prevent introduction of such materials into air, water, or ground; and detailing provisions for compliance with Federal,

Provincial, and Municipal laws and regulations for storage and handling of these materials.

1.6 FIRES

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

1.7 DRAINAGE

.1 Provide temporary drainage and pumping as necessary to keep work area and site free from water.

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

.3 Control disposal and/or runoff of water containing suspended materials or other harmful substances in accordance with local authority requirements.

1.8 SITE CLEARING AND PLANT PROTECTION

.1 Protect trees and plants from damage within the area of the Work, where applicable.

.2 Minimize over stripping of topsoil and vegetation.

.3 Protect and avoid contact with trees and shrubs adjacent to construction work, storage areas and trucking lanes.

.4 Imported fill materials must be free of seeds of any invasive plant species.

1.9 POLLUTION CONTROL

.1 Control emissions from equipment and plant in accordance with local authorities' emission requirements.

.2 Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious toxic substances and pollutants produced by construction operations.

.3 Be prepared to intercept, clean up, and dispose of spills or releases that may occur whether on land or water. Maintain materials and equipment required for cleanup of spills or releases readily accessible on site.

.4 Immediately report spills and releases potentially causing damage to environment to:

.1 Authority having jurisdiction and/or interest in spill and/or release including: the fire department, conservation authority, water supply authorities, drainage authority and/or road authority, as applicable.

.2 Owner of pollutant, if known.

.3 Person having control over pollutant, if known.

.4 Departmental Representative.

.5 Take immediate action using available resources to contain and mitigate effects on environment and persons from spill or release, if safe to do so.

.6 Provide spill response materials as detailed in the accepted spill response plan including at a minimum, containers, adsorbent, shovels, and personal protective equipment. Make

spill response materials available at all times in which hazardous materials or wastes are being handled or transported. Spill response materials: compatible with type of material being handled and as detailed in Emergency Response Plan.

1.10 NOTIFICATION

.1 Departmental Representative will notify Contractor in writing of observed noncompliance with Federal, Provincial or Municipal environmental laws or regulations, permits, and other elements of Contractor's Environmental Protection Plan.

.2 Contractor: after receipt of such notice, inform Departmental Representative within 24 hours of proposed corrective action and take such action for approval by Departmental Representative.

.3 No time extensions granted or equitable adjustments allowed to Contractor for such suspensions.

1.11 WILDLIFE

.1 Do not approach, feed or harass the wildlife.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

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

.1 Contractor will provide all refuse and recycling bins required to complete Work.

.2 Remove recycling and refuse containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General

1.1 REFERENCES AND CODES

.1 Perform Work in accordance with National Building Code of Canada (NBC) 2015 and National Fire Code of Canada (NFC) 2015 including all amendments up to bid closing date and other codes of provincial or local application provided that in case of conflict or discrepancy, more stringent requirements apply as directed by the Departmental Representative.

.2 Meet or exceed requirements of:

.1 Contract documents.

.2 Specified standards, codes and referenced documents.

1.2 HAZARDOUS MATERIAL DISCOVERY

.1 Stop work immediately and notify Departmental Representative if materials which may contain designated substances or PCB's are discovered in course of work.

1.3 BUILDING SMOKING ENVIRONMENT

.1 Comply with site and building smoking restrictions.

1.4 RELICS AND ANTIQUITIES

.1 Relics and antiquities, and items of historical or scientific interest such as cornerstones and contents, commemorative plaques, inscribed tables, and similar objects found on site shall remain the property of Parks Canada. Protect such articles and request directives from Departmental Representative.

.2 Should historic objects be uncovered, stop work immediately and notify the Departmental Representative. Do not resume work until directed to by the Departmental Representative.

1.5 TAXES

.1 Pay applicable Federal, Provincial and Municipal taxes.

1.6 EXAMINATION

.1 Examine existing conditions and determine conditions affecting work.

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 REFERENCES

.1 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.189-2000, Exterior Alkyd Primer for Wood.

.2 CAN/CGSB-1.59-97, Alkyd Exterior Gloss Enamel.

.2 Canadian Standards Association (CSA International)

.1 CSA A23.1-14/A23.2-14, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.

1.2 INSTALLATION AND REMOVAL

.1 Prepare and submit site plan within 10 days prior to mobilization to site indicating proposed location and dimensions of area to be fenced and used by Contractor, number of trailers to be used, avenues of ingress/egress to fenced area and details of fence installation.

.2 Indicate use of supplemental or other staging area.

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

.4 Remove from site all such work after use.

1.3 SITE STORAGE/LOADING

.1 Confine work and operations of employees by Contract Documents. Do not unreasonably encumber premises with products.

.2 Do not load or permit to load any part of Work with weight or force that will endanger Work.

1.4 CONSTRUCTION PARKING

.1 Parking will be permitted on site as directed by the Departmental Representative. Construction parking shall not interfere with facility operations.

.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.

1.5 EQUIPMENT, TOOL AND MATERIALS STORAGE

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

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

1.6 SANITARY FACILITIES

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

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

1.7 CONSTRUCTION SIGNAGE

.1 No other signs or advertisements, other than warning signs, are permitted on site.

.2 Signs and notices for safety and instruction in both official languages with Graphic symbols to CAN/CSA-Z321.

.3 Maintain approved signs and notices in good condition for duration of project, and dispose of off-site on completion of project or earlier if directed by Departmental Representative.

1.8 PROTECTION AND MAINTENANCE OF TRAFFIC

.1 Provide access and temporary relocated roads as necessary to maintain traffic.

.1 Maintain and protect traffic on affected roads during construction period except as otherwise specifically directed by Departmental Representative.

.2 Existing site access is from a seasonal gravel road that has speed restrictions and requires regular maintenance.

.3 Provide measures for protection and diversion of traffic, including provision of watch-persons and flag-persons, erection of barricades, placing of lights around and in front of equipment and work, and erection and maintenance of adequate warning, danger, and direction signs.

.4 Protect travelling public from damage to person and property.

.5 Contractor's traffic on roads selected for hauling material to and from site to interfere as little as possible with public traffic.

.6 Verify adequacy of existing roads and allowable load limit on these roads. Contractor: responsible for repair of damage to roads caused by construction operations.

.7 Provide necessary lighting, signs, barricades, and markings for safe movement of traffic.

.8 Dust control: adequate to ensure safe operation at all times.

.9 Provide snow removal during period of Work.

1.9 CLEAN-UP

.1 Remove construction debris, waste materials, packaging material from work site daily.

.2 Clean dirt or mud tracked onto paved or surfaced roadways.

.3 Store materials resulting from demolition or decommissioning activities that are salvageable.

.4 Recovered hazardous wastes to be disposed of in accordance with authority having jurisdiction. Provide a copy of manifests to owner.

.5 Clean salvaged material and load and haul to approved waste disposal or recycling facility.

.6 Clean-up in accordance with Section 01 74 11 - Cleaning.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 TEMPORARY EROSION AND SEDIMENTATION CONTROL

.1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust according to requirements of authorities having jurisdiction.

.2 Inspect, repair, and maintain erosion and sedimentation control measures during construction.

.3 Remove any temporary erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

END OF SECTION

Part 1 General

1.1 INSTALLATION AND REMOVAL

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

.2 Remove from site all temporary works after use.

1.2 ACCESS TO SITE

.1 Existing site access is from a seasonal gravel road that has speed restrictions and requires regular maintenance.

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

1.3 FIRE ROUTES

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

.2 The existing access road extending along on the west side of the property is used by the tenant and property Owner for emergency vehicle access to the airfield and shall not be used by the Contractor without prior written authorization from the Departmental Representative.

1.4 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 at no additional cost.

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 REFERENCE STANDARDS

.1 Canadian Construction Documents Committee (CCDC)

.1 CCDC 2-Stipulated Price Contract.

.2 Within text of each specifications section, reference may be made to reference standards. List of standards reference writing organizations is provided.

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

.4 If there is question as to whether products or systems are in conformance with applicable standards, Departmental Representative reserves right to have such products or systems tested to prove or disprove conformance.

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

1.2 QUALITY

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

.2 Procurement policy is to acquire, in cost effective manner, items containing highest percentage of recycled and recovered materials practicable consistent with maintaining satisfactory levels of competition. Make reasonable efforts to use recycled and recovered materials and in otherwise utilizing recycled and recovered materials in execution of work.

.3 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.

.4 Should disputes arise as to quality or fitness of products, decision rests strictly with Departmental Representative based upon requirements of Contract Documents.

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

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

1.3 AVAILABILITY

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

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

1.4 STORAGE, HANDLING AND PROTECTION

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

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

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

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

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

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

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

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

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

.10 Storage must be supplied by the Contractor.

1.5 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 Departmental Representative. Unload, handle and store such products.

1.6 MANUFACTURER'S INSTRUCTIONS

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

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

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

1.7 QUALITY OF WORK

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

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

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

1.8 CO-ORDINATION

.1 Ensure co-operation of workers in laying out Work. Maintain efficient and continuous supervision.

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

1.9 CONCEALMENT

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

.2 Before installation inform Departmental Representative if there is interference. Install as directed by Departmental Representative.

1.10 LOCATION OF FIXTURES

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

.2 Inform Departmental Representative of conflicting installation. Install as directed.

1.11 FASTENINGS

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

.2 Prevent electrolytic action between dissimilar metals and materials.

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

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

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

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

1.12 FASTENINGS - EQUIPMENT

.1 Use fastenings of standard commercial sizes and patterns with material and finish suitable for service.

.2 Use heavy hexagon heads, semi-finished unless otherwise specified. Use No. 304 stainless steel for exterior areas.

.3 Bolts may not project more than one diameter beyond nuts.

.4 Use plain type washers on equipment, sheet metal and soft gasket lock type washers where vibrations occur. Use resilient washers with stainless steel.

1.13 PROTECTION OF WORK IN PROGRESS

.1 Prevent overloading of parts of building. Do not cut, drill or sleeve load bearing structural member, unless specifically indicated without written approval of Departmental Representative.

1.14 EXISTING UTILITIES

.1 When breaking into or connecting to existing services or utilities, execute Work at times directed by local governing authorities, with minimum of disturbance to Work, and pedestrian and vehicular traffic.

.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.

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 PREPARATION

.1 Inspect existing conditions, including elements subject to damage or movement during cutting and patching.

.2 After uncovering, inspect conditions affecting performance of Work.

.3 Beginning of cutting and patching means acceptance of existing conditions.

.4 Provide temporary structural supports to ensure structural integrity of surroundings.

.5 Provide devices and methods to protect other portions of project from damage.

.6 Provide protection from elements for areas which may be exposed by uncovering work.

.7 Maintain excavations free of water.

1.2 MANUFACTURER'S INSTRUCTIONS

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

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

.3 Improper installation or erection of Products, due to failure in complying with these requirements, authorizes Departmental Representative to require removal and re-installation at no increase in Contract Amount.

1.3 WORKMANSHIP

.1 General:

.1 Execute work by workers experienced and skilled in the respective duties for which they are employed. Notify Departmental Representative immediately if required Work is such as to make it impractical to produce required results.

.2 Do not employ any unfit person or anyone unskilled in their required duties. Departmental Representative reserves the right to require the dismissal from the site, of workers deemed incompetent, careless, insubordinate or otherwise objectionable.

.3 Decisions as to the quality or fitness of workmanship in cases of dispute rest solely with Departmental Representative, whose decision is final.

.2 Co-Ordination:

.1 Ensure co-operation of workers in laying out Work. Maintain efficient and continuous supervision.

.2 Be responsible for co-ordination and placement of openings, sleeves and accessories.

.3 Protection of Work in Progress:

.1 Adequately protect Work completed or in progress. Work damaged or defaced due to failure in providing such protection is to be removed and replaced, or repaired, as directed by Departmental Representative, at no increase in Contract Amount.

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

.4 Remedial Work:

.1 Perform remedial work required to repair or replace the parts or portions of Work identified as defective or unacceptable. Coordinate adjacent affected Work as required.

.2 Perform remedial work by specialists' familiar with the materials affected. Perform in a manner to neither damage nor endanger any portion of Work.

.5 Location of Fixtures:

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

.2 Inform Departmental Representative of a conflicting installation. Install as directed.

1.4 EXISTING UTILITIES

.1 When breaking into or connecting to existing services or utilities, execute Work at times directed by local governing authorities, with a minimum of disturbance to Work, and/or building occupants.

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

.3 No shutdown may occurring without 2 weeks notice and approval from the local maintenance staff.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 NOT USED

END OF SECTION

Part 1 General

1.1 MANUAL

.1 An organized compilation of operating and maintenance data including detailed technical information, documents and records describing operation, warranties and maintenance of individual products or systems.

1.2 GENERAL INSTRUCTIONS

.1 Assemble, coordinate, bind, and index required data into Operation and Maintenance Manual.

.2 Submit four (3) hardcopies and four (3) electronic copies attached to each hard copy of the complete operation and maintenance manual to the Departmental Representative within 2 weeks of project completion.

.3 Material: label each section with tabs protected with celluloid covers fastened to hard paper dividing sheets.

.4 Type lists and notes.

.5 Drawings, diagrams, and manufacturer's literature must be legible.

1.3 BINDERS

.1 Binders: vinyl, hard covered, 3 "D" ring, loose leaf, sized for 215 x 280 mm paper, with spine pocket.

.2 Identify contents of each binder on spine.

1.4 CONTENTS

.1 Cover sheet containing:

- .1 Date submitted.
- .2 Project title, location, and project number.
- .3 Names and addresses of Contractor and all subcontractors.

.2 Table of Contents of all binders.

.3 List of maintenance materials provided.

.4 List of special tools provided.

.5 List of spare parts provided.

.6 Warranties, guarantees.

.7 Copies of approvals and certificates.

1.5 PRODUCT DATA

.1 Provide the following data:

- .1 List of equipment including service depot.
- .2 Nameplate information including equipment number, make, size, capacity, model number, and serial number.
- .3 Parts list.

.4 Installation details.

.5 Operating instructions.

.6 Maintenance instructions for equipment.

.7 Maintenance instructions for finishes.

.2 Shop drawings:

.1 One complete set of reviewed final shop drawings and product data.

.3 Warranties:

.1 One complete set of manufacturer warranties.

Part 2 Products

2.1 NOT USED

2.1.1 Not used.

Part 3 Execution

3.1 NOT USED

3.1.1 Not used.

END OF SECTION

Part 1 General

1.1 PROJECT CLEANLINESS

.1 Maintain work in tidy condition, free from accumulation of waste products and debris.

.2 Remove waste materials from site at daily regularly scheduled times or dispose of as directed by Departmental Representative. Do not burn waste materials on site.

.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 Dispose of waste materials and debris off site.

.6 Store volatile waste in covered metal containers, and remove from premises at end of each working day.

.7 Provide adequate ventilation during use of volatile or noxious substances.

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

.9 Remove waste material and debris from site and deposit in waste container at end of each working day.

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

1.2 FINAL CLEANING

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

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

.3 Prior to inspection by Departmental Representative and as per Section 01 77 00 - Closeout Procedures, 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 Departmental Representative. Do not burn waste materials on site.

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

.7 Clean, load and ship salvaged materials to approved waste disposal or recycling facility.

1.3 WASTE MANAGEMENT AND DISPOSAL

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

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 REFERENCES

.1 Definitions:

.1 Approved/Authorized recycling facility: waste recycler approved by applicable Provincial authority or other users of material for recycling approved by the Departmental Representative.

.2 Inert Fill: inert waste - exclusively asphalt and concrete.

.3 Recyclable: ability of product or material to be recovered at end of its life cycle and re-manufactured into new product for reuse.

.4 Recycle: process by which waste and recyclable materials are transformed or collected for purpose of being transferred into new products.

.5 Recycling: process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for purpose of using in altered form. Recycling does not include burning, incinerating, or thermally destroying waste.

.6 Salvage: Removal of structural and non-structural materials from deconstruction/disassembly projects for purpose of reuse or recycling.

.2 Reference Standards:

.1 Canadian Construction Association (CCA)

.1 CCA 81-2001: A Best Practices Guide to Solid Waste Reduction.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Prepare and submit on weekly basis, throughout project and/or at intervals agreed to in writing by Departmental Representative the following:

.1 Original receipts, scale tickets, waybills, and/or waste disposal receipts that show quantities and types of materials recycled or disposed of. Contractor invoices will not be paid until original receipts have been submitted and verified by Departmental Representative.

1.3 USE OF SITE AND FACILITIES

.1 Execute Work with minimal interference and disturbance to normal use of premises.

.2 Provide temporary security measures approved by Departmental Representative, where required.

1.4 WASTE PROCESSING SITES

.1 Contractor is responsible to do research and locate waste diversion resources and service providers. Waste materials are to be transported off site to approved and/or authorized recycling facilities. Contractor to provide proof of disposal for all materials removed from site.

1.5 STORAGE, HANDLING AND PROTECTION

.1 Store materials to be disposed of off-site at locations as directed by Departmental Representative.

.2 Separate non-salvageable materials for transport and delivery to licensed disposal facility.

.3 Protect structural components not removed from movement or damage.

.4 Protect surface drainage from damage and blockage.

.5 Handle materials in accordance with requirements for acceptance by designated processing facilities.

1.6 DISPOSAL OF WASTES

.1 Do not bury rubbish or waste materials.

.2 Do not dispose of waste into waterways, storm, or sanitary sewers.

.3 Keep records of waste including: waste type; tonnage generated for off-site disposal; tonnage recycled; and waste destination.

.4 Provide original waste manifest to Departmental Representative.

.5 Remove materials off-site as Work progresses.

1.7 SCHEDULING

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

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 APPLICATION

.1 Handle waste materials in accordance with all applicable regulations and codes.

3.2 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

END OF SECTION

Part 1 General

1.1 MATERIALS

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

1.2 FINAL CLEANING

.1 In preparation for Certificate of Completion or Total Performance of the project, perform final cleaning.

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

.3 Remove waste products and debris other than that caused by building occupants or other Contractors.

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

.5 Remove grease, dust dirt, stains, labels, fingerprints, and other foreign materials, from interior and exterior finished surfaces affected by our work.

.6 Remove debris and surplus materials.

.7 Remove snow and ice around the work area.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 NOT USED

END OF SECTION

Part 1 General

1.1 ADMINISTRATIVE REQUIREMENTS

.1 Acceptance of Work Procedures:

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

.1 Notify Departmental Representative in writing of satisfactory completion of Contractor's inspection and submit verification that corrections have been made.

.2 Request Departmental Representative inspection within 24 hours of project completion.

.2 Departmental Representative Inspection:

.1 Departmental Representative and Contractor to inspect Work and identify defects and deficiencies.

.2 Contractor to correct Work as directed.

.3 Completion Tasks: submit written certificates that tasks have been performed as follows:

.1 Work: completed and inspected for compliance with Contract Documents, including submittal of all original waste manifests and tank destruction certificates.

.2 Defects: corrected and deficiencies completed.

.3 Equipment and systems have been tested and are fully operational.

.4 Operation of systems have been demonstrated to facility personnel.

.5 Certificates required by authorities having jurisdiction: submitted.

.6 Work: complete and ready for final inspection.

.4 Final Inspection:

.1 When completion tasks are done, request final inspection of Work by Departmental Representative, and Contractor.

.2 When Work incomplete according to Owner and Departmental Representative, complete outstanding items and request re-inspection.

.5 Declaration of Substantial Performance: when Departmental Representative considers deficiencies and defects corrected and requirements of Contract substantially performed, make application for Certificate of Substantial Performance.

.6 Final Payment:

.1 When Departmental Representative considers final deficiencies and defects corrected and requirements of Contract met, make application for final payment.

.2 When Work deemed incomplete by Departmental Representative, complete outstanding items and request re-inspection.

1.2 FINAL CLEANING

.1 Clean in accordance with Section 01 74 11 - Cleaning.

.1 Remove waste and surplus materials, excess materials, rubbish, tools and equipment in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

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 ADMINISTRATIVE REQUIREMENTS

.1 Pre-warranty Meeting:

.1 Convene meeting one week prior to contract completion with Departmental Representative to:

.1 Verify Project requirements.

.2 Review manufacturer's installation instructions and warranty requirements.

.2 Departmental Representative to establish communication procedures for:

.1 Notifying construction warranty defects.

.2 Determine priorities for type of defects.

.3 Determine reasonable response time.

.3 Contact information for bonded and licensed company for warranty work action: provide name, telephone number and address of company authorized for construction warranty work action.

.4 Ensure contact is located within local service area of warranted construction, is continuously available, and is responsive to inquiries for warranty work action.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Two weeks prior to Substantial Performance of the Work, submit to the Departmental Representative, 2 final copies of operating and maintenance manuals in English.

.3 Provide spare parts, maintenance materials and special tools of same quality and manufacture as products provided in Work.

.4 Provide evidence, if requested, for type, source and quality of products supplied.

1.3 FORMAT

.1 Organize data as instructional manual.

.2 Binders: vinyl, hard covered, 3 'D' ring, loose leaf 219 x 279 mm with spine and face pockets.

.3 When multiple binders are used correlate data into related consistent groupings.

.1 Identify contents of each binder on spine.

.4 Cover: identify each binder with type or printed title 'Project Record Documents'; list title of project and identify subject matter of contents.

.5 Arrange content by systems, under Section numbers and sequence of Table of Contents.

.6 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.

.7 Text: manufacturer's printed data, or typewritten data.

.8 Drawings: provide with reinforced punched binder tab.

.1 Bind in with text; fold larger drawings to size of text pages.

.9 Provide 1:1 scaled CAD files in .dwg format on CD and email.

1.4 CONTENTS PROJECT RECORD DOCUMENTS

.1 Table of Contents for Each Volume: provide title of project;

.1 Date of submission; names.

.2 Addresses, and telephone numbers of Departmental Representative and Contractor with name of responsible parties.

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

.2 For each product or system:

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

.3 Product Data: mark each sheet to 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.

.1 Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

1.5 AS-BUILT DOCUMENTS AND SAMPLES

.1 Maintain, at site for Departmental Representative one record copy of:

.1 Contract Drawings.

.2 Specifications.

.3 Addenda.

.4 Change Orders and other modifications to 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.

.1 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.

.1 Label each document "PROJECT RECORD" in neat, large, printed letters.

.4 Maintain record documents in clean, dry and legible condition.

.5 Do not use record documents for construction purposes.

.6 Keep record documents and samples available for inspection by Departmental Representative.

1.6 RECORDING INFORMATION ON PROJECT RECORD DOCUMENTS

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

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

.3 Record information concurrently with construction progress.

.1 Do not conceal Work until required information is recorded.

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

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

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

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

.8 Field changes of dimension and detail.

.9 Changes made by change orders.

.10 Details not on original Contract Drawings.

.11 References to related shop drawings and modifications.

.12 Specifications: 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.

.13 Other Documents: maintain manufacturer's certifications, required by individual specifications sections.

.14 Provide digital photos, if requested, for site records.

1.7 FINAL SURVEY

.1 NOT USED.

1.8 EQUIPMENT AND SYSTEMS

.1 For each item of equipment and each system include description of unit or system, and component parts.

.1 Give function, normal operation characteristics and limiting conditions.

.2 Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.

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

.3 Include installed colour coded wiring diagrams.

.4 Operating Procedures: include start up, break in, and routine normal operating instructions and sequences.

.1 Include regulation, control, stopping, shut down, and emergency instructions.

.2 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 Contractor's co-ordination drawings, with installed colour coded piping diagrams.

.12 Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

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

.14 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.

.1 Provide information for re ordering custom manufactured products.

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

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

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

1.10 MAINTENANCE MATERIALS

.1 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 items.

.1 Submit inventory listing to Departmental Representative.

.2 Include approved listings in Maintenance Manual.

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

.2 Extra Stock Materials:

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

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

.2 Deliver to site; place and store.

.3 Receive and catalogue items.

.4 Submit inventory listing to Departmental Representative.

.5 Include approved listings in Maintenance Manual.

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

.3 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 items.

.1 Submit inventory listing to Departmental Representative.

.2 Include approved listings in Maintenance Manual.

1.11 DELIVERY, STORAGE AND HANDLING

.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 for review by Departmental Representative.

1.12 WARRANTIES AND BONDS

.1 Develop warranty management plan to contain information relevant to Warranties.

.2 Submit warranty management plan, 30 days before planned pre-warranty conference, to Departmental Representative approval.

.3 Warranty management plan to include required actions and documents to assure that Departmental Representative receives warranties to which it is entitled.

.4 Provide plan in narrative form and contain sufficient detail to make it suitable for use by future maintenance and repair personnel.

.5 Submit, warranty information made available during construction phase, to Departmental Representative for approval prior to each monthly pay estimate.

.6 Assemble approved information in binder, submit upon acceptance of work and organize binder as follows:

.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 applicable item of work.

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

.5 Co-execute submittals when required.

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

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

.8 Include information contained in Warranty Management Plan as follows:

.1 Roles and responsibilities of personnel associated with warranty process, including points of contact and telephone numbers within the organizations of Contractors, subcontractors, manufacturers or suppliers involved.

.2 Provide list for each warranted equipment, item, feature of construction or system indicating:

.1 Name of item.

.2 Model and serial numbers.

.3 Location where installed.

.4 Name and phone numbers of manufacturers or suppliers.

.5 Names, addresses and telephone numbers of sources of spare parts.

.6 Warranties and terms of warranty: include one-year overall warranty of construction. Indicate items that have extended warranties and show separate warranty expiration dates.

.7 Cross-reference to warranty certificates as applicable.

.8 Starting point and duration of warranty period.

.9 Summary of maintenance procedures required to continue warranty in force.

.10 Cross-Reference to specific pertinent Operation and Maintenance manuals.

.11 Organization, names and phone numbers of persons to call for warranty service.

.12 Typical response time and repair time expected for various warranted equipment.

.3 Procedure and status of tagging of equipment covered by extended warranties.

.4 Post copies of instructions near selected pieces of equipment where operation is critical for warranty and/or safety reasons.

.9 Respond in timely manner to oral or written notification of required construction warranty repair work.

.10 Written verification to follow oral instructions.

.1 Failure to respond will be cause for the Departmental Representative to proceed with action against Contractor.

1.13 WARRANTY TAGS

.1 Tag, at time of installation, each warranted item. Provide durable, oil and water-resistant tag approved by Departmental Representative.

.2 Attach tags with copper wire and spray with waterproof silicone coating.

.3 Leave date of acceptance until project is accepted for occupancy.

.4 Indicate following information on tag:

.1 Type of product/material.

.2 Model number.

.3 Serial number.

.4 Contract number.

.5 Warranty period.

.6 Inspector's signature.

.7 Construction Contractor.

1.14 PTMAA

.1 Provide proof of PTMAA Verification of Compliance and certificates.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 NOT USED

END OF SECTION

Part 1 General

1.1 MANUAL

.1 An organized compilation of operating and maintenance data including detailed technical information, documents and records describing operation and maintenance of individual products or systems as specified in individual sections of Divisions 02 to 26.

1.2 GENERAL

.1 Prepare 3 copies of documentation including as-constructed shop drawings to instruct Departmental Representative's operations and maintenance staff in the operation and associated maintenance of each piece of equipment and system as supplied and installed.

.2 Submit a skeleton of the O&M Manual, including table of contents, section tabs, scale mock-up of printing proposed for the binders and sample of proposed record drawing storage mechanism, to Departmental Representative for approval before 60% of the work is approved for payment. No payment over 60% of the Contract value will be made until this is received.

.3 Submit the completed O&M Manuals before 90% of the work is approved for payment. No payment for any work will be made over 90% of the Contract value until completed O&M Manuals are received and accepted as satisfactory.

1.3 BINDERS

.1 Provide the material in 80 mm or 135 mm spine, 215 x 280 mm capacity extension type black catalogue binders bound in heavyweight fabricord with gold lettering on front and spine.

1.4 CONTENTS

.1 Arrange the material in volumes as described below. Provide a separate binder for each volume unless directed otherwise by Departmental Representative. Where more than one binder is required to accommodate the documentation for a volume, increase or decrease the number of volumes and renumber as necessary.

- .1 Volume 1 - Operating Manual.
- .2 Volume 2 - Architectural/Structural.
- .3 Volume 3 - Mechanical Operations and Maintenance.
- .4 Volume 4 - Electrical and Instrumentation Operations.

.2 Permanently number each set.

.3 Letter the spine of the binder with the full identification title of the project and the front face with the following on the respective binders:

- .1 Full identification title of the project.
- .2 Volume Number.
- .3 Volume Title.

.4 Department's name.

.5 Number of Sets (e.g. 1 of 3).

.4 All Volumes are the responsibility of Contractor. Provide the binders and the dividing tabs to Departmental Representative.

.5 Arrange the binders according to the Construction Specifications Institute MASTERFORMAT - Master List of Sections, Titles and Numbers, utilizing laminated Mylar plastic divider tabs, colour coded according to section. Markings on the tabs are to be type written. Tab colours are to be as follows:

.1 Division – white.

.2 Sections – orange.

.3 Subsections – yellow.

.6 Make up each binder as follows:

.1 Tab: Table of Contents - details the titles of various divisions of the manual in the binder.

.2 Tab: Introduction to manual - written explanation of the layout of the manual and intended use.

.7 Include separately the following:

.1 Departmental Representative: name, address, telephone and FAX numbers, name of Project Manager.

.2 Contractor: name, address, telephone and FAX numbers, name of Project Manager.

.3 Major Sub-Contractors: name, address, telephone and FAX numbers of sub-contractors included in that binder.

.8 Provide the following for each respective discipline:

.1 Tab: Division number xx:

.2 Index - information in that division in order of appearance in the specification.

.3 List of sub-contractors and suppliers - name, address, and telephone and FAX numbers.

.4 Specification section cross reference.

.5 Drawing List.

.9 Organize the various applicable sections under separate divider tabs labelled division/number as required by the project. A typical outline is as follows:

Tab: DIVISION 26 – ELECTRICAL SPECIFICATIONS

26 00 10 – Electrical General Requirements
26 05 02 – Electrical Field Inspection and Testing
26 05 21 – Wire and Cables (0-1000V)
26 05 28 – Grounding Secondary

.10 Provide the information given below, where applicable, for each system and major piece of equipment. Refer to each piece of equipment by its name and tag number.

Where manufacturer's literature covers several models or options, highlight the applicable information, using a non-fading marker, and cross out redundant information.

.1 Index of information in that section in order of appearance.

.2 Description of system, components and technical data. Include interfaces, sequences, operations; characteristic changes for seasonal operation.

.3 Maintenance and operating instructions including:

.1 Installation instructions.

.2 Procedure for starting.

.3 Proper adjustment.

.4 Test procedures.

.5 Procedure for operating.

.6 Procedure for shutdown.

.7 Safety precautions.

.8 List of electrical relay settings and control and alarm contact settings.

.4 Troubleshooting data.

.5 Preventative maintenance program, complete with:

.1 Suggested check list sheets.

.2 Schematic, single line, and wiring diagrams.

.3 Recommended spare parts list.

.4 Certification, guarantee, warranty.

.5 Service representatives - name, address and telephone number.

.6 Suppliers for replacement parts - name, address, and telephone numbers.

.7 Test results; witness testing and commissioning, reports.

.8 Inspection approval certificates for all types of systems; plumbing and piping, hot air and ventilating, electrical supervisory, etc.

.11 The material submitted in accordance with the contractual requirements for "As-Constructed Shop Drawings" is generally bulky and difficult to file in a binder. If requested by Departmental Representative, provide copies of all "As-Constructed Shop Drawing" material in a single drawer legal size cardboard file cabinet. Arrange in accordance with the Construction Specifications Canada MasterFormat. Identity any material located in the file cabinet as such in the appropriate location in the binders.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 NOT USED

END OF SECTION

Part 1 General

1.1 START-UP AND ADJUSTMENT

.1 Test, adjust, balance and put into trial operation all electrical, and control works and equipment prior to commissioning, as specified elsewhere in these documents.

.2 Provide electrical inspection/permit compliance letter.

1.2 COMMISSIONING

.1 The Commissioning Period is that period of time required to put the Work into continuous operation, to the satisfaction of Departmental Representative.

.2 Give Departmental Representative 48 hours prior notice before commencing commissioning procedures.

.3 Commission Work in an orderly fashion, system by system, where system is defined as an integral operating entity or loop.

.4 Provide sufficient trained and knowledgeable workers during the Commissioning Period to ensure smooth and orderly commissioning of Work.

.5 Make adjustments to equipment and other works, as necessary to place Work into operation.

.6 Trial operation:

.1 Trial operate all units.
.2 Check for overload and undue vibration.
.3 Measure Ground value and insulation.
.4 Make necessary adjustments.
.5 Check internet connection and data transfer.
.6 Check operation for ON-Grid and Zero-Export Operations.
.7 Generate a tracking report for power consumption and generation.
.8 Initial operation:
.9 Check operation, clearance and rigidity.
.10 Make necessary adjustments.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 NOT USED

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 General requirements relating to commissioning of project's components and systems, specifying general requirements to performance verification (PV) of components, equipment, sub-systems, systems, and integrated systems.

.2 Related Requirements

.1 All other sections.

.3 Acronyms:

.1 AFD - Alternate Forms of Delivery, service provider.

.2 OMM - Operation and Maintenance Manual.

.3 Cx - Commissioning.

.4 EMCS - Energy Monitoring and Control Systems.

.5 OM - Operation and Maintenance.

.6 PI - Product Information.

.7 PV - Performance Verification.

.8 TAB - Testing, Adjusting and Balancing.

1.2 GENERAL

.1 Commissioning (Cx) is a planned program of tests, procedures and checks carried out systematically on systems and integrated systems of the finished Project. Cx is performed after systems and integrated systems are completely installed, functional and Contractor's Performance Verification responsibilities have been completed and approved. Objectives:

.1 Verify installed equipment, systems and integrated systems operate in accordance with contract documents and design criteria and intent.

.2 Ensure appropriate documentation is compiled into the Operations and Maintenance manual (OMM).

.3 Effectively train Operation and Maintenance (OM) staff.

.2 Contractor assists in Cx process, operating equipment and systems, troubleshooting and making adjustments as required.

.1 Systems to be operated at full capacity under various modes to determine if they function correctly and consistently at peak efficiency.

.2 During these checks, adjustments to be made to enhance performance to meet environmental or user requirements.

.3 Design Criteria: as per client's requirements or determined by designer. To meet Project functional and operational requirements.

.4 Cx to be carried out in compliance with all applicable Federal and Provincial regulations and codes. In accordance with SOR/2008-197, Storage Tank Systems for Petroleum

Products and Allied Petroleum Products Regulations (STR), submit the following information to the Departmental Representative a minimum of 14 days prior to Cx:

.1 Design as-built drawings, bearing the stamp and signature of a professional engineer licensed to practice in the Province of Alberta and show:

.1 the outline of the tank;

.2 the centreline of all piping;

.3 the centreline of all underground electrical power and monitor sensor conduits;

.4 the building foundation outlines;

.5 the property lines; and

.6 the secondary containment systems.

.2 Information requirements identified in Schedule 2 of the STR.

.5 Cx will require fuel in the new tank. Fuel delivery will be coordinated by the Owner. Fuel cannot be delivered into the tank until it is labeled with an Environment and Climate Change Canada (ECCC) tank ID number, an emergency response plan is completed and the PTMAA and ECCC has granted approval to operate. A spill response kit must also be on site before fuel is delivered. The Owner is responsible for registering the tank system with ECCC, informing the Departmental Representative of completed registration, preparing the emergency response plan and providing the spill response kit. Contractor is to ensure that the new tank is labelled with the ECCC ID number before first filling. It is the Contractor's responsibility to schedule commissioning to coincide with the ECCC Tank ID labelling.

1.3 COMMISSIONING OVERVIEW

.1 Cx Plan to be provided to Departmental Representative a minimum of 14 days prior to Cx.

.2 Cx to be a line item of Contractor's cost breakdown.

.3 Cx activities supplement field quality and testing procedures described in relevant technical sections.

.4 Cx is conducted in concert with activities performed during stage of project delivery. Cx identifies issues in Planning and Design stages which are addressed during Construction and Cx stages to ensure the built facility is constructed and proven to operate satisfactorily under weather, environmental and occupancy conditions to meet functional and operational requirements. Cx activities include transfer of critical knowledge to facility operational personnel.

.5 Departmental Representative will review Contractor Cx work for the following:

.1 Completed Cx documentation has been received, reviewed for suitability and approved by the Departmental Representative.

.2 Equipment, components and systems have been commissioned and all deficiencies have been addressed.

.3 OM training and manual have been completed.

1.4 NON-CONFORMANCE TO PERFORMANCE VERIFICATION REQUIREMENTS

.1 Should equipment, system components, and associated controls be incorrectly installed or malfunction during Cx, correct deficiencies, re-verify equipment and components within the non-functional system, including related systems as deemed required by Departmental Representative, to ensure effective performance.

.2 Costs for corrective work, additional tests, inspections, to determine acceptability and proper performance of such items to be borne by Contractor.

1.5 PRE-CX REVIEW

.1 Before Construction and to be discussed at contract award meeting:

.1 Review contract documents, confirm by writing to Departmental Representative.

.1 Adequacy of provisions for Cx.

.2 Aspects of design and installation pertinent to success of Cx.

.2 During Construction:

.1 Co-ordinate provision, location and installation of provisions for Cx.

.3 Before start of Cx:

.1 Have completed Cx Plan up-to-date and submitted to Departmental Representative 14 days before Cx.

.2 Ensure installation of related components, equipment, sub-systems, and system is complete.

.3 Fully understand Cx requirements and procedures.

.4 Understand completely design criteria and intent and special features.

.5 Submit complete start-up documentation to Departmental Representative.

.6 Have Cx schedules up-to-date.

.7 Ensure systems have been cleaned thoroughly.

.8 Ensure that tank system has ECCC registration number attached and emergency response plan on site with spill response kit.

.4 Inform Departmental Representative in writing of discrepancies and deficiencies on finished works.

1.6 CONFLICTS

.1 Report conflicts between requirements of this section and other sections to Departmental Representative before Cx start-up and obtain clarification.

.2 Failure to report conflict and obtain clarification will result in application of most stringent requirement.

1.7 ACTION AND INFORMATIONAL SUBMITTALS

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

.1 Submit no later than 4 weeks after award of Contract and 14 days prior to Cx:

.1 Name of Contractor's Cx agent.

.2 Draft Cx documentation.

.3 Preliminary Cx schedule.

.2 Request in Request in writing to Departmental Representative for changes to submittals and obtain written approval at least 2 weeks prior to start of Cx.

.3 Submit proposed Cx procedures to Departmental Representative where not specified and obtain written approval at least 2 weeks prior to start of Cx.

.4 Provide additional documentation relating to Cx process required by Departmental Representative.

1.8 COMMISSIONING DOCUMENTATION

.1 Provide completed and approved Cx documentation to Departmental Representative 14 days prior to Cx.

1.9 COMMISSIONING SCHEDULE

.1 Provide detailed Cx schedule as part of construction schedule in accordance with Section 01 32 16.07 - Construction Progress Schedules - Bar Chart.

.2 Provide adequate time for Cx activities prescribed in technical sections and commissioning sections including:

.1 Approval of Cx reports.

.2 Verification of reported results.

.3 Repairs, retesting, re-commissioning, re-verification.

.4 Demonstration and Training.

1.10 STARTING AND TESTING

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

.2 Undertake precision leak detection testing of tank and piping in accordance with Storage Tank Systems for Petroleum Products and Allied Petroleum Products Regulations (SOR/2008-197).

.3 Submit standalone written records documenting procedures and results of all testing 5 days prior to Cx. Owner to supply fuel and tank must be registered with ECCC prior to testing.

1.11 WITNESSING OF STARTING AND TESTING

.1 Provide 14 days notice to Departmental Representative prior to commencement.

.2 Departmental Representative to witness of start-up and testing.

.3 Contractor's Cx Agent to be present at tests performed and documented by sub-trades, suppliers and equipment manufacturers.

1.12 PROCEDURES

.1 Verify that equipment and systems are complete, clean, and operating in normal and safe manner prior to conducting start-up, testing and Cx.

.2 Correct deficiencies and obtain approval from Departmental Representative.

.3 Failure to follow accepted start-up procedures will result in re-evaluation of equipment by an independent testing agency selected by Departmental Representative. If results reveal that equipment start-up was not in accordance with requirements, and resulted in damage to equipment, implement following:

.1 Minor equipment/systems: implement corrective measures approved by Departmental Representative.

.2 Major equipment/systems: if evaluation report concludes that damage is minor, implement corrective measures approved by Departmental Representative.

.3 If evaluation report concludes that major damage has occurred, Departmental Representative shall reject equipment.

.1 Rejected equipment to be removed from site and replaced with new.

.2 Subject new equipment/systems to specified start-up procedures.

1.13 START-UP DOCUMENTATION

.1 Assemble start-up documentation and submit to Departmental Representative for approval 14 days before commencement of commissioning.

.2 Start-up documentation to include:

.1 ECCC Tank Number must be visible prior to fuelling the tank.

.2 Emergency Response Plan from Owner.

.3 Factory and on-site test certificates for specified equipment.

.4 Pre-start-up inspection reports.

.5 Signed installation/start-up check lists.

.6 Start-up reports.

.7 Step-by-step description of complete start-up procedures, to permit Departmental Representative and/or Owner to repeat start-up at any time.

.8 PTMAA verification.

1.14 MAINTENANCE OF EQUIPMENT AND SYSTEMS

.1 With assistance of manufacturer develop written maintenance program and submit to Departmental Representative for approval within 14 days of completion of Cx. Include approved documentation in OMM.

1.15 TEST RESULTS

.1 If start-up, testing and/or PV produce results not acceptable to Departmental representative, then repair, replace or repeat specified starting and/or PV procedures until results are accepted by Departmental Representative in writing.

.2 Provide manpower and materials, assume costs for re-commissioning. Repeat Part 1.15.1 above.

1.16 START OF COMMISSIONING

.1 Notify Departmental Representative at least 5 days prior to start of Cx.

.2 Start Cx after elements of building affecting start-up and performance verification of systems have been completed including ECCC tank registration by Owner. Contractor to apply ECCC registration to tank when Departmental Representative informs Contractor in writing.

1.17 INSTRUMENTS / EQUIPMENT

.1 Submit to Departmental Representative for review and approval:

.1 Complete list of instruments proposed to be used.

.2 Listed data including, serial number, current calibration certificate, calibration date, calibration expiry date and calibration accuracy.

.2 Provide the following equipment as required:

.1 Equipment as required to complete work.

1.18 COMMISSIONING PERFORMANCE VERIFICATION

.1 Carry out Cx:

.1 Under normal operating conditions, over entire operating range, in all modes.

.2 On independent systems and interacting systems.

.2 Cx procedures to be repeatable and reported results are to be verifiable.

.3 Follow equipment manufacturer's operating instructions.

1.19 WITNESSING COMMISSIONING

.1 Departmental Representative to witness activities and verify results.

1.20 AUTHORITIES HAVING JURISDICTION

.1 Where specified start-up, testing or commissioning procedures duplicate verification requirements of authority having jurisdiction, arrange for authority to witness procedures so as to avoid duplication of tests and to facilitate expedient acceptance of facility.

.2 Obtain certificates of approval, acceptance and compliance with rules and regulation of authority having jurisdiction.

.3 Provide four (4) hardcopies and four (4) electronic copies attached to each hard copy to Departmental Representative within 5 days of test and with Cx report.

1.21 EXTRAPOLATION OF RESULTS

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

1.22 SUNDRY CHECKS AND ADJUSTMENTS

.1 Make adjustments and changes which become apparent as Cx proceeds.

.2 Perform static and operational checks as applicable and as required.

1.23 DEFICIENCIES, FAULTS, DEFECTS

.1 Correct deficiencies found during start-up and Cx to written approval of Departmental Representative.

.2 Report problems, faults or defects affecting Cx to Departmental Representative in writing. Stop Cx until problems are rectified. Proceed with written approval from Departmental Representative.

1.24 COMPLETION OF COMMISSIONING

.1 Upon completion of Cx leave systems in normal operating mode.

.2 Except for warranty and seasonal verification activities specified in Cx specifications, Cx to be considered complete when contract Cx deliverables have been submitted and accepted by Departmental Representative.

1.25 ACTIVITIES UPON COMPLETION OF COMMISSIONING

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

1.26 TRAINING

.1 Provide system operation and maintenance training to a representative of the Owner at Owner’s convenience.

1.27 OWNER'S PERFORMANCE TESTING

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

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 SUMMARY

.1 Section includes:

.1 Description of overall structure of Cx Plan and roles and responsibilities of Cx team.

.2 Contractor to provide agent and update Cx plan to the team.

1.2 REFERENCES

.1 CSA-Z320-11-Building Commissioning Standard.

1.3 GENERAL

.1 Provide a fully functional:

.1 Systems, equipment and components meet user's functional requirements before date of acceptance, and operate consistently at peak efficiencies and within specified energy budgets under normal loads.

.2 Facility user and O&M personnel have been fully trained in aspects of installed systems.

.3 Optimized life cycle costs.

.4 Complete documentation relating to installed equipment and systems.

.2 Term "Cx" in this section means "Commissioning".

.3 Use this Cx Plan as master planning document for Cx:

.1 Outlines organization, scheduling, allocation of resources, documentation, pertaining to implementation of Cx.

.2 Communicates responsibilities of team members involved in Cx Scheduling, documentation requirements, and verification procedures.

.3 Sets out deliverables relating to O&M, process and administration of Cx.

.4 Describes process of verification of how built works meet design requirements.

.5 Produces a complete functional system prior to issuance of Certificate of Occupancy.

.6 Management tool that sets out scope, standards, roles and responsibilities, expectations, deliverables, and provides:

.1 Overview of Cx.

.2 General description of elements that make up Cx Plan.

.3 Process and methodology for successful Cx.

.4 Acronyms:

.1 Cx - Commissioning.

.2 BMM - Building Management Manual.

.3 EMCS - Energy Monitoring and Control Systems.

.4 MSDS - Material Safety Data Sheets.

.5 PI - Product Information.

.6 PV - Performance Verification.

.7 TAB - Testing, Adjusting and Balancing.

.8 WHMIS - Workplace Hazardous Materials Information System.

.5 Commissioning terms used in this Section:

.1 Bumping: short term start-up to prove ability to start and prove correct rotation.

.2 Deferred Cx - Cx activities delayed for reasons beyond Contractor's control due to lack of occupancy, weather conditions, need for heating/cooling loads.

1.4 DEVELOPMENT OF 100% CX PLAN

.1 Cx Plan 95% completed by the Departmental Representative and transmit to the contractor.

.2 Cx Plan to be 100% completed within 8 weeks of award of contract to take into account:

.1 Approved shop drawings and product data.

.2 Approved changes to contract.

.3 Contractor's project schedule.

.4 Cx schedule.

.5 Contractor's, sub-contractor's, suppliers' requirements.

.6 Project construction team's and Cx team's requirements.

.3 Submit completed Cx Plan to Departmental Representative and obtain written approval.

1.5 REFINEMENT OF CX PLAN

.1 During construction phase, revise, refine and update Cx Plan to include:

.1 Changes resulting from Client program modifications.

.2 Approved design and construction changes.

.2 Revise, refine and update every 6 weeks during construction phase if necessary. At each revision, indicate revision number and date.

.3 Submit each revised Cx Plan to Departmental Representative for review and obtain written approval.

.4 Include testing parameters at full range of operating conditions and check responses of equipment and systems.

1.6 COMPOSITION, ROLES AND RESPONSIBILITIES OF CX TEAM

.1 Departmental Representative to maintain overall responsibility for project and is sole point of contact between members of commissioning team.

.2 Project Manager will select Cx Team consisting of following members:

.1 Departmental Representative Design Quality Review Team: during construction, will conduct periodic site reviews to observe general progress.

.2 Departmental Representative Quality Assurance Commissioning Manager: ensures Cx activities are carried out to ensure delivery of a fully operational project including:

.1 Review of Cx documentation from operational perspective.

.2 Review for performance, reliability, durability of operation, accessibility, maintainability, operational efficiency under conditions of operation.

.3 Protection of health, safety and comfort of occupants and O&M personnel.

.4 Monitoring of Cx activities, training, development of Cx documentation.

.5 Work closely with members of Cx Team.

.3 Departmental Representative is responsible for:

.1 Organizing Cx.

.2 Monitoring operations Cx activities.

.3 Witnessing, certifying accuracy of reported results.

.4 Witnessing and certifying TAB and other tests.

.5 Developing BMM.

.6 Ensuring implementation of final Cx Plan.

.7 Performing verification of performance of installed systems and equipment.

.8 Implementation of Training Plan.

.4 Construction Team: contractor, sub-contractors, suppliers and support disciplines, is responsible for construction/installation in accordance with contract documents, including:

.1 Testing.

.2 TAB.

.3 Performance of Cx activities.

.4 Delivery of training and Cx documentation.

.5 Assigning one person as point of contact with Departmental Representative Cx Manager for administrative and coordination purposes.

.5 Contractor's Cx agent implements specified Cx activities including:

.1 Demonstrations.

.2 Training.

.3 Testing.

.4 Preparation, submission of test reports.

.6 Property Manager: represents lead role in Operation Phase and onwards and is responsible for:

.1 Receiving facility.

.2 Day-To-Day operation and maintenance of facility.

1.7 CX PARTICIPANTS

.1 Employ the following Cx participants to verify performance of equipment and systems:

.1 Installation contractor/subcontractor:

.1 Equipment and systems except as noted.

.2 Equipment manufacturer: equipment specified to be installed and started by manufacturer.

.1 To include performance verification.

.3 Specialist subcontractor: equipment and systems supplied and installed by specialist subcontractor.

.4 Specialist Cx agency:

.1 Possessing specialist qualifications and installations providing environments essential to client's program but are outside scope or expertise of Cx specialists on this project.

.5 Client: responsible for intrusion and access security systems.

.6 Ensure that Cx participant:

.1 Could complete work within scheduled time frame.

.7 Provide names of participants to Departmental Representative and details of instruments and procedures to be followed for Cx 3 weeks prior to starting date of Cx for review and approval.

1.8 EXTENT OF CX

.1 Commission electrical systems and equipment:

.1 Low voltage below 750 V:

.1 Low voltage equipment.

.2 Low voltage distribution systems.

.3 Electronic data and communications information systems.

1.9 DELIVERABLES RELATING TO O&M PERSPECTIVES

.1 General requirements:

.1 Compile English documentation.

.2 Documentation to be computer-compatible format ready for inputting for data management.

.2 Provide deliverables:

.1 Warranties.

.2 Project record documentation.

.3 Inventory of spare parts, special tools and maintenance materials.

.4 Maintenance Management System (MMS) identification system used.

.5 WHMIS information.

.6 MSDS data sheets.

.7 Electrical Panel inventory containing detailed inventory of electrical circuitry for each panel board. Duplicate of inventory inside each panel.

.8 Preventive Maintenance Program.

.9 Standard Operating Procedures (SOP).

.10 Contractor's and sub-contractors' as-built drawings.

1.10 DELIVERABLES RELATING TO THE CX PROCESS

.1 General:

.1 Start-up, testing and Cx requirements, conditions for acceptance and specifications form part of relevant technical sections of these specifications.

.2 Definitions:

.1 Cx as used in this section includes:

.1 Cx of components, equipment, systems, subsystems, and integrated systems.

.2 Factory inspections and performance verification tests.

.3 Deliverables: provide:

.1 Cx Specifications.

.2 Startup, pre-Cx activities and documentation for systems, and equipment.

.3 Completed installation checklists (ICL).

.4 Completed product information (PI) report forms.

.5 Completed performance verification (PV) report forms.

.6 Results of Performance Verification Tests and Inspections.

.7 Description of Cx activities and documentation.

.8 Description of Cx of integrated systems and documentation.

.9 Tests of following witnessed by Departmental Representative Design Quality Review Team:

.1 PV solar panels electrical parameters.

.2 Inverter operation and parameters.

.3 Combiner and rapid shut down operation.

.4 Zero Export Electricity.

.5 Insulation resistance and grounding.

.10 Training Plans.

.11 Cx Reports.

.12 Prescribed activities during warranty period.

.4 Departmental Representative to witness and certify tests and reports of results provided to Departmental Representative.

.5 Departmental Representative to participate.

1.11 START-UP

.1 Start up components, equipment and systems.

.2 Equipment manufacturer, supplier, installing specialist sub-contractor, as appropriate, to start-up, under Contractor's direction, following equipment, systems:

.1 PV Solar Panels.
.2 Inverters.
.3 Metering system.

.3 Departmental Representative to monitor these start-up activities.

.1 Rectify start-up deficiencies to satisfaction of Departmental Representative.

.4 Performance Verification (PV):

.1 Approved Cx Agent to perform.
.1 Repeat when necessary until results are acceptable to Departmental Representative.
.2 Use procedures modified generic procedures to suit project requirements.
.3 Departmental Representative to witness and certify reported results using approved PI and PV forms.
.4 Departmental Representative to approve completed PV reports.
.5 [Departmental Representative reserves right to verify up to 30% of reported results at random.
.6 Failure of randomly selected item shall result in rejection of PV report or report of system start-up and testing.

1.12 INSTALLATION CHECK LISTS (ICL)

.1 Contractor must develop a check list installation, verification forms and performance verification forms.

1.13 DELIVERABLES RELATING TO ADMINISTRATION OF CX

.1 General:

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

1.14 CX SCHEDULES

.1 Prepare detailed critical path Cx Schedule and submit to Departmental Representative for review and approval same time as project Construction Schedule. Include:

.1 Milestones, testing, documentation, training and Cx activities of components, equipment, subsystems, systems and integrated systems, including:
.1 Design criteria, design intents.
.2 Pre-TAB review.
.3 Cx agents' credentials.
.4 Cx procedures.

.5 Cx Report format.

.6 Submission of list of instrumentation with relevant certificates.

.7 Notification of intention to start TAB.

.8 TAB: after successful start-up, correction of deficiencies and verification of normal and safe operation.

.9 Notification of intention to start Cx.

.10 Notification of intention to start Cx of integrated systems.

.11 Identification of deferred Cx.

.12 Implementation of training plans.

.13 Cx reports: immediately upon successful completion of Cx.

.2 Detailed training schedule to demonstrate no conflicts with testing, completion of project and hand-over to Departmental Representative.

.2 After approval, incorporate Cx Schedule into Construction Schedule.

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

1.15 CX REPORTS

.1 Submit reports of tests, witnessed and certified by Departmental Representative to Departmental Representative who will verify reported results.

.2 Include completed and certified PV reports in properly formatted Cx Reports.

.3 Before reports are accepted, reported results to be subject to verification by Departmental Representative.

1.16 ACTIVITIES DURING WARRANTY PERIOD

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

.1 Inspection of trench for settlement or heaving after 0ne year of project completion.

1.17 FINAL SETTINGS

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

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section includes: Commissioning forms to be completed for equipment, system and integrated system.

1.2 INSTALLATION/START-UP CHECK LISTS

.1 Include the following data:

.1 Product manufacturer's installation instructions and recommended checks.

.2 Special procedures as specified in relevant technical sections.

.3 Items considered good installation and engineering industry practices deemed appropriate for proper and efficient operation.

.2 Equipment manufacturer's installation/start-up check lists are acceptable for use. As deemed necessary by Departmental Representative supplemental additional data lists will be required for specific project conditions.

.3 Use check lists for equipment installation. Document check list verifying checks have been made, indicate deficiencies and corrective action taken.

.4 Installer to sign check lists upon completion, certifying stated checks and inspections have been performed. Return completed check lists to Departmental Representative. Check lists will be required during Commissioning and will be included in Building Maintenance Manual (BMM) at completion of project.

.5 Use of check lists will not be considered part of commissioning process but will be stringently used for equipment pre-start and start-up procedures.

1.3 PRODUCT INFORMATION (PI) REPORT FORMS

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

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

1.4 PERFORMANCE VERIFICATION (PV) FORMS

.1 PV forms to be used for checks, running dynamic tests and adjustments carried out on equipment and systems to ensure correct operation, efficiently and function independently and interactively with other systems as intended with project requirements.

.2 PV report forms include those developed by Contractor records measured data and readings taken during functional testing and Performance Verification procedures.

.3 Prior to PV of integrated system, complete PV forms of related systems and obtain Departmental Representative's approval.

1.5 SAMPLES OF COMMISSIONING FORMS

.1 Departmental Representative will develop and provide to Contractor required project-specific Commissioning forms in electronic format complete with specification data. Refer to attached forms in the specifications.

.2 Revise items on Commissioning forms to suit project requirements.

.3 Samples of Commissioning forms and a complete index of produced to date will be attached to this section.

1.6 CHANGES AND DEVELOPMENT OF NEW REPORT FORMS

.1 When additional forms are required, but are not available from Departmental Representative develop appropriate verification forms and submit to Departmental Representative for approval prior to use.

.2 Additional commissioning forms to be in same format as provided by Departmental Representative.

1.7 COMMISSIONING FORMS

.1 Use Commissioning forms to verify installation and record performance when starting equipment and systems.

.2 Strategy for Use:

.1 Departmental Representative provides Contractor project-specific Commissioning forms with Specification data included.

.2 Contractor will provide required shop drawings information and verify correct installation and operation of items indicated on these forms.

.3 Confirm operation as per design criteria and intent.

.4 Identify variances between design and operation and reasons for variances.

.5 Verify operation in specified normal and emergency modes and under specified load conditions.

.6 Record analytical and substantiating data.

.7 Verify reported results.

.8 Form to bear signatures of recording technician and reviewed and signed off by Departmental Representative.

.9 Submit immediately after tests are performed.

.10 Reported results in true measured SI unit values.

.11 Provide Departmental Representative with originals of completed forms.

.12 Maintain copy on site during start-up, testing and commissioning period.

.13 Forms to be both hard copy and electronic format with typed written results in Building Management Manual.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 COMMISSIONING CHECKLIST

.1 Refer to attached Commissioning Checklist.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 This Section specifies roles and responsibilities of Commissioning: Training.

1.2 TRAINEES

.1 Trainees: personnel selected for operating and maintaining this facility. Includes Facility Manager, building operators, maintenance staff, security staff, and technical specialists as required.

.2 Trainees will be available for training during later stages of construction for purposes of familiarization with systems.

1.3 INSTRUCTORS

.1 Departmental Representative will provide:

- .1 Descriptions of systems.
- .2 Instruction on design philosophy, design criteria, and design intent.

.2 Contractor and certified factory-trained manufacturers' personnel: to provide instruction on the following:

- .1 Start-Up, operation, shut-down of equipment, components and systems.
- .2 Control features, reasons for, results of, implications on associated systems of, adjustment of set points of control and safety devices.
- .3 Instructions on servicing, maintenance and adjustment of systems, equipment and components.

.3 Contractor and equipment manufacturer to provide instruction on:

- .1 Start-up, operation, maintenance and shut-down of equipment they have certified installation, started up and carried out PV tests.

1.4 TRAINING OBJECTIVES

.1 Training to be detailed and duration to ensure:

- .1 Safe, reliable, cost-effective, energy-efficient operation of systems in normal and emergency modes under all conditions.
- .2 Effective on-going inspection, measurements of system performance.
- .3 Proper preventive maintenance, diagnosis and trouble-shooting.
- .4 Ability to update documentation.
- .5 Ability to operate equipment and systems under emergency conditions until appropriate qualified assistance arrives.

1.5 TRAINING MATERIALS

.1 Instructors to be responsible for content and quality.

.2 Training materials to include:

.1 "As-Built" Contract Documents.
.2 Operating Manual.
.3 Maintenance Manual.
.4 Management Manual.
.5 TAB and PV Reports.

.3 Project Manager, Commissioning Manager and Facility Manager will review training manuals.

.4 Training materials to be in a format that permits future training procedures to same degree of detail.

.5 Supplement training materials:

.1 Multimedia presentations.
.2 Manufacturer's training videos.
.3 Equipment models.

1.6 SCHEDULING

.1 Include in Commissioning Schedule time for training.

.2 Deliver training during regular working hours, training sessions to be 4 hours in length.

.3 Training to be completed prior to acceptance of facility.

1.7 RESPONSIBILITIES

.1 Be responsible for:

.1 Implementation of training activities,
.2 Coordination among instructors,
.3 Quality of training, training materials,

.2 Departmental Representative will evaluate training and materials.

.3 Upon completion of training, provide written report, signed by Instructors, witnessed by Departmental Representative.

1.8 TRAINING CONTENT

.1 Training to include demonstrations by Instructors using the installed equipment and systems.

.2 Content includes:

.1 Review of facility and occupancy profile.
.2 Functional requirements.
.3 System philosophy, limitations of systems and emergency procedures.
.4 Review of system layout, equipment, components and controls.

.5 Equipment and system start-up, operation, monitoring, servicing, maintenance and shut-down procedures.

.6 System operating sequences, including step-by-step directions for starting up, shut-down, operation of valves, dampers, switches, adjustment of control settings and emergency procedures.

.7 Maintenance and servicing.

.8 Trouble-shooting diagnosis.

.9 Inter-Action among systems during integrated operation.

.10 Review of O&M documentation.

.3 Provide specialized training as specified in relevant Technical Sections of the construction specifications.

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 PRICE AND PAYMENT PROCEDURES

.1 Measurement and Payment.

.1 Include removal of the existing fuel dispensing equipment, and all associated appurtenances and remote monitoring equipment in Lump Sum Price for decommissioning of the aboveground storage tanks (ASTs) as per Section 02 65 00 – Aboveground Storage Tank Removal, including removal of the existing ASTs.

.2 Include removal of the existing generator building, backup generator and associated electrical equipment not specified for re-use in Lump Sum Price for decommissioning of the generator shed as per Section 26 00 10 – Electrical General Requirements.

1.2 REFERENCES

.1 Reference Standards: comply with applicable standards and regulations in effect at the time the work is performed:

.1 Canadian Council of Ministers of the Environment (CCME)

.2 Canadian Environmental Assessment Act (CEAA)

.3 Canadian Environmental Protection Act (CEPA) and Regulations

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

.1 Material Safety Data Sheets (MSDS).

.5 Transport Canada (TC)

.1 Transportation of Dangerous Goods Act, 1992 (TDGA), c. 34.

.6 The Occupational Health and Safety Regulation (SK) 1996.

1.3 ADMINISTRATIVE REQUIREMENTS

.1 Site Meetings.

.1 The Departmental Representative will convene a pre-demolition meeting one week prior to beginning work of this Section in accordance with Section 01 32 16.07 - Construction Progress Schedule - Bar (GANTT) Chart to:

.1 Verify project requirements.

.2 Review site conditions.

.3 Co-ordinate with on-site personal.

.2 Departmental Representative will take minutes and distribute to Owner and Contractor

1.4 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Shop Drawings:

.1 Submit to Departmental Representative for review, five days prior to the start of construction, all drawings, diagrams and/or details showing sequence of demolition work and supporting structures and underpinning, where required by authorities having jurisdiction.

.3 Hazardous Materials:

.1 Provide description of Hazardous Materials and Notification of Filing with authorities having jurisdiction within 7 days of beginning of Work as required. Copy to be provided to Departmental Representative.

.4 Certificates:

.1 Submit originals of certified weigh bills, bills of lading, receipts from authorized disposal sites and recycling facilities, and certificate of tank destruction, for all material removed from site on a weekly basis and upon request of Departmental Representative. Payment of invoices will require receipt of all original documentation.

1.5 QUALITY ASSURANCE

.1 Regulatory Requirements: ensure Work is performed in compliance with CEPA, CEAA, TDGA, and all applicable Federal, Provincial and Municipal Acts and Regulations.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Store and manage hazardous materials in accordance with Section 01 35 43 - Environmental Procedures.

.2 Storage and Protection.

.1 Protect in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling

.2 Contractor to provide a written record of existing items designated to remain. Departmental Representative to review and approve in writing. Contractor to protect existing items designated to remain. In event of damage to such items, immediately replace or make repairs to approval of Departmental Representative and at no cost to Departmental Representative and/or Owner.

1.7 SITE CONDITIONS

.1 Site Environmental Requirements.

.1 Perform work in accordance with Section 01 35 43 - Environmental Procedures.

.2 Ensure that selective demolition work does not adversely affect adjacent watercourses, groundwater and wildlife or contribute to excess air and noise pollution. Details to be provided in reviewed Environmental Protection Plan.

.3 Do not dispose of waste of volatile materials including but not limited to, mineral spirits, oil, petroleum based lubricants or toxic cleaning solutions into watercourses, storm or sanitary sewers.

.1 Ensure proper disposal procedures are maintained throughout the project.

.4 Do not pump water containing suspended materials into watercourses, storm or sanitary sewers or onto adjacent properties.

.5 Control disposal or runoff of water containing suspended materials or other harmful substances. Methods to be provided in Environmental Protection Plan. Departmental Representative may stop work if non-compliant. Contractor to make repairs to approval of Departmental Representative at no cost to Departmental Representative and/or Owner.

Part 2 Products

2.1 EQUIPMENT

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

Part 3 Execution

3.1 PREPARATION

.1 Inspect site with Departmental Representative and verify extent and location of items designated for removal, disposal/recycling and items to remain.

.2 Locate and protect both public and private utilities before starting Work.

.3 Preserve active utilities traversing site in operating condition.

.4 Provide utility locate information to Departmental Representative within 5 days before starting Work.

3.2 REMOVAL OF HAZARDOUS WASTES

.1 Remove contaminated and/or dangerous materials defined by authorities having jurisdiction, relating to environmental protection, from site and dispose of in safe manner to a permitted facility to minimize danger at site and/or during disposal.

3.3 REMOVAL OPERATIONS

.1 Remove items indicated on the Contract Drawings, including the generator building, unused generators, overhead materials, and equipment between the tanks and generator building.

.2 The existing generator building, piping and fuel tank, and miscellaneous equipment are considered to be contaminated by diesel and must be removed safely.

.3 Do not disturb items designated to remain in place, as identified on the Contract Drawings.

.4 Disposal of Material:

.1 Dispose of waste materials at authorized permitted facilities.

.2 Aboveground Storage Tanks: remove and dispose of in accordance with CCME PN1326 and Section 02 65 00 - Aboveground Storage Tank Removal.

.5 Backfill:

.1 Backfill in areas as indicated and in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

3.4 STOCKPILING

.1 Designate appropriate security resources/measures to prevent vandalism, damage, fire and theft.

.2 Stockpile locations to be approved by Departmental Representative.

3.5 REMOVAL FROM SITE

.1 Remove stockpiled material as directed by Departmental Representative, when it interferes with operations of project and/or interferes with the mandate of the Owner.

.2 Dispose of materials in accordance with all applicable Acts and Regulations.

.1 Disposal Facilities: approved in writing by Departmental Representative.

.2 Written authorization from Departmental Representative is required to deviate from approved disposal facilities.

3.6 RESTORATION

.1 Restore areas and existing works outside areas of excavation to conditions that existed prior to beginning of Work and match condition of adjacent, undisturbed areas.

.2 Use soil treatments and procedures which are not harmful to health, are not injurious to plants, and do not endanger wildlife, adjacent water courses or ground water.

3.7 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Remove debris, trim surfaces and leave work site clean, upon completion of Work

.3 Use cleaning solutions and procedures which are not harmful to health, are not injurious to plants, and do not endanger wildlife, adjacent water courses or ground water.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

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

3.8 PROTECTION

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

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 Works of demolition are indicated on the drawings.

.2 Protective measures are required to prevent all demolished and/or removed elements, and debris from passing beyond the work zone at the west top of bank.

1.2 REFERENCES

.1 CSA International: CSA S350, Code of Practice for Safety in Demolition of Structures.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Prior to commencing structure demolition, the Contractor shall submit a detailed demolition plan. As a minimum, the demolition plan should include:

- .1 Descriptions of and anticipated quantities of materials to be salvaged reused, recycled and landfilled.
- .2 Schedule of selective demolition.
- .3 Number and location of dumpsters.
- .4 Name and address of waste facilities.

.2 The Contractor shall submit copies of certified receipts from authorized disposal sites and reuse and recycling facilities for material removed from site upon request of the Owner's Representative.

1.4 SITE CONDITIONS

.1 Environmental protection:

- .1 Ensure Work does not adversely affect adjacent structures, or contribute to excess air and noise pollution.
- .2 Fires and burning of waste or materials is not permitted on site.
- .3 Do not bury rubbish waste materials.
- .4 Do not dispose of waste or volatile materials including but not limited to: mineral spirits, oil, petroleum based lubricants, or toxic cleaning solutions into watercourses.
- .5 Ensure proper disposal procedures are maintained throughout project.
- .6 Cover or wet down dry materials and waste to prevent blowing dust and debris.

1.5 EXISTING CONDITIONS

.1 Structures to be demolished are based on their condition, at time of examination prior to tendering.

.2 Items to be salvaged, as identified by Owner's Representative, are to be carefully removed, protected and handed over to Owner's Representative.

.3 Store materials salvaged for reuse and recycling in as outlined in waste reduction work plan.

Part 2 Products

2.1 EQUIPMENT

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

Part 3 Execution

3.1 PREPARATION

.1 Obtain necessary permits and approvals. Provide copies to Departmental Representative prior to start of any Work on site.

.2 Remove obstructions, ice, and snow, from surfaces to be excavated within limits indicated.

.3 Post signs in visible locations and appropriate language which indicates to workers, subcontractors, haulers, and public, location of processing, stockpiling of each material and bin location and use e.g., "CLEAN WOOD ONLY".

.4 Do not disrupt active or energized utilities.

3.2 DEMOLITION

.1 Remove existing equipment, services and obstacles where required for refinishing or making good of existing surfaces.

.2 At end of each day's Work, leave Site in safe condition so that no part is in danger of toppling or falling. Protect interiors of parts not to be demolished from exterior elements at all times.

.3 Remove and dispose of demolished materials except where noted otherwise and in accordance with authorities having jurisdiction.

.4 Remove contaminated or dangerous materials as defined by authorities having jurisdiction, relating to environmental protection, from Site and dispose of in a safe and lawful manner.

END OF SECTION

Part 1 General

1.1 PRICE AND PAYMENT PROCEDURES

.1 Measurement and Payment:

.1 Removal of Aboveground Storage Tank (AST) systems will be a lump sum payment, including: decommissioning of all system infrastructure, including but not necessarily limited to:

.1 transfer of useable product contained within the ASTs to the new fuel tanks;

.2 decommissioning of aboveground storage tanks and associated supply, transfer and vent pipes;

.3 tank purging and destruction;

.4 decommissioning of the generator shed, associated appurtenances and electrical components not required as part of replacement system; and

.5 removal of underground electrical and communication cables, piping and conduits.

.2 The services of a vacuum truck, if necessary, for removal of any residual hydrocarbon product from the tanks shall be incidental to removal of the AST systems and will not be measured for payment.

.3 Disposal of residual hydrocarbon product from the tanks and piping using the services of a vacuum truck shall be incidental to removal of the AST systems and will not be measured for payment . Work to include removal, transport and disposal to a licensed waste receiving facility.

1.2 REFERENCES

.1 All references to be most recent issued.

.2 Canadian Council of Ministers of the Environment (CCME)

.1 CCME PN 1326-2003, Environmental Code of Practice for Aboveground and Underground Storage Tank Systems Containing Petroleum Products and Allied Petroleum Products.

.2 CCME PN 1299-2006, Canadian Environmental Quality Guidelines.

.1 Chapter 7-2006, Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health.

.3 Canadian Federal Legislation

.1 Canadian Environmental Protection Act (CEPA), 1999, c. 33.

.1 SOR/2008-197, Storage Tank Systems for Petroleum Products and Allied Petroleum Products Regulations.

.2 Canadian Environmental Assessment Act (CEAA), 1995, c. 37.

.2 Canada Labour Code (R.S. 1985, c. L-2).

.1 Part II (September 2000) - Occupational Health and Safety.

.3 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.

1.3 SUBMITTALS

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

.2 Provide the following information for each storage tank system:

.1 Tank serial numbers and other pertinent details as provided on tank identification tags.

.3 Provide Departmental Representative with copy of vapour removal test results.

.4 Forward photos and affidavit of destruction of aboveground storage tanks to the Departmental Representative.

.5 Provide Departmental Representative with completed Environmental Canada (EC) Storage Tank System Identification Form (attached as an Appendix to these specifications), including all pertinent information for the permanent removal of the aboveground storage tanks. One form for each system.

.6 Required submittals to be provided to Departmental Representative within 48 hours of completion of tank decommissioning.

1.4 QUALITY ASSURANCE

.1 Contractor personnel must be licensed/certified by the Province of Alberta, the authority having jurisdiction for removal of storage tanks.

.1 License/certificate, title and number must accompany bid.

.2 Regulatory Requirements: ensure Work is performed in compliance with CEPA, TDGA and all applicable Federal and Provincial regulations (latest editions).

1.5 DELIVERY, STORAGE AND HANDLING

.1 Waste Management and Disposal:

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

.2 Divert metal materials where practical from landfill to metal recycling facility approved by Departmental Representative.

.3 Segregate and deliver non-salvageable and/or non-recyclable materials, including waste liquid and sludge to provincially licensed/permitted waste facility. Provide original manifest documents to Departmental Representative. Originals will be required for payment of Contractor invoices.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 PREPARATION SAFETY AND SECURITY

.1 Conform to or exceed Federal, Provincial and Municipal codes, by-laws, and codes and regulations of utility authorities having jurisdiction.

.2 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

.3 Protection:

.1 Meet safety requirements of Occupational Safety and Health, Canada Labour Code Part II and Regulations for Construction Projects, and applicable Alberta Occupational Safety and Health requirements.

.2 Disconnect or remove all sources of ignition from vicinity of tanks.

.3 Provide temporary protection for safe movement of personnel and vehicle traffic.

.4 Cut, braze or weld metal only in monitored areas established to be free of ignitable vapour concentrations.

.5 Ground and bond metal equipment, including tanks and transfer pipes, before operating equipment and/or transferring flammable materials.

.6 Use non-sparking tools and intrinsically safe electrical equipment.

.7 Smoking is not permitted on site.

3.2 WATER CONTROL

.1 Maintain excavations free of water.

.2 Protect site from puddling or running water.

.3 Prevent surface water runoff from leaving work areas.

.4 Do not discharge decontaminated water or surface water runoff and/or groundwater which may have come in contact with potentially contaminated material, off site or to municipal sewers.

.5 Prevent precipitation from infiltrating and/or from directly running off stockpiled waste materials. Cover stockpiled waste materials with tarps during periods of work stoppage including at end of each working day and as directed by Departmental Representative.

.6 Direct surface waters that have not contacted potentially contaminated materials to the existing surface drainage systems. Use silt fences, as required, to minimize any silt load in the surface water.

.7 Control surface drainage including ensuring that gutters are kept open, water is not directed across or over pavements or sidewalks except through approved pipes or properly constructed troughs, and runoff from un-stabilized areas is intercepted and diverted to suitable outlet.

.8 Dispose of water in manner not injurious to public health or safety, to property or to any part of Work completed or under construction.

.9 Provide, operate, and maintain necessary equipment appropriately sized to keep excavations, staging pads, and other work areas free from water.

.10 Have on site sufficient pumping equipment, machinery, and storage tanks in good working condition for ordinary emergencies, including power outage.

.11 Departmental Representative will review all water control measures.

3.3 DRAINING

.1 Drain and flush piping into tanks.

.2 Pump out liquid from tanks.

.1 Use explosion proof, air driven or hand pump.

.3 Remove sludge from tank bottoms.

.1 Dispose of product and sludge in accordance with local, Municipal, and Provincial regulations using waste disposal carrier licensed by authority having jurisdiction (Alberta).

3.4 EXCAVATION TRENCHING AND BACKFILL

.1 Do work in accordance with Section 31 23 33.01 - Excavation, Trenching and Backfilling.

3.5 TANK REMOVAL

.1 Permanently remove tanks in accordance with SOR/2008-197, Storage Tank Systems for Petroleum Products and Allied Petroleum Products Regulations, CCME Code of Practice PN 1326 and/or applicable provincial standards and regulations, and place in designated location as approved by Departmental Representative.

3.6 VAPOUR REMOVAL

.1 Purging:

.1 Purge vapours in accordance with applicable Federal and Provincial guidelines.

.2 Purge vapours to less than 10% of lower explosive limit (LEL).

.3 Verify with combustible gas metre.

.4 Purge vapours prior to removal of ASTs from site.

.5 Provide Departmental Representative with written copy of all test results.

.2 Inverting:

.1 Displace oxygen to levels below necessary to sustain combustion.

.2 Verify with combustible gas metre.

.3 Dry Ice Method:

.1 Add 1.85 gm of solid carbon dioxide (dry ice) for each 100 litre capacity.

.2 Crush and distribute ice evenly over greatest area to secure rapid evaporation. Avoid skin contact.

.3 Verify dry ice has vaporized.

.4 Air Method:

.1 Ventilate tanks with air using small gas exhauster operated with compressed air or other suitable means.

.2 Air to enter opening at one end and to exit opening at other end to quickly remove vapour.

.3 Test interior of tanks to determine when tanks are free of vapour.

3.7 CAPPING

.1 Plug or Cap holes after tanks have been freed of vapours and before tanks are moved from site.

.1 Leave vents open.

.2 Plug corrosion leak holes using screwed (boiler) plugs.

.3 Leave 3 mm vent hole in one plug to prevent tanks from being subjected to excessive pressure differential caused by extreme temperature change.

3.8 SECURING AND REMOVAL FROM SITE

.1 Check vapour levels prior to transport:

.1 Remove vapour if required.

.2 Dispose of tanks in accordance with most stringent of local, Provincial and/or Federal regulations.

.3 Truck removal:

.1 Secure tanks on truck for transport to disposal site.

.2 Cut suitable openings in tank sides to render tanks unusable.

.3 Ensure minimum 3 mm vent hole located at uppermost point on tanks.

.4 Provide pictures of tanks and destruction certificates to Departmental Representative.

3.9 SITE REMEDIATION

.1 Repair/replace finish grade to match surrounding area after approval by Departmental Representative to proceed.

END OF SECTION

Part 1 General

1.1 PRICE AND PAYMENT PROCEDURES

.1 Measurement and Payment

.1 No measurement of payment will be made for this section.

.1 Include on-site storage, handling and management of hazardous materials costs in lump sum price for new AST Installation as per Section 33 56 13 - Aboveground Fuel Storage Tanks.

1.2 REFERENCES

.1 Definitions:

.1 Dangerous Goods: product, substance or organism specifically listed or meets hazard criteria established in Transportation of Dangerous Goods Regulations.

.2 Hazardous Material: product, substance or organism used for its original purpose; and is either dangerous goods or material that will cause adverse impact to environment or adversely affect health of persons, animals, or plant life when released into the environment.

.3 Hazardous Waste: hazardous material no longer used for its original purpose and that is intended for recycling, treatment or disposal.

.2 Reference Standards (latest edition):

.1 Canadian Environmental Protection Act,1999 (CEPA 1999)

.1 Export and Import of Hazardous Waste and Hazardous Recyclable Material Regulations (SOR/2005-149).

.2 Department of Justice Canada (Jus)

.1 Transportation of Dangerous Goods Act, 1992 (TDG Act), (c. 34).

.2 Transportation of Dangerous Goods Regulations (T-19.01-SOR/2001-286).

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

.1 Material Safety Data Sheets (MSDS).

.4 National Research Council Canada Institute for Research in Construction (NRC-IRC)

.1 National Fire Code of Canada - 2015.

1.3 SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for hazardous materials and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements and Section 01 35 43 - Environmental

Procedures to Departmental Representative for each hazardous material required prior to bringing hazardous material on site.

1.4 DELIVERY, STORAGE AND HANDLING

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

.2 Transport hazardous materials and wastes in accordance with Transportation of Dangerous Goods Act, Transportation of Dangerous Goods Regulations and applicable Provincial regulations.

.3 Storage and Handling Requirements:

.1 Co-ordinate storage of hazardous materials with Departmental Representative and abide by internal requirements for labelling and storage of materials and wastes.

.2 Store and handle hazardous materials and wastes in accordance with applicable Federal and Provincial laws, regulations, codes and guidelines.

.3 Store and handle flammable and combustible materials in accordance with National Fire Code of Canada requirements.

.4 Keep no more than 250 litres of flammable and combustible liquids such as gasoline, kerosene and naphtha for ready use.

.1 Store flammable and combustible liquids in approved safety cans bearing the Underwriters' Laboratory of Canada or Factory Mutual seal of approval.

.2 Storage of quantities of flammable and combustible liquids exceeding 250 litres for work purposes requires the written approval of the Departmental Representative.

.5 Transfer of flammable and combustible liquids is prohibited within buildings.

.6 Transfer flammable and combustible liquids away from open flames or heat-producing devices.

.7 Solvents or cleaning agents must be non-flammable or have flash point above 38 degrees C.

.8 Store flammable and combustible waste liquids for disposal in approved containers located in safe, ventilated area. Keep quantities to minimum.

.9 No smoking allowed on site.

.10 Storage requirements for quantities of hazardous materials and wastes in excess of 5 kg for solids and 5 litres for liquids:

.1 Store hazardous materials and wastes in closed and sealed containers.

.2 Label containers of hazardous materials and wastes in accordance with WHMIS.

.3 Store hazardous materials and wastes in containers compatible with that material or waste.

.4 Segregate incompatible materials and wastes.

.5 Ensure that different hazardous materials or hazardous wastes are stored in separate containers.

.6 Store hazardous materials and wastes in secure storage area with controlled access.

.7 Maintain clear egress from storage area.

.8 Store hazardous materials and wastes in location that will prevent them from spilling into environment.

.9 Have appropriate emergency spill response equipment available near storage area, including personal protective equipment as detailed in the Environmental Protection Plan and reviewed by the Departmental Representative.

.10 Maintain inventory of hazardous materials and wastes, including product name, quantity, and date when storage began.

.11 When hazardous waste is generated on site:

.1 Co-ordinate transportation and disposal with Departmental Representative.

.2 Comply with applicable Federal, Provincial and Municipal laws and regulations for generators of hazardous waste.

.3 Use licensed carrier authorized by Provincial authorities to accept subject material.

.4 Before shipping material obtain written notice from intended hazardous waste treatment or disposal facility it will accept material and it is licensed to accept this material.

.5 Label containers with legible, visible safety marks as prescribed by federal and Provincial regulations.

.6 Only trained personnel handle, offer for transport, or transport dangerous goods. Certificates of training to be provided on request of Departmental Representative.

.7 Provide photocopy of shipping documents and waste manifests to Departmental Representative.

.8 Track receipt of completed manifest from consignee after shipping dangerous goods. Provide photocopy of completed manifest to Departmental Representative.

.9 Report discharge, emission, or escape of hazardous materials immediately to Departmental Representative and appropriate Provincial authority. Take reasonable measures to control release. Spill Response Plan in Environmental Protection Plan to be followed.

.12 Ensure personnel have been trained in accordance with Workplace Hazardous Materials Information System (WHMIS) requirements.

.13 Report spills or accidents immediately to Departmental Representative and authority having jurisdiction. Submit a written spill report to Departmental Representative within 24 hours of incident.

Part 2 Products

2.1 MATERIALS

.1 Description:

.1 Bring on site only the quantities of hazardous material required to perform Work.

.2 Maintain MSDS in proximity to where materials are being used where the environmental protection plan is stored. Communicate this location to personnel who may have contact with hazardous materials.

Part 3 Execution

3.1 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

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

.1 Dispose of hazardous waste materials in accordance with applicable Federal and Provincial acts, regulations and guidelines.

.2 Burning, diluting or mixing hazardous wastes for purpose of disposal is prohibited.

.3 Disposal of hazardous materials in waterways, storm or sanitary sewers or in municipal solid waste landfills is prohibited.

.4 Dispose of hazardous wastes in timely fashion in accordance with applicable Provincial regulations.

.5 Minimize generation of hazardous waste to maximum extent practicable. Take necessary precautions to avoid mixing clean and contaminated wastes.

END OF SECTION

Part 1 General

1.1 MEASUREMENT AND PAYMENT

.1 This work is considered incidental to the Work and shall not be measured for payment.

1.2 REFERENCES

.1 Conform to the latest edition of the following reference standards:

- .1 CSA-A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
- .2 CSA S269.1, Falsework for Construction Purposes.
- .3 CAN/CSA-S269.3, Concrete Formwork, National Standard of Canada.

Part 2 Products

2.1 MATERIALS

.1 Formwork materials:

- .1 Forms for exposed surfaces:
  - .1 Use 18 mm Coated Formply consisting of Douglas Fir substrate with resin-impregnated paper overlay and factory treated chemically active release agent.
  - .2 Use full-sized sheets as practical.
  - .3 Obtain approval of Departmental Representative prior to the reuse of any form.
  - .4 Support pours less than 1.5 m height at 300 mm maximum on centres.
  - .5 Support pours greater than 1.5 m height at 200 mm maximum on centre.
  - .6 Use strong-backs or walers placed perpendicular to supports to ensure straightness of form.
  - .7 Construct metal bolts or anchorages within the form so as to allow their removal to a depth of at least 20 mm from the concrete surface.
  - .8 Remove plastic sleeves for a distance of 100 mm from the face of the concrete and fill cavity with a non-shrink grout approved by the Departmental Representative to 75 mm from the surface. Fill remaining 75 mm with an approved concrete patching material.
- .2 Forms for unexposed surfaces:
  - .1 Use 15 mm plywood supported at 400 mm maximum on centre.
- .3 Rigid insulation board: to CAN/ULC-S701.
- .4 Epoxy bonding agent: A two component epoxy resin. Acceptable product: Sikadur 35 Hi-Mod LV by Sika (or equivalent).
- .5 Grout for dowels: A two component epoxy resin. Acceptable product (overhead or horizontal): Sikadur 31 Hi Mod Gel by Sika (or equivalent).

.2 Form ties: removable or snap-off metal ties, fixed or adjustable length, free of devices leaving holes larger than 25 mm diameter in concrete surface and leaving no metal within 25 mm of concrete surface when forms have been removed. Use tapered plastic cones on faces of concrete to facilitate grouting and use purpose made waterstop flange at mid-length of tie.

.3 Form release agent: non-staining type, containing compounds that react with free lime present in concrete to provide water insoluble soaps, preventing concrete from sticking to forms. Agent to be compatible with subsequent surface finishes.

.4 Falsework materials: to CSA-S269.1.

Part 3 Execution

3.1 FABRICATION AND ERECTION

.1 Verify lines, levels and centres before proceeding with formwork/falsework and ensure dimensions agree with drawings.

.2 Hand trim sides and bottoms and remove loose earth from earth forms before placing concrete.

.3 Fabricate and erect falsework in accordance with CSA S269.1.

.4 Fabricate and erect formwork in accordance with CAN/CSA-S269.3 to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CSA-A23.1/A23.2.

.5 Do not place shores or fillcrete mudslabs on frozen ground.

.6 Provide site drainage to prevent washout of soil supporting fillcrete mudslabs and shores.

.7 Align form joints and make watertight. Keep form joints to minimum.

.8 Use 20 mm chamfer strips on external corners and/or 20 mm fillets at interior corners, joints, unless specified otherwise.

.9 Form chases, slots, openings, drips, recesses, expansion and control joints as indicated.

.10 Locate construction joints as shown and maximum 11m in any direction, in all slabs and walls unless noted otherwise.

.11 Build in anchors, sleeves, and other inserts required to accommodate Work specified in other sections.

.1 Ensure that anchors and inserts will not protrude beyond surfaces designated to receive applied finishes, including painting.

.12 Clean formwork in accordance with CSA-A23.1/A23.2, before placing concrete.

3.2 REMOVAL AND RESHORING

.1 Leave formwork in place for following minimum periods of time after placing concrete.

.1 Fourteen (14) days for beam soffits, slabs, decks and other structural members, or Ten (10) days when replaced immediately with adequate shoring to standard specified for falsework.

.2 Seven (7) days for footings.

.2 Re-use formwork and falsework subject to requirements of CSA-A23.1/A23.2.

3.3 EPOXY RESINS

.1 Mix, apply and cure in strict accordance with manufacturer's instructions and recommendations.

END OF SECTION

Part 1 General

1.1 MEASUREMENT AND PAYMENT

.1 Shall be incidental to Cast-In-Place Concrete and will not be measured for payment.

1.2 REFERENCES

.1 Conform to the latest edition of the following reference standards:

- .1 CSA-A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/ Test Methods and Standard Practices for Concrete.
- .2 CAN/CSA-A23.3, Design of Concrete Structures.
- .3 CSA-G30.18, Carbon Steel Bars for Concrete Reinforcement.
- .4 CSA-G40.20/G40.21, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
- .5 RSIC, Reinforcing Steel Manual of Standard Practice.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 013300 - Submittal Procedures.

.2 Prepare reinforcement drawings in accordance with RSIC Manual of Standard Practice.

.3 Shop Drawings:

- .1 Indicate placing of reinforcement, and:
  - .1 Bar bending details.
  - .2 Lists.
  - .3 Quantities of reinforcement.
  - .4 Sizes, spacings, locations of reinforcement and mechanical splices if approved by Departmental Representative, with identifying code marks to permit correct placement without reference to structural drawings.
- .2 Detail lap lengths and bar development lengths to CAN/CSA-A23.3.
  - .1 Provide class B splice unless shown otherwise and stagger splices.
  - .2 Co-ordinate splice locations with pour breaks identified in Section 03 10 00 - Concrete Forms and Accessories.

1.4 QUALITY ASSURANCE

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

- .1 Mill Test Report: upon request, provide Departmental Representative with certified copy of mill test report of reinforcing steel, as part of the shop drawing submission.
- .2 Upon request submit in writing to Departmental Representative proposed source of reinforcement material to be supplied.

1.5 DELIVERY, STORAGE AND HANDLING

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

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials off ground and cover to keep dry.

.2 Replace defective or damaged materials with new.

Part 2 Products

2.1 MATERIALS

.1 Substitute different size bars only if permitted in writing by Departmental Representative.

.2 Reinforcing steel: billet steel, grade 400R, deformed bars to CSA-G30.18, unless indicated otherwise.

.3 Cold-drawn annealed steel wire ties: to ASTM A82/A82M.

.4 Chairs, bolsters, bar supports, spacers: to CSA-A23.1/A23.2.

.5 Mechanical splices: subject to approval of Departmental Representative.

2.2 FABRICATION

.1 Fabricate reinforcing steel in accordance with CSA-A23.1/A23.2.

.2 Obtain Departmental Representative's written approval for locations of reinforcement splices other than those shown on placing drawings.

.3 Upon approval of Departmental Representative, weld reinforcement in accordance with CSA W186.

.4 Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and lists.

2.3 SOURCE QUALITY CONTROL

.1 Upon request, provide Departmental Representative with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis.

.2 Upon request inform Departmental Representative of proposed source of material to be supplied.

Part 3 Execution

3.1 FIELD BENDING

.1 Do not field bend or field weld reinforcement except where indicated or authorized by Departmental Representative.

.2 When field bending is authorized, bend without heat, applying slow and steady pressure.

.3 Replace bars, which develop cracks or splits.

3.2 PLACING REINFORCEMENT

.1 Place reinforcing steel as indicated on placing drawings and in accordance with CSA-A23.1.

.2 Prior to closing wall forms and placing concrete, obtain Departmental Representative's approval of reinforcing material and placement.

.3 Ensure cover to reinforcement is maintained during concrete pour.

.4 Exposed concrete, including the underside of slabs and beams are considered as architectural concrete: Use non-staining supports and spacers.

.5 Slabs on grade, structural beams, and structural slabs: Support reinforcement on and secure to supports. For base slabs, use pre-soaked, pre-cast concrete blocks for bottom mat and bar chairs for top mat.

.6 Provide additional bars necessary to support dowels, stirrups or straight bars.

.7 Supports are to be purpose made and maintain integrity and water-tightness of concrete construction.

.8 Provide 10M “U” spacers at 3 m on-centre horizontally and 1.5 m on-centre vertically to hold wall reinforcing mats in position.

.9 Support slab-on-grade and structural slab reinforcing at 1000 mm maximum on-centre.

.10 All reinforcing steel shall be cleaned to the satisfaction of the Departmental Representative, and free of any rust, scale, mortar, paint, oil mud, ice, or other foreign substances, which will reduce bond, prior to placement of concrete.

END OF SECTION

Part 1 General

1.1 MEASUREMENT & PAYMENT

.1 The work in this Section will be paid as a Lump Sum item as Cast-in-Place Concrete.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA-A23.1/A23.2-2004, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

.2 CSA A283-00(R2003), Qualification Code for Concrete Testing Laboratories.

.3 CAN/CSA-A3000-03, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).

.1 CSA-A3001-03, Cementitious Materials for Use in Concrete.

.2 ICRI (International Concrete Repair Institute)

.1 ICRI Surface Preparation Guide Number 03732.

1.3 SUBMITTALS

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

.2 Shop Drawings:

.1 Submit placing drawings prepared in accordance with plans to clearly show size, shape, location, and necessary details of reinforcing.

.3 Provide testing results for review by Departmental Representative and do not proceed without written approval when deviations from mix design or parameters are found.

.4 Concrete hauling time: provide for review by Departmental Representative deviations exceeding maximum allowable time of 120 minutes for concrete from batch time to time of discharge.

1.4 QUALITY ASSURANCE

.1 Provide Departmental Representative, minimum 2 weeks prior to starting concrete work, with valid and recognized certificate from plant delivering concrete.

.1 Provide test data and certification by qualified independent inspection and testing laboratory that materials and mix designs used in concrete mixture will meet specified requirements.

.2 Minimum 4 weeks prior to starting concrete work, provide proposed quality control procedures for review by Departmental Representative on following items:

.1 Falsework erection.

.2 Hot weather concrete.

.3 Cold weather concrete.

.4 Curing.

.5 Finishes.

.6 Formwork removal.

.7 Joints.

.3 Quality Control Plan: provide written report to Departmental Representative verifying compliance that concrete in place meets performance requirements of concrete as established in PART 2 - PRODUCTS.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Delivery and Acceptance Requirements:

.1 Concrete hauling time: deliver to site of Work and discharged within 120 minutes maximum after batching.

.1 Do not modify maximum time limit without receipt of prior written agreement from Departmental Representative and concrete producer as described in CSA A23.1/A23.2.

.2 Concrete delivery: ensure continuous concrete delivery from plant meets CSA A23.1/A23.2.

Part 2 Products

2.1 PERFORMANCE CRITERIA

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

2.2 MATERIALS

.1 Cement: to CSA A3001, Type HS.

.2 Supplementary cementing materials: to CAN/CSA-A23.5, Type for Type C Flyash.

.3 Water: to CSA A23.1/A23.2.

.4 Aggregates: Fine and coarse aggregates: to CAN/CSA-A23.1, stockpiled separately.

.5 Admixtures:

.1 Air entraining admixture: to CAN3-A266.1.

.2 Chemical admixture: to CAN3-A266.2. Representative to approve accelerating or set retarding admixtures during cold and hot weather placing.

.6 Curing compound: to CSA A23.1/A23.2.white.

2.3 MIXES

.1 Proportion normal density concrete in accordance with CAN/CSA-A23.1, Table 11. Alternative 1 to give following properties for all concrete.

.2 Volume stability to be considered in mix proportions to prevent creep and shrinkage in accordance with Cl.4.1.1.9 and Cl.4.3.6 of CSA A23.1.

.3 Do not change concrete mix without prior approval of Departmental Representative. Should change in materials source be proposed, the new mix design is to be approved by Departmental Representative.

.4 Mix design to minimize shrinkage and to maximize water-tightness.

.5 Use of super-plasticizer is recommended. Add to mix at jobsite immediately prior to placing concrete. Slump of concrete prior to super-plasticizer addition to be 70+20 mm. Slump of concrete after super-plasticizer addition to be maintained in the range of 120+30 mm during the discharge period.

.6 One retempering of the mix is permitted with super-plasticizer during the discharge period. Retempering of the mix with water after the addition of super-plasticizer is not permitted.

Designation	**S1**
Application	**Exterior Concrete Slabs**
Structural Requirements	
CSA Exposure Class	S-1
Minimum Specified Strength (MPa)	35
Age (days) for Specified Strength	28
Maximum W/CM Ratio	0.40
Maximum Aggregate Size	20
Durability Requirements	
Exposure to Sulphate Attack	N
Alkali Aggregate Reactivity Addressed (Y/N)	Y
Aggressive Chemical/Waste/Other	N
Air Content	1
Color (Y/N)	N
Materials	
SCM Usage (Y/N)	Y
HVSCM 1 or HVSCM 2	2
Fly Ash (Y/N)	Y
Fly Ash Class	F or Cl
Silica Fume (Y/N)	N
Ground Granulated Blast Furnace Slag (GGBFS) (Y/N)	N

Part 3 Execution

3.1 PREPARATION

.1 Obtain Departmental Representative's written approval before placing concrete.

.1 Provide 48 hours minimum notice prior to placing of concrete.

.2 Place concrete reinforcing in accordance with Section 03 20 00 - Concrete Reinforcing.

.3 Prior to placing of concrete obtain Departmental Representative's approval of proposed method for protection of concrete during placing and curing including provisions for adverse weather.

3.2 INSTALLATION/APPLICATION

.1 Do cast-in-place concrete work to CSA A23.1/A23.2.

.2 During concreting operations:

.1 Development of cold joints are not allowed.

.2 Ensure concrete delivery and handling facilitates placing with minimum of re-handling, and without damage to existing structure or Work.

.3 Pumping of concrete is permitted only after approval of equipment and mix.

.4 Ensure reinforcement and inserts are not disturbed during concrete placement.

.5 Protect previous Work from staining.

.6 Clean and remove stains prior to application for concrete finishes.

.7 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.

.8 Do not place load upon new concrete until authorized by Departmental Representative.

.9 Minimum 3 days to elapse between adjacent walls or slab pours (continuous sequence pattern).

.10 Maximum 11m pour length between construction joints in any direction.

.11 All phases of construction, materials and workmanship, are to proceed with full regard to providing a watertight structure upon completion.

.12 Temperature of the concrete during discharge into the forms is to be between 10ºC and 22ºC. The temperature of the mix is to be maintained below 22ºC maximum temperature. Typical methods of reducing mix temperature include evaporative cooling of aggregate stockpiles, use chilled batch water or the inclusion of ice to the mix at the plant, taking care to maintain the design water/cementing material ratio. Obtain approval of Departmental Representative for proposed method of temperature control.

.13 Do not place concrete against any surfaces such as rebar, concrete or formwork that have a surface temperature of less than 5°C.

.14 Consolidate concrete using internal vibrators. Use pencil vibrators where larger sizes are unsuitable.

.15 Sleeves and inserts:

.1 Do not permit penetrations, sleeves, ducts, pipes or other openings to pass through joists, beams, column capitals or columns, except where indicated or approved by Departmental Representative.

.2 Where approved by Departmental Representative, set sleeves, ties, pipe hangers and other inserts and openings as indicated or specified elsewhere.

.3 Sleeves and openings greater than 100 x 100 mm not indicated, must be reviewed by Departmental Representative.

.4 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain written approval of modifications from Departmental Representative before placing of concrete.

.5 Confirm locations and sizes of sleeves and openings shown on drawings.

.6 Set special inserts for strength testing as indicated and as required by non-destructive method of testing concrete.

.16 Finishing and curing:

.1 Finish concrete to CSA A23.1/A23.2. Concrete tolerance - use straight edge method, Class A.

.2 Protect surfaces from excessive drying before and during finishing operations. The use of fly ash concrete will tend to increase the setting time of a concrete mix while reducing the amount of bleed water available to balance evaporation. Rapid loss of moisture from the surface of the concrete can result in defects such as plastic shrinkage cracking, crazing and/or crusting.

.3 Use procedures as reviewed by Departmental Representative to remove excess bleed water. Ensure surface is not damaged.

.4 Reservoir interior wall surfaces shall be given a sack rubbed finish to A23.1. Bug holes are to be filled.

.5 Reservoir exterior surfaces shall be given a smooth form finish.

.6 Apply hardener to all interior floor surfaces except on the pads and where coating is specified.

.7 All tie recesses are to be grouted with waterproof grout.

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

.17 Joint fillers:

.1 Furnish filler for each joint in single piece for depth and width required for joint, unless otherwise authorized by Departmental Representative.

.2 When more than one piece is required for joint, fasten abutting ends and hold securely to shape by stapling or other positive fastening.

.3 Locate and form construction joints as indicated.

.4 Install joint filler.

3.3 CRACK REPAIR

.1 Utilize the best possible care and construction techniques to minimize cracking of concrete walls and slabs.

.2 Cracks which do appear shall be routed out on each face and repaired with Cementitious waterproof grout in accordance with manufacturer's recommendations, except that cracks which are in excess of 0.50 mm width, or deemed by the Departmental Representative to be structurally detrimental, or subject to movement, shall be grouted with pressure injected epoxy resin.

.3 Obtain approval from Departmental Representative of pressure grouting techniques and epoxy materials to be utilized prior to proceeding with the work.

.4 Depth of epoxy grouting shall be sufficient to restore structural integrity and/or water-tightness, as required, but shall not be less than 100 mm.

.5 Cure crack repairs to manufacturer's instructions.

3.4 CURING

.1 In accordance with CSA A23.1 - Concrete Materials and Methods of Concrete Construction.

.2 Provide wet curing for not less than seven (7) consecutive days in all cases, at not less than 10ºC. In addition, suspended slabs shall be continuously cured until the concrete has attained a minimum of 80% of the specified strength.

.3 Acceptable curing methods:

.1 Ponding or continuous sprinkling.

.2 Absorptive mat or fabric kept continuously wet.

.3 Other moisture retaining method approved by the Departmental Representative.

.4 Provide insulation, hoarding and/or heating as required to prevent freezing during inclement weather.

.5 During hot weather, begin curing process immediately after finishing.

3.5 COLD WEATHER & HOT WEATHER CONCRETING

.1 Protection and preparation to comply with CSA A23.1.

.2 Hot weather concreting procedures are to be followed, when ambient air temperature exceeds 20ºC, during the placing period.

3.6 SURFACE TOLERANCE

.1 Concrete tolerance to CSA A23.1 Straightedge Method.

3.7 FIELD QUALITY CONTROL

.1 Site tests: conduct tests as follows:

.1 Concrete pours.

.2 Slump.

.3 Air content.

.4 Compressive strength at 7 and 28 days.

.5 Air and concrete temperature.

.2 Concrete testing: to CSA A23.1/A23.2 by testing laboratory approved by Departmental Representative and paid for by Contractor.

.3 Take concrete samples for testing in accordance with CSA A23.2. One (1) strength test shall consist of test cylinders for each 50 m^3 of concrete, or portions of each mix type of concrete or each separate type of structural element in any one (1)-day's pour. For concrete with specified twenty-eight (28) day strength, strength test shall consist of minimum three (3) test cylinders. Test first cylinder at seven (7) days and remaining two (2) at twenty-eight (28) days.

.4 Every load or batch of concrete shall be tested for air content and slump until satisfactory control is established and the Departmental Representative requires fewer tests. Whenever a test falls outside the specified limits, the testing frequency shall revert to one (1) test per load or batch until satisfactory control is re-established.

.5 Departmental Representative will take additional test cylinders during cold weather concreting. Cure cylinders on job site under same conditions as concrete which they represent.

.6 Non-Destructive Methods for Testing Concrete: to CSA A23.1/A23.2.

3.8 CLEANING

.1 Provide appropriate area on job site where concrete trucks and be safely washed.

.2 Do not dispose of unused admixtures and additive materials into sewer systems, into lakes, streams, onto ground or in other location where it will pose health or environmental hazard.

.3 Prevent admixtures and additive materials from entering drinking water supplies or streams.

.4 Using the appropriate safety precautions, collect liquid or solidify liquid with inert, non-combustible material and remove for disposal.

.5 Dispose of waste in accordance with applicable local, Provincial/Territorial and National regulations.

END OF SECTION

Part 1 General

1.1 PRICE AND PAYMENT PROCEDURES

.1 Measurement and Payment.

.1 No measurement of payment will be made for this section; include fuel system piping costs in Lump Sum Price for new AST Installation, as per Section 33 56 13 - Aboveground Fuel Storage Tanks.

1.2 REFERENCES

.1 All work covered by this section shall be carried out in accordance with, but not limited to the following standards, which shall be deemed to be and form part of this specification:

.1 American National Standards Institute:

.1 B31.3 – "Chemical Plant and Petroleum Refinery Piping".

.2 B2.1 – "Pipe Threads".

.3 B16.50 – "Steel Pipe Flanges and Flanged Fittings".

.4 B16.90 – "Steel Butt-weld Fittings.

.5 B16.11 – Forged Steel Fittings Socket Welding and Threaded.

.6 B16.21 – "Non-Metallic Gaskets for Pipe Flanges".

.7 B18.20 – "Square and Hex Nuts and Bolts".

.8 B16.25 – "Butt Welding Ends".

.2 Petroleum Tank Manufacturers Association of Alberta

.3 American Society of Mechanical Engineers: ASME Boiler and Pressure Vessel Code.

.4 Applicable Municipal and Regional Codes.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.

Part 2 Products

2.1 MATERIALS

.1 Steel Pipe – Class 150:

.1 Steel pipe, valves and fittings shall meet the following requirements:

.1 40 mm and down - Steel, seamless, Schedule 80, API 5L, Gr.B threaded or socket ends.

.2 50 mm - Steel, seamless, XS, API 5L Gr.B plain or B.W. ends.

.2 Stainless Steel Pipe - 304L, Schedule 40.

.3 Petroleum Tubing/Fittings:

.1 Tubing: Type 316 stainless steel, ASTM A-269, seamless, full annealed, max. RB80, 12mm O.D. x 1.3 mm wall thickness.

.2 Tube Fittings: 316 SS compression type.

.3 Shut-Off Valves: 316 SS compression type.

.4 Fusible link valve: 12 mm.

.5 Flexible Metal Hoses: 316SS tube with SS overbraid, 12mm nominal hose I.D., 900 mm minimum length.

.4 Fittings

.1 For 40 mm and down: ANSI Class 3000 CWP, steel, A-105 forged, threaded or socket.

.2 For 50 mm: B.W., carbon steel, std. Wt., A-234 Gr. WPB.

Part 3 Execution

3.1 INSTALLATION - GENERAL

.1 All work to meet local, Provincial, and Federal Acts, codes, and regulations, installed and tested to the satisfaction of governing fire authority and Departmental Representative. Fuel system installation work is to be done by a Petroleum Installer certified by the Province of Alberta. Certificates to be provided with bid. PWGSC requires the ITA Certified Petroleum Installer to provide a signed record that they completed the installed works as per CEPA Storage Tank Systems for Petroleum Products and Allied Petroleum Products Regulations, CCME Environmental Code of Practice for Aboveground and Underground Storage Tank Systems Containing Petroleum and Allied Petroleum Products, and the National Fire Code.

.2 Fabrication of all piping shall be as per CSA B139-09, ANSI B31.3 and ASME Boiler and Pressure Vessel Codes as applicable.

.3 Piping to be installed fitted and tested only by a petroleum pipe fitter of journeyman status. Journeyman certificates to be provided with bid.

.4 All piping must be flushed and tested.

.5 The use of close nipples is not permitted.

.6 The use of street elbows or 45 degree elbows for swing joints is not permitted.

.7 The Contractor shall follow the drawings in all matters concerning the location and placement of all pipe, valves, fittings and supports, and no changes are to be made from the drawings without prior written permission from the Departmental Representative.

.8 Pipes shall be adequately supported to prevent abnormal stress from being imposed on equipment. Inaccuracies in pipe fabrication causing stress to be imposed on the equipment will not be permitted. The Departmental Representative reserves the right to have flanged joints unbolted at the equipment flanges to determine if there is any misalignment. Unsatisfactory workmanship shall be corrected by re-adjustment of pipe supports, anchor points, or re-fabrication.

.9 All pipe and fittings must be swabbed clean (i.e. wire with a rag) prior to their assembly.

.10 After a pipe or fitting has been swabbed, plug the end with a rag or other device.

.11 Pipes shall be accurately cut to length so as to permit normal thread engagement between male and female threads.

.12 Threads shall be tapered and smooth, cut with the correct taper, lead, thread angle and diameter and shall conform to NPT (A.S.A.-B2-1-1945).

.13 After completion of installation, all scale, dirt, welding electrodes, slag, rags and other foreign materials shall be removed from the lines.

.14 Each joint shall be cleaned to remove dirt, loose mill scale or foreign substances before placing pipe in alignment for welding.

.15 Pipe not yet in use or in material stock pile on site shall be plugged with a rag or similar device to prevent foreign material from entering the pipe.

.16 All practical precautions shall be taken to prevent the introduction of foreign material into instruments, valves, meters, loaders, pumps and any other equipment.

3.2 ABOVEGROUND PIPE INSTALLATION

.1 Pipelines must be located aboveground, in parallel banks, plumb and true to provide a neat, orderly arrangement.

.2 Pipeline runs located as shown on plot plan and piping plan. Spaced centre to centre:

.1 For 40 mm and smaller: 150 mm C.C.

.2 For 50 mm: 200 mm C.C.

.3 Pipe Supports:

.1 Pipe supports/hangers shall be provided to support lines from 20 mm to 75 mm diameter every 2400 mm minimum and 100 mm to 300 mm diameter every 6500 mm, or as shown on drawings.

.2 If variations to .1 above are indicated on the drawings, the drawings shall govern.

3.3 INSPECTION AND TESTING

.1 The Contractor's work shall be available for inspection at any time by the Departmental Representative. All work shall be in accordance with and inspected and tested to meet the requirements of the standards specified.

.2 Contractor shall test valves for shut off and operation, and check packing for leakage.

.3 Defects disclosed in the work shall be made good or the work replaced without additional cost to the Owner.

.4 Test Procedures:

.1 The Contractor's work shall be available for inspection at any time by the Owner. All work shall be in accordance with and inspected and tested to meet the requirements of the standards specified.

.2 Contractor shall test valves for shut-off and operation, and check packing for leakage.

.3 Defects disclosed in the work shall be made good or the work replaced without additional cost to the Owner.

.5 Repairs to piping systems shall be made with new material. No caulking or screwed joints, cracks, or holes will be acceptable. Where it becomes necessary to replace pieces of pipe, such replacements shall be the same lengths as the defective pieces.

3.4 PAINTING

.1 All aboveground pipelines including all vent lines and pipe supports are to be painted to meet CPPI Colour-Symbol System.

.2 Painting and coating shall be performed after inspection and testing of the pipe.

.3 Gasoline pipe, Vent pipe and Supports in White.

.4 Surface preparation: Sandblast to SSPC-SP6 Commercial Blast Cleaning or cleaned to SSPC-SP11 Power Tool Cleaning to Bare Metal.

.5 Prime Coat: One coat (3 mils dry thickness).

.6 Final Coat: One coat (3 mils dry thickness).

.7 Contractor to touch up any paint damaged during installation.

END OF SECTION

Part 1 General

1.1 GENERAL

.1 All existing redundant electrical installation in areas to be renovated, will be removed where these have not been specifically indicated for re-use. Visit site and refer to drawings.

.2 Render safe the installations at locations from which existing equipment has been removed, by withdrawing the existing wiring and removing conduits to source. Where conduits are cast in concrete or are inaccessible they will be sealed and left in place.

.3 All 'reference specifications', indicated in Division 26, are to be distributed as part of the specification.

.4 This Section covers items common to Sections of Division 26. This section supplements requirements of Division 01.

.5 If this specification or the referenced drawings conflict in any way with the requirements of the applicable codes and/or standards, the more rigorous requirement shall prevail. Contractor shall be responsible for the compliance with applicable codes and/or standards.

.6 The Contractor shall provide all material, labour, equipment and transportation as necessary to complete the project in conformity with the Contract Documents. In general, this work includes everything essential for a complete electrical system in operating order as shown or implied on the drawings or hereinafter specified.

.7 Contractor shall furnish all scaffolding, rigging, hoisting and services necessary for delivery, erection and installation of all equipment and apparatus required to be installed by the Contractor. All equipment shall be removed by the Contractor upon completion of the project.

.8 The drawings depicting electric work are diagrammatic and show, in their approximate location, symbols representing electrical equipment and devices. The exact location of such equipment and devices shall be established in the field.

.9 Contractor shall furnish and install all such work, piping, structural supports, electrical wiring and conduit and any other additional equipment for a complete operational system.

.10 Unless specifically stated to the contrary, no measurement of an electrical drawing by scale shall be used as a dimension. Dimensions noted on the electrical drawings are subject, in each case, to measurements of adjacent or previously completed work and all such measurements necessary shall be taken before undertaking any work dependent upon them.

.11 In the event of a conflict between the drawings and specifications this Contractor shall base his bid on the greater quantity, cost, or quality of the item in question, unless such conflict is resolved by an addendum.

.12 Prior to any digging, excavation or ground work the contractor shall identify the location of all utilities and underground services and be responsible for maintaining their integrity and operation while working in the area.

1.2 CODES AND STANDARDS

.1 Do complete installation in accordance with CSA C22.1 unless more stringently identified by drawings, specifications or by the authority having jurisdiction.

.2 Do overhead and underground systems in accordance with CSA C22.3 No.1 unless more stringently identified by drawings, specifications or by the authority having jurisdiction.

.3 All materials shall have a CSA (or NRTL/C) label where a CSA standard or test exists.

.4 Contractor shall comply with National, Provincial and local Codes, laws, ordinances and regulations.

.5 New and existing cables that are being moved or spliced to, are to be tested to the International Electrical Testing Association (NETA) Standards (ANSI/NETA ATS-2013) before energization. Inform Departmental Representative of any cable failures within one (1) working day.

1.3 REGULATORY REQUIREMENTS

.1 Furnish products listed and classified by CSA and/or a nationally accepted testing laboratory (NRTL) such as UL, ETL etc. Products must be acceptable to authority having jurisdiction.

1.4 DEFINITIONS

.1 Provide: Furnish, install and wire complete and ready for service.

.2 Furnish: Responsible for purchasing item and also delivery to the jobsite.

.3 Install: Responsible for moving and mounting equipment to the final location.

.4 Wire: Responsible for final connections, ready for service.

.5 Exposed: Exposed to view in any room, corridor or stairway.

.6 Demolish: Isolate, disconnect, remove equipment and appurtenances from site and dispose, take out wiring, conduit and any supports back to source.

1.5 CARE, OPERATION AND START-UP

.1 Instruct operating personnel in the operation, care and maintenance of systems, system equipment and components.

.2 Arrange and pay for services of manufacturer's Factory Service Engineer to supervise start-up of installation, check, adjust, balance and calibrate components and instruct operating personnel.

.3 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with all aspects of its care and operation.

1.6 VOLTAGE RATINGS

.1 Operating voltages: to CAN3-C235.

.2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard. Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

1.7 PERMITS, FEES AND INSPECTION

.1 Submit to Electrical Inspection Department and Supply Authority necessary number of drawings and specifications for examination and approval prior to commencement of work.

.2 Pay associated fees and taxes as required to complete the work.

.3 Departmental Representative will provide drawings and specifications required by Electrical Inspection Department and Supply Authority at no cost.

.4 Notify Departmental Representative of changes required by Electrical Inspection Department prior to making changes.

.5 Furnish Certificates of Acceptance from Electrical Inspection Department on completion of work to Departmental Representative.

1.8 MATERIALS AND EQUIPMENT

.1 Provide materials and equipment in accordance with Division 01.

.2 Equipment and material to be CSA certified. Where there is no alternative to supplying equipment, which is not CSA certified, obtain special approval from Electrical Inspection Department.

.3 Factory assembled control panels and component assemblies.

.4 All items specified shall be the latest type or model produced by the manufacturer specified. If descriptive specification or model number is obsolete, substitute with current product.

1.9 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

.1 Supplier and installer responsibility is indicated in Motor, Control and Equipment Schedule on electrical drawings and related mechanical responsibility is indicated on Mechanical Equipment Schedule on mechanical drawings.

.2 Control wiring and conduit is specified in Division 26 except for conduit, wiring and connections below 50 V which are related to control systems and shown on mechanical drawings.

1.10 FINISHES

.1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.

.2 All couplings, connectors, junction boxes, enclosures, switchgear, pull boxes and cover plates to be coloured to match below colour coding schedule:

System	Colour*		
120/208 V Power	Grey	-	416
347/600 V Power	Green	-	393
Low Voltage Switching System	Black	-	T-170

*Color numbers match Cloverdale Paint.

.3 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.

.4 The Contractor shall clean all exposed ironwork, the interior and exterior of cabinets and pull boxes, etc., and remove all rubbish and debris resulting from the work.

.5 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

.6 During the progress of the work and when directed by the Departmental Representative, the Contractor shall remove from the building site rubbish, dirt and other debris caused by performance of the work.

1.11 LABELLING

.1 Labelling - Equipment

.1 Identify electrical equipment with nameplates and labels as follows:

.1 Nameplates: Lamicoid 3 mm thick plastic engraving sheet, mechanically attached with self-tapping screws.

Table 1-1: Nameplate Sizes

Size 1	10 x 50 mm	1 line	3 mm high letters
Size 2	12 x 70 mm	1 line	5 mm high letters
Size 3	12 x 70 mm	2 lines	3 mm high letters
Size 4	20 x 90 mm	1 line	8 mm high letters
Size 5	20 x 90 mm	2 lines	5 mm high letters
Size 6	25 x 100 mm	1 line	12 mm high letters
Size 7	25 x 100 mm	2 lines	6 mm high letters

.2 Labels: Embossed plastic labels with 6 mm high letters unless specified otherwise.

.3 Nameplates to be white letters on red background for emergency and white letters on black background for normal power. Wording of nameplates to be co-ordinated with Hospital to ensure existing standards are adhered to.

.2 Wording on nameplates and labels to be approved by Departmental Representative prior to manufacture.

.3 Allow for average of twenty-five (25) letters per nameplate and label.

.4 Identification to be English.

.5 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.

.6 Identify equipment with Size 3 labels engraved "ASSET INVENTORY No. ". Number as and if directed by Departmental Representative.

.7 Disconnects, starters and contactors: indicate equipment being controlled and voltage.

.8 Terminal cabinets and pull boxes: indicate system and voltage.

.9 Transformers: indicate capacity, primary and secondary voltages.

.10 Receptacles. Indicate panel number and circuit

.11 Disconnect switches. Indicate description and supply point.

.12 Transformers. Indicate primary and secondary voltage, KVA and feeder identification.

.13 Switchgear. Main identification label and component breakers and switches to indicate unit designated and voltage.

.14 Panelboards. Main identification label and voltage.

.2 Labelling – Wiring

.1 All power, instrumentation and control wires:

.1 Shall be provided with indelible permanent wire tags at each end of the wire.

.2 Shall use polyester or polyolefin heat-shrinkable sleeves.

.3 Marking shall be abrasion, ozone, ultraviolet, and solvent resistant.

.4 Numbering shall match control wiring diagrams

.5 Numbering shall match on both ends of phase conductors of feeders and branch circuit wiring.

.2 Maintain phase sequence and colour coding throughout.

.3 Colour code: to CSA C22.1.

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

.3 Labelling – Cable

.1 Conductors to be labelled at each end by slip-on plastic tags Wieland type Z5 or Weidmuller type Z or by machine-printed heat-shrink labels. Use the conductor designations shown on the wiring drawings. Seal all conductor labels with clear heat-shrink covers.

.2 WRITE-ON LABELS ARE NOT ACCEPTABLE.

.3 Colour code conduits, boxes and metallic sheathed cables.

.4 All branch CCT conductors Hot and Neutrals in junction boxes, panels, wiring devices, light fixtures, etc., to be marked with panel and circuit number identification approved by the Hospital. Contractor to submit a cable schedule with tagging for approval prior to final fixing.

1.12 LABELS – MANUFACTURER AND CSA

.1 Visible and legible, after equipment is installed.

.2 All electrical equipment shall be approved by a nationally recognized testing laboratory such as the Canadian Standards Association.

1.13 WIRING TERMINATIONS

.1 Lugs, terminals, screws used for termination of wiring to be suitable for either copper or aluminum conductors.

1.14 WARNING SIGNS

.1 As specified and to meet requirements of Electrical Inspection Department and Departmental Representative.

.2 Decal signs, minimum size 175 x 250 mm.

1.15 SINGLE LINE ELECTRICAL DIAGRAMS

.1 Provide full site single line electrical diagrams under plexiglass in all electrical substations

.2 Provide fire alarm riser diagram, plan and zoning of building under plexiglass at fire alarm control panel and annunciator.

.3 Drawings: ANSI D – 22″x34″ minimum size.

1.16 LOCATION OF OUTLETS

.1 Locate outlets as shown on drawings and to CSA C22.1.

.2 Do not install outlets back-to-back in wall; allow minimum 150 mm horizontal clearance between boxes.

.3 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000 mm, and information is given before installation.

.4 Locate light switches on latch side of doors. Locate disconnect devices in mechanical and elevator machine rooms on latch side of floor.

1.17 MOUNTING HEIGHTS

.1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.

.2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.

.3 Install electrical equipment at following heights unless indicated otherwise.

- .1 Local switches: 1400 mm.
- .2 Wall receptacles:
  - .1 General: 300 mm.
  - .2 Above top of continuous baseboard heater: 200 mm.
  - .3 Above top of counters or counter splash backs: 175 mm.
  - .4 In mechanical rooms or process areas: 1400 mm.
- .3 Panelboards: as required by Code or as indicated.

1.18 LOAD BALANCE

.1 Measure phase current to panelboards with normal loads (lighting) operating at time of acceptance. Adjust branch circuit connections as required to obtain best balance of current between phases and record changes.

.2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.

.3 Submit, at completion of work, report listing phase and neutral currents on panelboards, dry-core transformers and motor control centres, operating under normal load. State hour and date on which each load was measured, and voltage at time of test.

1.19 CONDUIT AND CABLE INSTALLATION

.1 Install conduit and sleeves prior to pouring of concrete. Sleeves through concrete: schedule 40 steel pipe, sized for free passage of conduit, and protruding 50 mm.

.2 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.

.3 Install cables, conduits and fittings to be embedded or plastered over, neatly and close to building structure so furring can be kept to minimum.

1.20 FIELD QUALITY CONTROL

.1 All electrical work to be carried out by qualified, licensed electricians or apprentices as per the conditions of the Provincial Act respecting manpower vocational training and qualification. Employees registered in a provincial apprentices' program shall be permitted, under the direct supervision of a qualified licensed electrician, to perform

specific tasks - the activities permitted shall be determined based on the level of training attained and the demonstration of ability to perform specific duties.

.2 The work of this division to be carried out by a Certified Master Electrician who holds a valid Master Electrical contractor license as issued by the Province that the work is being constructed.

.3 Conduct and pay for following tests:

- .1 Power system including phasing, voltage, grounding and load balancing.
- .2 Circuits originating from branch distribution panels.
- .3 Lighting and its control.
- .4 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.
- .5 Systems: fire alarm system, communications.

.4 Furnish manufacturer's certificate or letter confirming that entire installation as it pertains to each system has been installed to manufacturer's instructions.

.5 Insulation resistance testing.

- .1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.
- .2 Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument.
- .3 Megger 4160V circuits, feeders and equipment with a 5000 V instrument.
- .4 Check resistance to ground before energizing.

.6 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.

.7 Submit test results for Departmental Representative’s review.

.8 Should it be found by the Departmental Representative that any equipment or any portion of the electrical system installed under this Contract fails to comply with the Contract Documents with respect to quality of workmanship or materials, such shall be replaced by the Contractor and all other work disturbed by correction of defects or imperfections shall also be corrected at the Contractor's expense.

.9 The operation of the equipment and electrical systems does not constitute an acceptance of the work by the Owner. The final review is to be made after the Contractor has adjusted his equipment and demonstrated that it fulfills the requirements of the drawings and the specifications.

.10 Upon completion of the installation, the Contractor shall furnish certificates of approval from all authorities having jurisdiction. Demonstrate that all work is complete and in ideal operating condition, with raceway and conduit system properly grounded, all wiring free from grounds, shorts, and that the entire installation is free from any physical defects. In the presence of the Departmental Representative and the Owner, the Contractor shall demonstrate the proper operation of all miscellaneous systems.

1.21 CO-ORDINATION OF PROTECTIVE DEVICES

.1 Contractor is responsible for providing transformer, breaker and breaker trip details to the Departmental Representative.

.2 Departmental Representative will provide the contractor with breaker trip settings.

.3 Contractor to ensure circuit protective devices such as over current trips, relays and fuses are installed to required values and settings.

1.22 RECORD DRAWINGS

.1 The Contractor shall keep a detailed up to date record of the following items:

- .1 Feeder conduit routing.
- .2 Dimensions drawings indicating all conduits in the slab.
- .3 Approximate junction box and branch conduit locations.
- .4 Actual circuit numbers, the equipment and devices are connected to.
- .5 Inverts of all services entering and leaving the building and at property lines.
- .6 Dimensions of underground services in relation to building lines at key point of every run.
- .7 Elevations of underground services in relation to ground floor level of the building.
- .8 Exact dimensioned location of all services embedded in the structure.
- .9 Exact dimensioned locations of all service left for future work.
- .10 All changes to the work during construction and ensure that corrections are made on floor plans and riser diagrams, etc. as applicable.
- .11 All conduit and wiring and all deviations from circuit numbers shown on the Contract documents.
- .12 For the sake of clarity, produce separate lighting, power and communications drawings and show all conduit and wiring.
- .13 Revised and/or draw new riser and connections diagrams as necessary.
- .14 Revised motor control schedules, motor control centre elevations and schematics required.
- .15 Existing drawing to be incorporated into new drawing where necessary.
- .16 All as-built drawings are to be submitted to the Departmental Representative and then transmitted to Facilities Management liaison in hard copy and electronic formats.

.2 Record drawings shall be maintained throughout the duration of the project. At the time of project completion, a complete set drawings reflecting pertinent information shall be completed and turned over to the Departmental Representative.

.3 Refer to General Requirements Division 1, for additional information concerning record documents.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 GENERAL

.1 Secure equipment to masonry, tile and plaster surfaces with Hilti anchors.

.2 Secure equipment to poured concrete with expandable inserts.

.3 Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.

.4 Secure surface mounted equipment with twist clip fasteners to inverted T bar ceilings. Ensure that T bars are adequately supported to carry weight of equipment specified before installation.

.5 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.

.6 Fasten exposed conduit or cables to building construction or support system using straps.

- .1 One-hole steel straps to secure surface conduits and cables 50 mm and smaller.
- .2 Two-hole steel straps for conduits and cables larger than 50 mm.
- .3 Beam clamps to secure conduit to exposed steel work.

.7 Suspended support systems.

- .1 Support individual cable or conduit runs with 6 mm dia threaded rods and spring clips.
- .2 Support 2 or more cables or conduits on channels supported by 6 mm dia threaded rod hangers where direct fastening to building construction is impractical.

.8 For surface mounting of two or more conduits use channels at 2.4 m oc spacing.

.9 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.

.10 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.

.11 Do not use wire lashing or perforated strap to support or secure raceways or cables.

.12 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Departmental Representative.

.13 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

END OF SECTION

Part 1 General

1.1 FIELD INSPECTION AND TESTING

.1 This specification covers the field inspection, testing, checking out and adjustments, if necessary, of all electrical equipment and materials in the completed facility.

.2 All Start-up and Commissioning to conform to the requirements of Division 01.

1.2 GENERAL

.1 Workmanship, methods, inspections, and materials used in erection and installation of the subject equipment to conform with accepted engineering practices, IEEE Standards, the Canadian Electrical Code and the Specifications for electrical work.

.2 Perform all wire checks, including factory wiring, setting up all test equipment and any other preliminary work in preparation for the electrical acceptance tests. Inspect all equipment to make sure it has been installed in accordance with the Manufacturer's recommendations.

.3 Each acceptance test shall be witnessed by the authorized representative for the Departmental Representative, unless otherwise advised.

.4 Schedule all testing with Departmental Representative’s approval and no testing shall be performed without Departmental Representative’s approval.

.5 The testing shall be performed by and under the immediate supervision of the Contractor:

.1 Notify the Departmental Representative in writing at least seventy-two (72) hours prior to test establishing the time the test is to be performed.

.6 Field test (as outlined in the following paragraphs) all wire, cable and electrical equipment to assure proper installation, settling, connections, and functioning in accordance with this project's contract drawings, Specifications, and manufacturer's recommendations and perform any additional tests deemed necessary by Departmental Representative to determine that equipment, materials and systems meet the requirements of the project.

.7 Final acceptance will not only depend on equipment dependability, as determined by the subject tests; but will depend on complete operational tests on all equipment to show that the equipment will perform the functions for which it was designed and meet the requirements of the project and specifications.

.8 Manufacturers shall be notified and shall be permitted to witness high voltage or other tests performed on their equipment, if they so request.

.9 No equipment is to be energized without the approval of a designated representative of the Departmental Representative.

.10 The following precautions shall be observed prior to energizing any equipment:

.1 Make certain that all construction dirt and debris, conducting material, wire trimmings, and unused or dropped hardware have been removed. All electrical equipment shall be vacuum cleaned to dust free condensation (equipment shall be

dried out, if necessary). The enclosures, door or doors, etc., shall then be visually inspected for protective integrity.

.2 Inspect and check all bolted bus connection and bus bracing for proper assembly.

.3 Operate the equipment manually and visually inspect the same for proper clearances of all moving items also making certain that proper lubrication is in evidence.

.11 Furnish all required testing equipment and safety devices including, but not limited to the following items:

.1 500 V and 1000 V DC meggers, 0-10+ giga ohm scale.

.2 Portable telephone sets and 2-way radios, if required.

.3 Battery powered ringing sets.

.4 150-1000 V AC voltmeters, 0-500A AC ammeters 1.5% accuracy, General Electric Co. type portable instruments, or as approved.

.5 Volt-OHM-Milli-ammeters, Simpson or as approved.

.6 Micro-ohm meter 10A output.

.7 Phase rotation meters, 60 hertz.

.8 D.C. voltmeter 0-1000 V DC. DC ammeter to 10 Amps.

.9 Rubber gloves, rubber mats, goggles, insulated tools, and any other equipment necessary to ensure safe working condition.

.10 Signals and danger signs.

.11 Miscellaneous cable, switches, receptacles, plugs, etc., as required.

1.3 SAFETY

.1 The purpose of electrical equipment testing and checking is to determine whether the device will work properly as intended for the specific job to which it is applied. The field testing of apparatus shall, as much as possible, duplicate actual operating conditions, e.g. control circuits energized. In many instances, this requires that the apparatus be in actual use. For safety, however, the testing of live equipment at power voltage shall be avoided whenever possible.

.2 If temporary circuits must be maintained, accidental contact with other circuits and live parts on adjacent apparatus must be prevented. If at all possible, power to adjacent apparatus shall be disconnected prior to testing.

.3 Equipment under test shall be isolated from remote control or feedback circuits to prevent accidental energization by others. If power must be maintained as part of the test, personnel shall be protected against electrical shock by rubber floor mats, rubber gloves, goggles, approved non-conducting safety hats and insulated tools.

.4 Bus runs that have been disconnected for test purposes shall be grounded to prevent feedback of test voltages. If these conductors cannot be grounded, the test area shall be roped off or otherwise protected from the accidental approach of unauthorized and unnecessary personnel while test is in progress.

.5 Capacitive circuits and any device capable of storing electrical energy received from test voltages are a significant hazard. They shall be grounded during the test, or if they are

necessary and included in the circuitry, they shall be grounded after each application of test voltages.

1.4 PHASING AND SYNCHRONIZING

.1 Check phasing before and after the generator is moved, and the phasing at all disconnect points before connected to the overhead system.

.2 All power cable and bus duct circuits shall be checked to verify that connections, in regard to phasing, are in accordance with the contract drawings.

.3 All power cable circuits shall be checked to verify that all circuits that can be energized from two (2) or more sources are in phase.

1.5 WIRE AND CABLE

.1 All cable connections must pass visual inspection for workmanship and conformance with standard practice.

.2 All wire and cable shall be tested for continuity.

.3 All cables for 600 V AC circuits shall be meggered with a 1000 V DC megger for one (1) minute. The insulation resistance level shall not be less than 100 megaohms, with the exception of circuit directly connected to existing equipment shall not be less than five (5) megaohms.

.1 During insulation tests all switchboards, panelboards, fuse holders, switches, and overcurrent devices to be in place (except devices with sensitive electronic components recommended by manufacturer not to be meggered).

.2 Motors and transformers shall not be connected during megger tests.

.4 Each phase shall be tested between conductor and ground and between phases.

.5 For 600 V cables, the cable megger test shall be held until three (3) equal readings, each one (1) minute apart, are obtained.

.6 Lighting circuits and all 120V power services shall be tested only during construction for continuity and identification and shall pass operational tests to see that the circuits perform all functions for which they are designed.

.7 120 VAC control cable shall be checked by megger tests similar to those described for 600 V wire and cable. Control wiring shall be checked for proper connection in accordance with interconnection diagrams or tables and for tightness of terminal contacts and continuity through each "run" of control circuiting.

.8 Complete and accurate records of all cable tests and inspection shall be made.

1.6 CONTROLS

.1 Electrical controls, circuits and systems shall be tested by trial operation of control equipment after all wiring is completed to see that each interlock and control function operates in accordance with the contract drawings, specifications and the description of operation for the equipment. Where field conditions prevent actual equipment functioning during testing, the Contractor shall simulate the intended operating condition in the associated control circuits.

.2 Locate the cause of any malfunction, within the contractor's scope of responsibility, and make the necessary wiring and/or equipment changes or corrections to obtain the particular systems intended operation as defined by the contract drawings. Costs of these necessary changes are included in the base bid. Such changes shall be included in the test report.

.3 Control panels shall be operated through all design functions. This shall include remote operation of all equipment and actuation of alarms and indicating devices according to design requirements.

.4 Complete operational tests shall be given to all relays and control devices to show that the equipment performs all design functions and meets design and procurement specifications.

1.7 METERING

.1 Verify correct PT and CT ratio and that the connection conforms to manufacturer's recommendation.

.2 Voltage, current, kW, pf, harmonics, etc., displayed on meter must be verified to Departmental Representative, to be representing actual system characteristics.

1.8 MISCELLANEOUS

.1 All other breakers, switches and contactors shall be given complete operational tests to determine that all design functions are satisfactorily performed.

.2 All switches (control, instrument, disconnect, safety, etc.) shall be inspected and tested as to cleanliness and operation. Contacts so requiring, shall be cleaned before operation.

.3 Switches shall be checked for correct sequence of operation.

.4 Fuses shall be inspected for correct rating.

.5 Coordinate all testing of instruments for those devices.

1.9 TEST REPORTS

.1 During each of the aforementioned tests, maintain a comprehensive set (quantity of duplicates to be determined by Departmental Representative) of test reports defining the specific condition in which the apparatus is left, after it has been given approval for use in its intended service. The completed reports shall become the property of the Departmental Representative.

.2 A checklist type report for each individual item of major electrical equipment should be headed with, but not limited to, the following identification data defining:

.1 Equipment Name.
.2 Item Tag Number.
.3 Manufacturer.
.4 Type of Class.
.5 Application.
.6 Plant Location.
.7 Voltage Rating.

.8 Date of Test.

.9 Ambient Conditions.

.10 Testers Signature.

.3 Among the specific requirements of testing to determine the equipment's operational condition relative to that particular apparatus, all items shall be visually inspected and evaluated on the report as to its general condition both exterior and interior.

.4 Unless otherwise directed by Departmental Representative, the forms used for testing shall be those that are available by the particular equipment's manufacturer and as per Division 01.

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 REFERENCE STANDARDS

.1 Conform to CSA STANDARD C22.1, Canadian Electrical Code: Part I, latest edition.

Part 2 Products

2.1 POWER CABLES: 0 - 1000V

.1 Non-armoured Cable (cable in conduit installation):

- .1 Conductors:
  - .1 Grounding conductor: Stranded bare copper. To be insulated (green jacket) in conduit.
  - .2 Circuit conductors: Stranded insulated copper.
- .2 Size: Minimum size of #12 AWG for power circuits.
- .3 Insulation: XLPE - Chemically cross-linked thermosetting polyethylene.
- .4 Insulation rating: minimum 1000VAC for feeder circuits and 600VAC for branch circuits.
- .5 Wiring to outlets connected to ground fault interrupter breakers or to an isolated power system shall have 1,000-volt insulation.

2.2 INSTRUMENTATION AND CONTROL CABLES

.1 Analogue signals: 4-20 mA, 1-5VDC, 0-10VDC.

- .1 Digital signals: 24VDC and under pulse type signals.
- .2 Twisted pair shielded (TPSH) cables shall be constructed as follows:
  - .1 Two (2) copper conductors, stranded, tinned, minimum #18 AWG, PVC insulated, twisted in nominal intervals of 50 mm. Conductor identification to be by black and white coloured insulation.
  - .2 Insulated for 600 V, 90ºC.
  - .3 100% coverage aluminum foil or tape shield.
  - .4 Separate bare stranded, tinned copper drain wire, minimum #18 AWG.
  - .5 Overall PVC jacket rated to -40ºC and meeting low gas emission and FT 4 flame test requirements set forth in CSA C22.2 - No 0.3 and IEEE 383. Overall PVC jacket to be grey in colour.
  - .6 The entire cable assembly to be suitable for pulling in conduit. Cables located in cable tray to be armoured with overall PVC jacket-type, in accordance with Paragraph 2.3.
- .3 Multi-pair cables to have individual shield as well as an overall shield and overall flame retardant PVC jacket.

.2 120VAC Control Signal and Power to Instruments:

.1 Minimum allowable sizes:
  .1 120VAC Power to Instruments: #14AWG.
  .2 120VAC Control signals: #16AWG.
.2 Insulation rating: 600V, 90ºC.

2.3 WIRE CONNECTORS

.1 The following listings specify products for copper conductors only. Aluminum conductors are not permitted.
  .1 Compliance: CSA C22.2 No. 65 and No. 188.
  .2 Terminal Connectors:
    .1 Ring-type or locking fork-type, crimp-on terminal with nylon insulating sleeve over brazed seam shank.
    .2 Minimum rating, as required V, 105ºC.
    .3 Conductive member made from electro tin-plated copper.
    .4 Limited for use up to No. 10 AWG.

2.4 COLOUR CODING

.1 All conductors shall be identifiable by coloured insulation and permanent markers at every terminal and accessible point as follows:

Table 2-1: Conduit and Raceway Colours

System	Colour*
Grounding Conductors	Green
Neutral Conductors	White
120/208 V Normal Power	Red, Black, Blue
120/208 V Emergency Power	Red, Black, Blue

2.5 ELECTRICAL TAPE

.1 To be compatible with conductor or cable insulation or jacketing, as applicable.

.2 For general purpose: Vinyl plastic, premium grade, minimum 0.18 mm (7 mil) thickness, black or colour coded, as required. Acceptable product: 3M Super 33 + or 35.

.3 Self-vulcanizing, linerless, rubber tape, minimum 0.76 mm (30 mil) thickness. Acceptable product: 3M, Type 130C.

Part 3 Execution

3.1 INSTALLATION OF CABLES AND WIRES: 0 - 1000 VOLTS

.1 Install wires and cables as indicated and in accordance with these specifications.

.2 Conduits and cables to be tagged in accordance with Division 26 - Electrical.

.3 Group cable wherever possible on channels.

.4 In-line splices are not permitted.

.5 Provide mechanical protection for cables that are turned up above the floor through sleeves or slots. Provide channels, angle sills or rigid conduit sleeves.

.6 Where cables are not run in tray, support on Unistrut channels with a maximum spacing of one (1) metre between intervals. Run cables parallel to the lines of the building. Bends to be concentric. Group cables wherever possible:

.1 Fasteners for all cables on Unistrut channels shall be cable clamp type. Use non-ferrous fasteners in wet locations.

.7 Care shall be taken to ensure that cable jacket is not damaged by application of the clamps.

.8 Cinch anchors shall be used to fasten the Unistrut brackets to walls. Concrete beams shall not be drilled without prior authorization by the Departmental Representative. Care shall be taken in drilling concrete blocks or masonry work to ensure the surface will not be cracked.

.9 Power actuated fastening tools, e.g., Hilti, shall not be used without written approval from the Departmental Representative.

.10 Any damage to the jacket of cable shall be immediately repaired in accordance with the manufacturer's recommendation.

.11 Install instrumentation cables in conduit systems. Use a minimum of 300 mm length of liquid tight flexible conduit to connect the field sensors to conduit.

.12 At each end of the run leave sufficient cable for termination.

.13 Do not make splices in any of the instrumentation cable runs.

.14 Ground cable shields at one end only. Unless otherwise specified, ground the shields at the controller panel.

3.2 CONDUCTOR TERMINATIONS FOR INSTRUMENTATION CABLES

.1 Provide all equipment with terminal blocks to accept conductor connections.

.2 Equip instrumentation conductors terminated at equipment terminals other than terminal blocks with Burndy YAE-2 or STA-KON, self-insulated, locking type terminators. Size as required to fit conductors and screw terminals.

3.3 TESTING OF WIRES AND CABLES

.1 Perform tests in accordance with Division 26 – Electrical Inspection and Testing.

3.4 GROUND CONDUCTORS IN CONDUITS

.1 Ensure that every circuit is provided with a ground conductor of sufficient ampacity to meet the requirements of the Canadian Electrical Code.

3.5 IDENTIFICATION

.1 Identify all instrumentation and power cables per Division 26 - Electrical.

.2 The contractor shall produce complete cable schedules for review. All cable and wire tagging shall be as owner standards.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 ANSI/IEEE837, Qualifying Permanent Connections Used in Substation Grounding.

Part 2 Products

2.1 EQUIPMENT

.1 Clamps for grounding of conductor: size as indicated as required to electrically conductive underground water pipe.

.2 Rod electrodes: copper clad steel 19 mm dia by 3 m long.

.3 Grounding conductors: bare stranded copper, size as indicated.

.4 Insulated grounding conductors: green, type TW75, sizes to CSA requirements, minimum size #12.

.5 Ground bus: copper, size as indicated, complete with insulated supports, fastenings, connectors.

.6 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to: grounding and bonding bushings; protective type clamps; bolted type conductor connectors; bonding jumpers, straps; and pressure wire connectors.

Part 3 Execution

3.1 INSTALLATION GENERAL

.1 Install complete permanent, continuous grounding system, including electrodes, conductors, connectors, and accessories.

.2 Where EMT is used, run ground wire in conduit.

.3 Install connectors in accordance with manufacturer's instructions.

.4 Protect exposed grounding conductors from mechanical injury.

.5 Make buried connections, and connections to conductive water main, electrodes, using permanent mechanical connectors or inspectable wrought copper compression connectors to ANSI/IEEE837.

.6 Use mechanical connectors for grounding connections to equipment provided with lugs.

.7 Soldered joints not permitted.

.8 Install flexible ground straps for bus duct enclosure joints, where such bonding is not inherently provided with equipment.

.9 Install separate ground conductor to outdoor lighting standards.

.10 Connect building structural steel and metal siding to ground by welding copper to steel.

.11 Make grounding connections in radial configuration only, with connections terminating at single grounding point street side of water pipe. Avoid loop connections.

.12 Bond single conductor, metallic armoured cables to cabinet at supply end, and provide non-metallic entry plate at load end and load end.

.13 Ground secondary service pedestals.

3.2 ELECTRODES

.1 Install rod, electrodes and make grounding connections.

.2 Bond separate, multiple electrodes together.

.3 Use size #2/0 AWG copper conductors for connections to electrodes.

.4 Make special provision for installing electrodes that will give acceptable resistance to ground value where rock or sand terrain prevails. Ground as indicated.

.5 Connections to the ground rods to be by Cadweld connections.

3.3 SYSTEM AND CIRCUIT GROUNDING

.1 Install system and circuit grounding connections to neutral of secondary 120 V system.

.2 Install a bare #6 ground wire in cable tray. Bond as required for tray sections to make continuous ground plus to structural steel every 10 m.

3.4 EQUIPMENT GROUNDING

.1 Install grounding connections to typical equipment included in, but not necessarily limited to the following list: service equipment, transformers, switchgear, duct systems, frames of motors, motor control centres, starters, control panels, building steel work, generators, elevators and escalators, distribution panels, and outdoor lighting.

3.5 GROUNDING BUS

.1 Ground items of electrical equipment in electrical room to ground bus with individual bare stranded copper connections size #2/0 AWG.

3.6 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Division 26 - Electrical.

.2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of Departmental Representative and local authority having jurisdiction over installation.

.3 Perform tests before energizing electrical system.

.4 Disconnect ground fault indicator during tests.

END OF SECTION

Part 1 General

1.1 GENERAL

.1 This section covers the hangars and supports for the electrical systems.

Part 2 Products

2.1 SUPPORT CHANNELS

.1 U shape, size 41 x 41 mm, 2.5 mm thick, surface mounted or suspended.

Part 3 Execution

3.1 INSTALLATION

.1 Secure equipment to poured concrete with expandable inserts.

.2 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.

.3 Fasten exposed conduit or cables to building construction or support system using straps.

.4 One-hole steel straps to secure surface conduits and cables 50 mm and smaller.

.5 Support individual cable or conduit runs with 9 mm dia threaded rods and spring clips.

.6 Support 2 or more cables or conduits on channels supported by 9 mm dia threaded rod hangers where direct fastening to building construction is impractical.

.7 For surface mounting of two or more conduits use channels at 3 m oc spacing.

.8 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.

.9 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.

.10 Do not use wire lashing or perforated strap to support or secure raceways or cables.

.11 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

END OF SECTION

Part 1 General

1.1 DEFINITIONS

.1 Junction Box: A box where conductors are spliced with or without terminal blocks, generally not scheduled on drawings or tagged in field. Junction Box can be used as a Pull Box for some cables.

.2 Terminal Box: A box containing terminal blocks to connect conductors, generally scheduled on drawings and tagged in field per specifications and drawings.

.3 Pull Box: A box used to ease the pulling of conductors. May be a through-pull or a T or X conduit connection, but no splicing of conductors is being done. Generally, not scheduled on drawings or tagged in field.

.4 Panel: An enclosure containing electrical control components such as relays, controllers and the like or an enclosure with a large number of terminal blocks for the purpose of serving as a marshalling point for a number of branch circuits. Scheduled on drawings and tagged in field.

.5 Splitter: An enclosure containing a splitter block or bus bars for the connection of a main circuit and several branch circuits.

Part 2 Products

2.1 ACCEPTABLE MANUFACTURERS

.1 Catalogue numbers specified are for the purpose of illustrating features and to establish the grade of quality of the products specified in this section and are taken from one manufacturer's product line. Unless otherwise noted, products from other listed manufacturers that have identical features and characteristics are acceptable.

.2 All equipment shall be CSA certified.

2.2 SPLITTERS

.1 Compliance: CSA C22.2 - No. 76.

.2 Sheet metal enclosure, welded corners and formed hinged gasketted cover suitable for locking in closed position.

.3 Main and branch lugs or connection bars to match required size and number of connecting conductors as indicated.

.4 At least three (3) spare terminals on each set of lugs in splitters.

2.3 JUNCTION BOXES AND PULL BOXES

.1 For outlet and conduit boxes refer to Division 26 - Outlet Boxes, Conduit Boxes and Fittings.

.2 Metal enclosure, NEMA Type 4

2.4 TERMINAL AND PULL BOXES

.1 Intended for surface mounting, except as otherwise shown or specified.

.2 Weatherproof Style:

.1 Metal enclosure, NEMA Type 4.

.2 Hinged door if any one (1) dimension exceeds 300 mm.

.3 Manufactured breather, designed to maintain weatherproof classification of enclosure.

.4 When used as terminal box, equipped with mounting pan and terminal strip.

.3 Weather- and Corrosion-Proof

.1 Same features as for weather proof style, stainless steel, NEMA Type 4X enclosure.

.2 Quick-release latches.

2.5 PANELS

.1 Intended for surface mounting, except as otherwise shown or specified.

.2 Single or double door construction with stainless steel full-length hinge.

.3 Minimum standard: Formed and welded NEMA Type 12 construction, of minimum 1.8 mm thick sheet steel, with automotive door handle.

.4 For process and outdoor areas: Formed and welded NEMA Type 4 construction of minimum 2 mm thick sheet aluminum, with stainless steel door clamps.

.5 Full size equipment mounting pan of formed sheet metal.

2.6 EQUIPMENT MOUNTING HARDWARE

.1 Mounting straps, brackets and fastening hardware designed for the installation of terminal blocks.

.2 Welded studs in sheet metal enclosures to avoid penetration of enclosure walls.

.3 Raised cast bosses in cast metal enclosures, drilled and tapped, for hardware installation.

2.7 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Division 26 - Electrical.

Part 3 Execution

3.1 SPLITTER INSTALLATION

.1 Install splitters and mount plumb, true and square to the building lines.

.2 Extend splitters full length of equipment arrangement except where indicated otherwise.

3.2 JUNCTION, PULL BOXES AND PANELS INSTALLATION

.1 Install pull boxes in inconspicuous but accessible locations.

.2 Mount panels with top not higher than 2 m above finished floor, coordinated with masonry, panelboards, fire hose cabinets and similar items.

.3 Install terminal blocks as indicated using mounting straps and hardware designed for this purpose.

.4 Only main pull boxes are indicated. Install pull boxes so as not to exceed 30 m of conduit runs between pull boxes as specified in Division 26 - Conduits, Conduit Fastenings and Conduit Fittings.

.5 Minimum standard for outdoor locations is NEMA Type 4x.

.6 Install a breather in locations of high humidity and changing temperature conditions; the downgrading to weatherproof of the enclosure will be acceptable.

.7 Where boxes terminate conduits at interior walls below grade elevation, provide a drain hole in the bottom of the box suitable for accumulated moisture drainage.

.8 Label source and destination and what is inside.

END OF SECTION

Part 1 General

1.1 GENERAL

.1 This section covers the hangars and supports for the electrical systems.

1.2 REFERENCES

.1 Canadian Electrical Code, Part 1.

1.3 GENERAL

.1 Establish installation method based on area use; provide concealed installation in finished areas; embed or surface mount boxes on unfinished poured concrete walls as indicated.

.2 Installation methods to be consistently followed in each area.

.3 All junction, pull boxes and cover plates shall be coloured coded with paint to match that required for conduits in Division 26.

.4 Junction box cover plates are to include circuit description, number and panel identification number labels.

Part 2 Products

2.1 OUTLET AND CONDUIT BOXES GENERAL

.1 Size boxes in accordance with CSA C22.1.

.2 Size: 102 mm or larger outlet boxes as required for special devices.

.3 Gang boxes where wiring devices are grouped.

.4 Blank cover plates for boxes without wiring devices.

.5 Combination boxes with barriers where outlets for more than one system are grouped.

.6 Provide corrosion resistant boxes in corrosive areas.

2.2 SHEET STEEL OUTLET BOXES

.1 Electro-galvanized steel single and multi gang flush device boxes for flush installation, minimum size 76 x 50 x 38 mm or as indicated. Use 102 mm square outlet boxes when more than one conduit enters one side with extension and plaster rings as required.

.2 Minimum 102 mm square or octagonal outlet boxes for lighting fixture outlets.

2.3 CONDUIT BOXES

.1 Cast FS Feraloy boxes with factory-threaded hubs and mounting feet for surface wiring of switches and receptacle.

2.4 FITTINGS - GENERAL

.1 Bushing and connectors with nylon insulated throats.

.2 Knock out fillers to prevent entry of debris.

.3 Conduit outlet bodies for conduit up to 32 mm and pull boxes for larger conduits.

.4 Double locknuts and insulated bushings on sheet-metal boxes.

Part 3 Execution

3.1 INSTALLATION

.1 Support boxes independently of connecting conduits.

.2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.

.3 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.

.4 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Reducing washers are not allowed.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA) C22.2.: CAN/CSA C22.2 No. 18, Outlet Boxes, Conduit Boxes, and Fittings and Associated Hardware.

Part 2 Products

2.1 CONDUITS

.1 Rigid metal conduit: to CSA C22.2 No. 45, aluminum threaded.

.2 Epoxy coated conduit: to CSA C22.2 No. 45, with zinc coating and corrosion resistant epoxy finish inside and outside.

.3 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings.

.4 Rigid PVC conduit: to CSA C22.2 No. 211.2.

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

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

2.2 COLOUR CODING

.1 All conduit and raceways shall be colour coded as follows:

.2 All couplings, connectors, junction boxes, pull boxes and cover plates to be coloured to match colour coding schedule.

Table 2-1: Conduit and Raceway Colours

Description	Colour*
120/208 V Power	Grey - 416
347/600 V Power	Green - 393
Low Voltage Switching System	Black - T-170

*Colour numbers match Cloverdale Paint.

2.3 CONDUIT FASTENINGS

.1 One-hole malleable iron steel straps to secure surface conduits 50 mm and smaller. Two-hole steel straps for conduits larger than 50 mm.

.2 Single runs, use galvanized conduit straps

.3 Multiple runs, use rod suspended or surface mounted 41mm Unistrut channels with 25% space for future.

.4 Vertical run use 41 mm Unistrut channels, and 9 mm Rod.

.5 Pipe racks: double matted with flat and lock washers

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

.7 Channel type supports for two or more conduits at 3 m oc.

.8 Threaded rods, 6 mm dia., to support suspended channels.

2.4 CONDUIT FITTINGS

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

.2 Factory "ells" where 90º bends are required for NPS 25 mm and larger conduits.

.3 Watertight connectors and couplings for EMT. Set-screws are not acceptable.

2.5 EXPANSION FITTINGS FOR RIGID CONDUIT

.1 Weatherproof expansion fittings with internal bonding assembly suitable for 100 mm linear expansion.

.2 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19 mm deflection in all directions.

.3 Weatherproof expansion fittings for linear expansion at entry to panel.

2.6 FISH CORD

.1 Polypropylene.

Part 3 Execution

3.1 INSTALLATION

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

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

.3 Use rigid aluminum threaded conduit except where specified otherwise.

.4 Use epoxy coated conduit in corrosive areas.

.5 Use electrical metallic tubing (EMT) above 2.4 m not subject to mechanical damage in service areas.

.6 Exposed raceways in any other areas shall be equal to Wiremold 200,500,700 or 1000 with special permission.

.7 Use rigid PVC conduit in corrosive areas.

.8 Use flexible metal conduit for connection to motors in dry areas. Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations.

.9 Use explosion proof flexible connection for connection to explosion proof motors.

.10 Install conduit sealing fittings in hazardous areas. Fill with compound.

.11 Minimum conduit size for lighting and power circuits: 19 mm.

.12 There shall be, no looping of conduit in walls. Run from device box in wall to ceiling space. Join in ceiling space.

.13 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.

.14 Mechanically bend steel conduit over 19 mm dia.

.15 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.

.16 Install fish cord in empty conduits.

.17 Run 2-NPS 25 mm spare conduits up to ceiling space and 2-NPS 25 mm spare conduits down to ceiling space from each flush panel. Terminate these conduits in 152 x 152 x 102 mm junction boxes in ceiling space or in case of an exposed concrete slab, terminate each conduit in flush concrete surface type box.

.18 Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.

.19 Dry conduits out before installing wire.

3.2 SURFACE CONDUITS

.1 Run parallel or perpendicular to building lines.

.2 Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.

.3 Run conduits in flanged portion of structural steel.

.4 Group conduits wherever possible on suspended surface channels.

.5 Do not pass conduits through structural members except as indicated.

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

3.3 CONCEALED CONDUITS

.1 Run parallel or perpendicular to building lines.

.2 Do not install horizontal runs in masonry walls.

.3 Do not install conduits in terrazzo or concrete toppings.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Canadian Standards Association (CSA): CAN/CSAC22.2 No.126, Cable Tray Systems.

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittals.

.2 Identify types of cable trays used.

Part 2 Products

2.1 CABLETROUGH

.1 Cabletroughs and fittings: to EEMACF5-1.

.2 Ladder type, Class C1 to CAN/CSAC22.2 No. 126.

.3 Trays: extruded aluminum or sheet aluminum minimum 150 mm wide with minimum depth of 100 mm.

.4 Fittings: horizontal elbows, end plates, dropouts, vertical risers and drops, tees, wyes, expansion joints and reducers where required, manufactured accessories for cabletrough supplied. Radii on fittings: 300 mm minimum.

.5 Barriers where different voltage systems are in the same cabletrough.

2.2 SUPPORTS

.1 Provide rubber ballast supports as required.

Part 3 Execution

3.1 INSTALLATION

.1 Install complete cable tray system.

.2 Support cable tray on one side or both when hanging.

.3 Remove sharp burrs or projections to prevent damage to cables or injury to personnel.

3.2 CABLES IN CABLETROUGH

.1 Install cables individually.

.2 Secure cables in cable tray at 6 m centers, with nylon ties.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Installation of cable and conduit in trenches.

.2 Restore the area after the installation is complete.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 CABLE AND CONDUIT INSTALLATION IN TRENCHES

.1 Lay conduits at minimum 1000 mm below grade and maintain 100 mm clearance from each side of trench to nearest conduit.

.2 Provide RPVC sleeves where cable is installed direct buried under vehicular traffic areas.

.3 Install continuous Brady Detectable Identoline cable marker tape 150 mm below grade over the full length of the conduit run.

.4 Provide 200 mm of sand over the entire length of the direct buried cable and/or conduit.

3.2 CABLE INSTALLATION IN CONDUIT

.1 Install cables in ducts or conduit sleeves where indicated.

.2 Do not pull spliced cables inside conduit sleeves.

.3 Use CSA approved lubricants of type compatible with cable jacket to reduce pulling tension.

.4 Before pulling cable into conduit and until cables properly terminated, seal ends of cables with moisture seal tape.

.5 Install in each conduit a 6 mm stranded polypropylene pull rope continuous throughout each conduit run with 3 m spare rope at each end. Pull rope to remain inside the conduits after cables have been pulled through.

.6 Install in each spare conduit a 6 mm stranded polypropylene pull rope continuous throughout each conduit run with 3 m spare rope at each end.

.7 After installation of cables, seal conduit ends with duct sealing compound and seal all wall and/or roof penetrations to form a completely leak-proof system.

.8 CAP off all spare conduits.

3.3 INSPECTIONS

.1 Advise Departmental Representative so that he may inspect cables and conduits installed in trenches prior to and during the installation of backfilling material.

3.4 TESTING

.1 Perform tests in accordance with Division 26 - Field Inspection and Testing.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 Install circuit breakers in panel boards before shipment.

.2 Furnish and install lighting and appliance panel board(s) as specified herein and where shown on the associated schedules and drawings.

.3 In addition to CSA requirements manufacturer's nameplate must show fault current that panel including breakers has been built to withstand.

.4 Panel shall be weatherproof and rated to -40 DegC.

1.2 STANDARDS

.1 The panel board(s) and circuit breaker(s) referenced herein are designed and manufactured according to the latest revision of the following specifications.

.1 NEMA PB 1.1 - Instructions for Safe Installation, Operation and Maintenance of Panel Boards Rated 600 Volts or Less.

.2 CSA Standard C22.2 No. 29 - Panel Boards and Enclosed Panel Boards.

.3 CSA Standard C22.2 No. 5 - Molded Case Circuit Breakers.

1.3 SUBMITTALS

.1 Approval documents shall include drawings. Drawings shall contain overall panel board dimensions, interior mounting dimensions, and wiring gutter dimensions. The location of the main, branches, and solid neutral shall be clearly shown. In addition, the drawing shall illustrate one-line diagrams with applicable voltage systems.

.2 Operations and Maintenance Manuals: Manufacturer shall provide installation instructions and NEMA Standards Publication PB 1.1 - Instructions for Safe Installation, Operation and Maintenance of Panel Boards Rated 600 Volts or Less.

Part 2 Products

2.1 PANEL BOARDS

.1 208/120 V lighting panel boards: bus and breakers rated for 10,000 A (symmetrical) interrupting capacity or as indicated.

.2 Panel boards: mains, number of circuits, and number and size of branch circuit breakers as indicated on schedules.

.3 Contractor will provide 25% Spare capacity.

.4 Suitable for -40^{o}C or provided with a strip heater with thermostat control.

2.2 CONSTRUCTION

.1 Interior

.1 Continuous main current ratings, as indicated on associated schedules and drawings, not to exceed 600 amperes maximum.

.2 Provide one (1) continuous bus bar per phase. Each bus bar shall have sequentially phased branch circuit connectors suitable for plug-on or bolt-on branch circuit breakers. The bussing shall be fully rated. Bussing rated 100-400 amperes shall be plated aluminum. Bussing rated for 600 amperes shall be plated copper as standard construction. Bus bar plating shall run the entire length of the bus bar. Panel boards shall be suitable for use as Service Equipment.

.3 All current-carrying parts shall be insulated from ground and phase-to-phase by high dielectric strength thermoplastic.

.4 A solidly bonded copper equipment ground bar shall be provided.

.5 Split solid neutral shall be plated and located in the mains compartment up to 225 amperes so all incoming neutral cable may be of the same length. CSA Listed panel boards with 200% rated solid neutral shall be plated copper for non-linear load applications (200% Neutral only required when specified). Panel boards shall be marked for non-linear load applications.

.6 Interior trim shall be of dead-front construction to shield user from energized parts. Dead-front trim shall have filler plates covering unused mounting spaces.

.7 Nameplates shall contain system information and catalog number or factory order number. Interior wiring diagram, neutral wiring diagram, CSA Listed label and short circuit current rating shall be displayed on the interior or in a booklet format.

.8 Interiors shall be field convertible for top or bottom incoming feed. Main circuit breakers in 100A interiors shall be horizontally mounted. Main circuit breakers over 100A shall be vertically mounted. Sub-feed circuit breakers shall be vertically mounted. Main lug interiors up to 400 amperes shall be field convertible to main breaker. Interior leveling provisions shall be provided for flush mounted applications.

.9 Interior phase bus shall be pre-drilled to accommodate field installable options, i.e., Sub-Feed Lugs, Sub-Feed Breakers, Thru-Feed Lugs.

.10 Panelboards to have “door-in-door” industrial grade trim.

.2 Main Circuit Breaker

.1 Main circuit breakers shall have an over-center, trip-free, toggle mechanism which will provide quick-make, quick-break contact action. Circuit breakers shall have a permanent trip unit with thermal and magnetic trip elements in each pole. Each thermal element shall be true rms sensing and be factory calibrated to operate in a 40°C ambient environment. Thermal elements shall be ambient compensating above 40°C.

.2 Two- and three-pole circuit breakers shall have common tripping of all poles. Circuit breaker frame sizes above 100 amperes shall have a single magnetic trip adjustment located on the front of the circuit breaker that allows the user to

simultaneously select the desired trip level of all poles. Circuit breakers shall have a push-to-trip button for maintenance and testing purposes.

.3 Breaker handle and faceplate shall indicate rated ampacity. Standard construction circuit breakers shall be rated for reverse connection without restrictive line or load markings.

.4 Circuit breaker escutcheon shall have international I/O markings, in addition to standard ON/OFF markings. Circuit breaker handle accessories shall provide provisions for locking handle in the ON or OFF position.

.5 Lugs shall be CSA Listed to accept solid or stranded copper conductors only. Lugs shall be suitable for 90°C rated wire, sized according to the 75°C temperature rating. Lug body shall be bolted in place; snap-in designs are not acceptable.

.6 The circuit breakers shall be CSA Listed for use with the following accessories: Shunt Trip, Under Voltage Trip, Ground Fault Shunt Trip, Auxiliary Switch, Alarm Switch, Mechanical Lug Kits, and Compression Lug Kits.

.3 Branch Circuit Breakers

.1 Circuit breakers shall be CSA and UL Listed with amperage ratings, interrupting ratings, and number of poles as indicated on the associated schedules and drawings.

.2 Molded case branch circuit breakers shall have bolt-on type bus connectors.

.3 Circuit breakers shall have an over-center toggle mechanism which will provide quick-make, quick-break contact action. Circuit breakers shall have thermal and magnetic trip elements in each pole. Two- and three-pole circuit breakers shall have common tripping of all poles.

.4 There shall be two forms of visible trip indication. The breaker handle shall reside in a position between ON and OFF. In addition, there shall be a red VISI-TRIP® indicator appearing in the clear window of the circuit breaker housing.

.5 The exposed faceplates of all branch circuit breakers shall be flush with one another.

.6 Lugs shall accept solid or stranded copper conductors only. Lugs shall be suitable for 90°C rated wire. Branch circuit breakers rated 20 amperes and below shall be CSA Listed to accept 60°C rated wire.

.7 Beakers shall be CSA Listed for use with the following factory installed accessories: Shunt Trip, Auxiliary Switch, and Alarm Switch.

.4 Enclosures

.1 Type 1 Boxes.

.2 Boxes shall be galvanized steel constructed. Galvannealed steel will not be acceptable.

.3 Boxes shall have removable endwalls with knockouts located on one end. Boxes shall have welded interior mounting studs. Interior mounting brackets are not required.

.4 Box width shall be 26 inches wide maximum.

.5 Front shall have ANSI 49 gray enamel electrodeposited over cleaned phosphatized steel.

.6 Fronts shall be 1-piece with door. Mounting shall be as indicated on associated schedules or drawings.

.7 Panel boards shall have MONO-FLAT fronts with concealed door hinges and mounted with trim screws. Front shall not be removable with the door locked. Doors on front shall have rounded corners and edges shall be free of burrs.

.8 Front shall have cylindrical tumbler type lock with catch and spring-loaded stainless steel door pull. All lock assemblies shall be keyed alike. Two (2) keys shall be provided with each lock. A clear plastic directory cardholder shall be mounted on the inside of door.

2.3 FINISH AND COLOUR

.1 Properly clean all exterior and interior steel surfaces of the switchgear and provided with a rust-inhibited phosphatized coating.

Table 2-1: Panelboard Colour

Description	Colour*
120/208 V Power	Grey - 416
120/208 V Emergency	Yellow - 347
347/600 V Power	Green - 393
347/600V Emergency	Blue - 406

*Colour numbers match Cloverdale Paint.

2.4 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Division 26 - Electrical.

.2 Complete circuit directory with typewritten legend showing equipment tag for each circuit. Handwritten directory is not acceptable.

Part 3 Execution

3.1 INSTALLATION

.1 Locate panel boards as indicated and mount securely, plumb, and true and square, to adjoining surfaces.

.2 Install surface mounted panel boards on plywood backboards. Where practical, group panel boards on common backboard. Install panel boards in accordance with manufacturer's written instructions, NEMA PB 1.1 and NEC standards.

.3 Individual circuits shall not be supplied from left and right sides of a panelboard.

.4 Mount panel boards to height specified in Division 26 – Electrical, or as indicated.

.5 Connect loads to circuits and balance loads.

.6 Connect neutral conductors to common neutral bus with respective neutral identified.

.7 Inspect complete installation for physical damage, proper alignment, anchorage, and grounding.

.8 Measure steady state load currents at each panel board feeder; rearrange circuits in the panel board to balance the phase loads within 20% of each other. Maintain proper phasing for multi-wire branch circuits.

.9 Check tightness of bolted connections and circuit breaker connections using calibrated torque wrench or torque screwdriver per manufacturer's written specifications.

END OF SECTION

Part 1 General

1.1 GENERAL

.1 This specification details the requirements for low voltage local disconnect switches.

1.2 PRODUCT DATA

.1 Submit product data in accordance with Division 01 - Submittals and Operating and Maintenance Data.

Part 2 Products

2.1 DISCONNECT SWITCHES

.1 NEMA 12 inside and NEMA 4x outside.

.2 Provision for padlocking in OFF position by three locks.

.3 Mechanically interlocked door to prevent opening when handle in ON position. Provide defeater mechanism for opening by trained personnel with an appropriate tool while in ON position.

.4 Fuses: size and type as indicated.

.5 Fuse holders: suitable for type and size of fuse indicated, without adaptors.

.6 Supply 10% spare or a minimum of three spare fuses of each fuse type used.

.7 Quick-make, quick-break action.

.8 ON-OFF switch position indication on switch enclosure cover.

2.2 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Division 26 - Electrical.

.2 Indicate name of load controlled on Size 4 nameplate.

Part 3 Execution

3.1 INSTALLATION

.1 Install disconnect switches complete with fuses if applicable.

.2 Label equipment.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 CAN3-C13, Instrument Transformers.

.2 ANSI/NEMAICS 2, Industrial Control Devices, Controllers, and Assemblies.

.3 Division 26 - Electrical.

.4 Division 01 - Submittals.

.5 Division 01 - Operating and Maintenance Data.

1.2 SYSTEM DESCRIPTION

.1 Manual 2 input one output load transfer equipment.

.2 Load transfer equipment to contain a transition to a neutral (center) position where no connection to source one or source two is present.

1.3 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Division 01.

.2 Include:

.1 Make, model and type.

.2 Load classification:

.1 For example: General loads, 50kW AT 0.8 pf or higher.

1.4 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance data for automatic load transfer equipment for incorporation into manual specified in Division 01.

.2 Detailed instructions to permit effective operation, maintenance and repair.

.3 Technical data:

.1 Illustrated parts lists, with parts catalogue numbers.

.2 Certified copy of factory test results.

Part 2 Products

2.1 MATERIALS

.1 Instrument transformers: to CAN3-C13.

.2 Contactors: to ANSI/NEMAICS2.

2.2 CONTACTOR TYPE TRANSFER EQUIPMENT

.1 Two 3 phase contactors mounted on common frame, in double throw arrangement, mechanically and electrically interlocked, motor solenoid operated, open type with CSA1 enclosure.

.2 When integrated with neutral wire connection:

.1 Overlapping neutral contacts (wiper / make before break) on contactor type transfer equipment.

.2 Switched neutral position during operation. IE: Line one - switch action - neutral position with delay - switch action - Line two.re

.3 Rated: 600 V, 60Hz, minimum 4 wire.

.4 Main contacts: silver surfaced, protected by arc disruption means.

.5 Switch and relay contacts, coils, spring and control elements accessible for inspection and maintenance from front of panel without removal of switch panel or disconnection of drive linkages and power conductors.

.6 Rated for -40 and provided with a strip heater if the equipment cannot operate reliably at -40^{o}C.

.7 Fault withstand rating to match switchgear.

.1 Unless indicated otherwise in drawings, the fault withstand rating to be minimum 10 kA symmetrical for 3cycles with maximum peak value of 22kA.

2.3 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Division 26 - Electrical.

.2 Control panel:

.1 For selector switch: Size 4-5 nameplates.

.2 For meters, indicating lights, minor controls: Size 2-3 nameplates.

Part 3 Execution

3.1 INSTALLATION

.1 Locate, install and connect transfer equipment.

3.2 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Division 26 - Electrical.

.2 Energize transfer equipment from normal power supply.

END OF SECTION

Part 1 General

1.1 PRICE AND PAYMENT PROCEDURES

.1 Measurement and Payment:

.1 No measurement of payment will be made for this section:

.1 Include excavation and backfilling costs in lump sum price for new AST Installation as per Section 33 56 13 - Aboveground Fuel Storage Tanks.

.2 The services of a vacuum truck, if necessary, for excavation dewatering and the removal of any residual hydrocarbon product from the tank shall not be measured for payment and will be incidental to removal of the AST systems. To include mobilization/ demobilization, removal and transport to approved waste receiving facility.

.3 Disposal of excavation water and residual hydrocarbon product from tank and piping using the services of a vacuum truck shall not be measured for payment and will be incidental to removal of the AST systems.

.4 Measure compaction testing and proctor analyses of Type 2 and Type 4 backfill as part of lump sum.

1.2 REFERENCES

.1 Codes and standards referenced in this section refer to the latest edition thereof.

.2 American Society for Testing and Materials International (ASTM)

.1 ASTM C117-04, Standard Test Method for Material Finer than 0.075 mm (No.200) Sieve in Mineral Aggregates by Washing.

.2 ASTM C136-05, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

.3 ASTM D422-63-2002, Standard Test Method for Particle-Size Analysis of Soils.

.4 ASTM D698-00ae1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (600 kN-m/m).

.5 ASTM D1557-02e1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (2,700 kN-m/m).

.6 ASTM D4318-05, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-8.1-88, Sieves, Testing, Woven Wire, Inch Series.

.2 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.

.4 Canadian Standard Association (CSA)

.1 CAN/CSA-A23.1, Concrete Materials and Methods of Concrete Construction.

.5 Canadian Council of Ministers of the Environment (CCME)

.1 Canadian Environmental Quality Guidelines (2012).

.2 Canada Wide Standard for Petroleum Hydrocarbons in Soil (2008).

.6 Environmental Protection Agency (EPA)

.1 US EPA 832/R-92-005 - Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices, September 1992.

.7 Environmental Site Assessment, EGE 2018 (see Appendix C).

.8 Geotechnical Investigation Report, MJI 2018 (see Appendix A).

1.3 REGULATIONS

.1 Shore and brace excavations, protect slopes and banks and perform all work in accordance with Federal, Provincial and Municipal Laws, regulations and by-laws whichever is more stringent.

1.4 DEFINITIONS

.1 Waste material: excavated material unsuitable for use in Work or surplus to requirements.

.2 Borrow material: material obtained from locations outside area to be graded, and required for construction of fill areas or for other portions of Work.

.3 Unsuitable materials:

.1 Weak, chemically unstable, frozen and/or compressible materials.

.2 Frost susceptible materials:

.1 Fine grained soils with plasticity index less than 10 when tested to ASTM D4318, and gradation within limits specified when tested to ASTM D422 and C136: Sieve sizes to CAN/CGSB-8.1.

.2 Table:

Sieve Designation	% Passing
2.00 mm	[100]
0.10 mm	[45 - 100]
0.02 mm	[10 - 80]
0.005 mm	[0 - 45]

.3 Coarse grained soils containing more than 20 % by mass passing 0.075 mm sieve.

.4 Unshrinkable fill: very weak mixture of cement, concrete aggregates and water that resists settlement when placed in utility trenches, and capable of being readily excavated.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Pre-construction Submittals:

.1 Submit records of underground utility locates, indicating: location plan of existing utilities as found in field and abandoned services within 5 days before starting work.

.3 Samples:

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

.2 Inform Departmental Representative 5 days prior to start of Work of proposed source of fill materials and provide representative samples to a third party testing agency for proctor analysis.

.3 Provide third party test results demonstrating the proposed fill material meets the specifications to Departmental Representative, including the results of the proctor testing, prior to delivery and start of backfilling.

.4 Submit 2 kg sample of proposed fill materials at Contractor expense to Departmental Representative, in tightly closed container to prevent contamination and exposure to elements, for environmental testing 5 days prior to start of Work.

1.6 QUALITY ASSURANCE

.1 Do not use soil material until written report of soil test results are reviewed and approved in writing by Departmental Representative.

.2 Health and Safety Requirements:

.1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements as a minimum.

1.7 WASTE MANAGEMENT AND DISPOSAL

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

1.8 EXISTING CONDITIONS

.1 Examine 2018 ESA report by EGE provided in Appendix C and 2018 Geotechnical Investigation report by MJI provided in Appendix A.

.2 Buried services:

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

.2 Arrange with appropriate authority for relocation of active buried services that interfere with execution of work: pay costs of relocating services.

.3 Prior to beginning excavation Work, notify Departmental Representative and establish in writing, location and state of use of buried utilities and structures.

.4 Maintain and protect from damage, water, electric, telephone and other utilities and structures to remain.

.5 Remove obsolete buried services within 2 m of foundations. Cap cut-offs.

.6 Record location of maintained and abandoned underground lines and provide written record to Departmental Representative within 5 days of completion of the work.

.3 Existing buildings and surface features:

.1 Conduct, with Departmental Representative, condition survey of existing buildings, lawns, fencing, service poles, wires, pavement, survey bench marks and monuments which may be affected by Work.

.2 Protect existing buildings and surface features from damage as directed by Departmental Representative while Work is in progress. In event of damage, immediately make repair as directed by Departmental Representative.

.3 Where required for excavation, cut roots or branches as directed by Departmental Representative.

1.9 PROTECTION

.1 Keep excavations clean, free of standing water, and loose soil.

.2 Where soil is subject to significant volume change due to change in moisture content, cover and protect to Departmental Representative approval.

Part 2 Products

2.1 MATERIALS

.1 Unshrinkable fill: proportioned and mixed to provide:

.1 Maximum compressive strength of 0.4 MPa at 28 days.

.2 Maximum Portland cement content of 25 kg/m^3.

.3 Minimum strength of 0.07 Mpa at 24 h.

.4 Concrete aggregates: to CAN/CSA-A23.1.

.5 Portland cement: Type 10.

.6 Slump: 160 to 200 mm.

.2 Type 2 fill: approved by the Departmental Representative and meeting the following requirements:

.1 Crushed, pit run or screened stone, gravel or sand.

.2 Gradations to be within limits specified when tested to ASTM C136 and ASTM C117. Sieve sizes to CAN/CGSB-8.1.

.3 Gradation to meet the following:

Sieve Designation	% Passing Type 2
75 mm	[100]
50 mm	-
37.5 mm	-
25 mm	-
19 mm	-
12.5 mm	-
9.5 mm	-
4.75 mm	[22-85]
2.00 mm	-
0.425 mm	[5-30]
0.180 mm	-
0.075 mm	[0-10]

.3 Type 4 fill: approved by the Departmental Representative and meeting the following requirements:

.1 Crushed, pit run or screened stone, gravel or sand.

.2 Gradations to be within limits specified when tested to ASTM C136 and ASTM C117. Sieve sizes to CAN/CGSB-8.1.

.3 Gradation to meet the following:

Sieve Designation	% Passing Type 4
18 mm	[100]
12.5 mm	[75-100]
5.0 mm	[70-75]
2.00 mm	[32-52]
0.900 mm	[20-35]
0.400mm	[15-25]
0.160 mm	[8-15]
0.071 mm	[6-11]

Part 3 Execution

3.1 EROSION AND SEDIMENTATION CONTROL

.1 Provide erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff that complies with US EPA 832/R-92-005 and/or requirements of authorities having jurisdiction, whichever is more stringent.

.2 Inspect, repair, and maintain erosion and sedimentation control measures during construction.

.3 Remove any temporary erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.2 SITE PREPARATION

.1 Remove obstructions, ice and snow, from surfaces to be excavated within limits indicated and place in designated area as approved by Departmental Representative.

3.3 PREPARATION/PROTECTION

.1 Keep excavations clean, free of standing water and loose soil.

.2 Protect natural and man-made features required to remain undisturbed.

.3 Protect buried services that are required to remain undisturbed.

.4 Prevent movement, settlement or damage of adjacent structures, services, walks, paving, trees, landscaping and adjacent grades. Provide bracing and/or shoring as required.

.5 At end of each day's work, leave Work Site in safe and stable condition, and to not be a hazard to wildlife, people and Owner’s operations on site.

3.4 STOCKPILING

.1 Stockpile clean fill materials in areas designated by Departmental Representative.

.1 Stockpile granular materials in manner to prevent segregation.

.2 Protect fill materials from contamination.

.3 Implement sufficient erosion and sediment control measures to prevent sediment release off construction boundaries and into water bodies.

3.5 DEWATERING AND HEAVE PREVENTION

.1 Keep excavations free of water while Work is in progress.

.2 Protect open excavations against flooding and damage due to surface run-off.

.3 Dispose of water in accordance with Section 01 35 43 - Environmental Procedures and in a manner not detrimental to public and private property or portion of Work completed or under construction.

3.6 EXCAVATION

.1 Advise Departmental Representative at least 7 working days in advance of excavation operations.

.2 Excavate to lines, grades, elevations and dimensions as directed by Departmental Representative.

.3 Strip topsoil over areas to be covered by new construction, over areas where grade changes are required, and so that excavated material may be stockpiled without covering existing in place topsoil.

.4 Stockpile excavated materials at locations approved by the Departmental Representative.

.5 Restrict vehicle operations directly adjacent to open trenches.

.6 Do not obstruct flow of surface drainage or natural watercourses.

.7 Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft or organic matter.

.8 Excavate trenches to provide uniform continuous bearing and support for 150 mm thickness of pipe bedding material on solid and undisturbed ground. Trench widths below point 150 mm above pipe not to exceed diameter of pipe plus 600 mm.

.9 Excavate for slabs to subgrade levels. In addition, remove all topsoil, organic matter, debris and other loose and harmful matter encountered at subgrade level.

.10 Notify Departmental Representative when bottom of excavation is reached.

.11 Obtain Departmental Representative written approval of completed excavation.

.12 Remove unsuitable material from trench bottom including those that extend below required elevations to extent and depth as directed by Departmental Representative.

.13 Correct unauthorized over-excavation at Contractor’s expense with Type 2 fill compacted to not less than 95% of corrected Standard Proctor maximum dry density.

3.7 BACKFILLING

.1 Do not proceed with backfilling operations until completion of following:

.1 Inspection, testing, approval, and recording location of underground utilities.

.2 Removal of shoring and bracing (as required); backfilling of voids with satisfactory soil material.

.2 Areas to be backfilled to be free from debris, snow, ice and water.

.3 Do not use backfill material which is frozen or contains ice, snow or debris.

.4 Lateral support: maintain even levels of backfill around structures as work progresses, to equalize earth pressures.

.5 Place backfill material in uniform layers not exceeding 150 mm compacted thickness up to grades indicated. Compact each layer before placing succeeding layer. Add water as required to achieve specified density. Compaction testing is to be completed by Contractor's third party testing agency.

.6 Compaction: compact each layer of material to following densities for material to ASTM D 698:

.1 Concrete Pad:

.1 Type 2 fill from 0.9 m to within 0.3 m of underside of pad: 98%.

.2 Type 4 fill from 0.3 m to underside of pad: 100%.

.7 Backfilling around installations:

.1 Place bedding and surround material as specified by Departmental Representative.

.2 Do not backfill around or over cast-in-place concrete within 24 hours after placing of concrete.

.3 Where temporary unbalanced earth pressures are liable to develop on walls or other structures, erect bracing or shoring to counteract unbalance, and leave in place until no longer required.

3.8 GRADING

.1 Grade so that areas of work match surrounding slope and grade and provide positive drainage away from area.

.2 The surface of finished pavement shall be within required profile and cross-section ± 3 mm. No depressions or bumps shall exceed 5 mm beneath a 3 metre straight edge.

3.9 RESTORATION

.1 Upon completion of Work, remove waste materials and debris in accordance to Section 01 74 21 - Construction/Demolition Waste Management and Disposal, trim slopes, and correct defects as directed by Departmental Representative.

.2 Clean and reinstate areas affected by Work as directed by Departmental Representative.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 A 5,000 fuel tank for gasoline and a 10,000L tank for diesel.

.2 Comply with all application safety and storage standards, including ULC-S601.

.3 100% secondary containment.

.4 Overfill prevention device.

.5 Access stairs and platform to provide access to for filling and inspection.

.6 Spill box at fill point.

.7 Weatherproof lockable cabinets for dispensing pumps.

.8 Dispenser pumps to be designated as gasoline and diesel.

.9 Factory pre-wired for power, instrumentation and control to a junction box.

.10 Gasoline – maximum flow rate of 38 lpm.

.11 Emergency shut down switches mounted external from the tanks.

.12 Dispensing hose retractors.

.13 LED Area Lighting for the fill point.

.14 Visible leak indicator for interstitial space on tanks.

.15 Appropriate product and safety signage on tanks (no smoking, ignition off, tank contents, hazards, shut off switch, user must stay outside vehicle in view of fueling, emergency instructions in case of spill, emergency contact numbers).

.16 Grounding.

.17 The tanks should be skid mounted. They will sit on a concrete pad.

.18 Fire extinguishers and cabinets

.19 Anti-siphon devices.

1.2 PRICE AND PAYMENT PROCEDURES

.1 Measurement and Payment:

.1 Supply, installation and commissioning of new Aboveground Storage Tank (AST) fueling systems to be measured on a lump sum basis and shall include all associated structural, electrical and mechanical works.

1.3 REFERENCES

.1 All references latest edition.

.2 Petroleum Tank Manufactures Association of Alberta (PTMAA).

.3 American National Standards Institute (ANSI):

.1 ANSI/NFPA-329, Handling Underground Releases of Flammable and Combustible Liquids.

.2 ANSI/API 650, Welded Steel Tanks for Oil Storage.

.3 API-620, “Design and Construction of Large, Welded, Low-Pressure Storage Tanks”.

.4 American Petroleum Institute (API):

.1 API RP 651, Cathodic Protection of Aboveground Petroleum Storage Tanks.

.2 API STD 653, Tank Inspection, Repair, Alteration, and Reconstruction.

.5 American Society for Testing and Materials International, (ASTM):

.1 ASTM C618, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.

.6 Canadian Council of Ministers of the Environment (CCME):

.1 CCME-PN1326, Environmental Code of Practice for Aboveground and Underground Storage Tank Systems Containing Petroleum and Allied Petroleum Products.

.7 Department of Justice Canada (Jus):

.1 Canadian Environmental Protection Act, (CEPA).

.8 Canadian Standards Association (CSA)/CSA International:

.1 CAN/CSA-B139, Installation Code for Oil Burning Equipment.

.9 Canadian Environmental Protection Act (CEPA):

.1 Storage Tank Systems for Petroleum Products and Allied Products Regulations SOR/2008-197

.10 The Master Painters Institute (MPI):

.1 Architectural Painting Specification Manual - September 2012.

.11 National Research Council/Institute for Research in Construction:

.1 NRCC 38727, National Fire Code of Canada (NFC) - 2015.

.12 Transport Canada (TC):

.1 Transportation of Dangerous Goods Act, 1992 (TDGA).

.13 Underwriters' Laboratories of Canada (ULC):

.1 ULC-S655, “Protected Aboveground Tank Assemblies for Flammable and Combustible Liquids”.

.2 ULC/ORD-C58.9, Secondary Containment Liners for Underground and Aboveground Tanks.

.3 ULC/ORD-C58.12, Leak Detection Devices (Volumetric Type) for Underground Storage Tanks.

.4 ULC/ORD-C58.14, Leak Detection Devices (Nonvolumetric Type) for Underground Storage Tanks.

.5 ULC/ORD-C58.15, Overfill Protection Devices for Underground Tanks.

.6 ULC/ORD-C107.4, Ducted Flexible Underground Piping Systems for Flammable and Combustible Liquids.

.7 ULC/ORD-C107.7, Glass-Fibre Reinforced Plastic Pipe and Fittings.

.8 ULC/ORD-C107.19, Secondary Containment of Underground Piping.

.9 ULC/ORD-C142.23, Aboveground Waste Oil Tanks.

.10 ULC-S601, Aboveground Horizontal Shop Fabricated Steel Tanks.

.11 CAN/ULC-S602, Aboveground Steel Tanks for Fuel Oil and Lubricating Oil.

.12 CAN/ULC-S603.1, Galvanic Corrosion Protection Systems for Steel Underground Tanks.

.13 ULC-S630, Aboveground Vertical Shop Fabricated Steel Tanks.

.14 ULC-S652, Tank Assemblies for Collection of Used Oil.

.14 National Best Management Practices for Petroleum Storage Tank Systems (see Appendix D).

1.4 SUBMITTALS

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

.2 Indicate details of construction appurtenances installation leakage detection system.

.3 Shop drawings to detail and indicate following as applicable to project requirements. Submit manufacturer’s product data to supplement shop drawings:

.1 Size, materials and locations of ladders, ladder cages, catwalks and lifting lugs.

.2 Tanks capacity.

.3 Size and location of fittings.

.4 Environmental compliance package accessories.

.5 Decals, type size and location.

.6 Accessories: provide details and manufacturers product data.

.7 Size, material and location of manholes.

.8 Size, materials and locations of railings, stairs, ladders and walkways.

.9 Finishes.

.10 Electronic accessories: provide details and manufacturers product data.

.11 Insulation types, locations and RSI values.

.12 Identification, name, address and phone numbers of corrosion expert where applicable. Grading drawings to be stamped by licensed corrosion expert.

.13 Piping, values and fittings: type, materials, sizes, piping connection details, valve shut-off type and location, cathodic protection system complete with stamp of corrosion expert indicating that design complies with standards, Federal and Provincial regulations.

.14 Spill containment: conduct product transfer area risk assessment and provide description of methods and show sizes, materials and locations for collecting spills at connection point between storage tank system and delivery truck, rail car, or vessel.

.15 Anchors: description, material, size and locations.

.16 Concrete: type, composition and strength.

.17 Level gauging: type and locations.

.18 Ancillary devices: provide details and manufacturer's product data.

.19 Leak detection system, type and locations.

.20 Grounding and bonding: provide details of design, type, materials and locations.

.21 Corrosion protection: provide details of design, type, materials and locations.

.22 Containment system for spills, overfills and storm runoff water: provide details, materials used, and locations. Meet NFC as a minimum.

.4 Contractor to submit an updated Application for Approval to Construct to the Alberta and Federal requirements. Obtain the necessary authorizations and assume all responsibilities related to finalizing the application.

.5 Provide maintenance data for tank appurtenances for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.5 WASTE MANAGEMENT AND DISPOSAL

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

.2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal paper, plastic, polystyrene, and corrugated cardboard packaging for recycling.

.4 Place materials defined as hazardous or toxic in designated containers.

.5 Handle and dispose of hazardous materials in accordance with the Regional and Municipal regulations.

.6 Clearly label location of salvaged material's storage areas and provide barriers and security devices.

.7 Ensure emptied containers are sealed and stored safely.

.8 Divert unused metal materials from landfill to metal recycling facility as approved by Departmental Representative.

.9 Divert unused concrete materials from landfill to local facility as approved by Departmental Representative.

.10 Dispose of unused paint and/or coating material to a licensed hazardous material collections site as approved by Departmental Representative.

.11 Do not dispose of unused paint and/or toxic material into sewer system, into streams, lakes, onto ground or in other location where it will pose health or environmental hazard.

.12 Fold up metal banding, flatten and place in designated area for recycling. Do not leave on site.

Part 2 Products

2.1 TANKS: CONVENTIONAL STEEL

.1 Two tanks"

.1 One (1) tank of 10,000 L capacity, dimensions as indicated double wall, self-containing.

.2 One (1) tank of 5,000 L capacity, dimensions as indicated double wall, self-containing.

.2 Horizontal tanks: ULC-S601.

.3 Connections: 50 mm minimum. Sizes: as indicated.

.4 Manholes: as indicated.

.5 Tank must be grounded to prevent electrostatic potential.

.6 Railings, stairs, ladders and walkways: as indicated.

.7 Finishes:

.1 Exterior of tank: SSPC-SP6 blast finish, 2 coats exterior enamel.

.2 Interior of tank: SSPC-SP6 blast finish, epoxy lining.

2.2 ANCHORAGE

.1 As indicated on Contract Drawings.

2.3 LIGHTING

.1 LED lighting to be provided at fill end of the AST and must illuminate both the tank and filling area.

.2 Install at a height of between 3 m above the concrete slab.

.3 Each light to have a minimum of 10,00 lumens.

.4 Top of the tank, access stairs and fuel dispensing cabinet to be within the pattern of light created.

.5 Lighting to be dark sky friendly and IDA approved.

2.4 CONCRETE

.1 In accordance with Section 03 30 00 - Cast-in-Place Concrete.

.2 Pad elevation to match fueling ramp.

2.5 PIPING, VALVES AND FITTINGS

.1 Mechanical joints on buried primary piping are not permitted.

.2 Piping located below product level equipped with either manual or automatic shut-off at storage tank.

.3 Provide means for collecting spills at connection point between storage tank system and delivery truck.

.4 Underground piping: none.

.5 Fuel dispensing valve to have automatic shut-off.

2.6 LEVEL GAUGING

.1 Tank gauging stick: to manufacturer's standard.

.2 Tank level gauging and indicator.

.1 Direct reading device with Ø50 mm size dial minimum.

.2 Gauge and gauge openings: protected against liquid overflow and possible liquid and vapour release.

2.7 LEAKAGE DETECTION SYSTEM

.1 To ANSI/NFPA-329.

.2 Leak detector: direct reading device.

2.8 GROUNDING AND BONDING

.1 To Section 26 00 10 – Electrical General Requirements and Section 26 05 28 – Grounding Secondary.

2.9 OVERFILL AND SPILL CONTAINMENT

.1 Shop-fabricated AST overfill protection.

.1 Automatic valve closure on product supply line, or automatic pump shut-off to terminate petroleum product flow upon detection of high levels in the storage tank.

.2 Overfill protection device compatible with intended method of filling designed, built and certified to ULC/ORD-C58.15 with positive shut-off action.

.3 Audible and visual alarm located at the tank fill location to alert personnel during transfer operation to promptly stop flow when detected levels are too high.

.4 Level gauge located on storage tank for frequent monitoring throughout transfer operation permitting personnel to promptly shut down flow, or communicate immediately with person controlling delivery for shut down.

2.10 PRODUCT TRANSFER

.1 ASTs with normal vent and separate emergency vent.

.1 Liquid- and vapour-tight connection on fill pipes for flammable products.

.2 Coupling at end of storage tank suction tube for connection to remove stored fuel.

2.11 TANK BOTTOM WATER

.1 Segregated from rainwater.

.2 Disposed of in accordance with applicable provincial and/or municipal regulations, guidelines and policies.

2.12 SPILLS, OVERFILLS AND STORM RUNOFF WATER

.1 Contained, treated and disposed of in accordance with applicable provincial regulations, guidelines and policies.

2.13 FUEL DISPENSING CABINET – LOCKABLE

.1 Cabinet must be lockable to prevent intentional damage and access to equipment inside. Provide three sets of keys to owner.

.2 Cabinet to be constructed of steel, weatherproof, protect and contain electrical connections and disconnects.

.3 Equipment

.1 Fuel filling pump,

.2 Dispensing meter and totalizer,

.3 Equipment to be factory pre-wired.

.4 Protective barriers as indicated.

.5 Operating instructions conspicuously posted.

.6 All manufacturer provided signage to bilingual throughout.

2.14 EMERGENCY SHUT OFF

.1 Emergency fuel shut off to be located outside of spill area and conveniently accessible to each fueling position.

.2 Must work in power outage.

.3 Clearly marked with letters at least 2 inches high with method of operation indicated in both English and French.

.4 Reset by authorized personnel only.

.5 Location of emergency shut off to be confirmed on-site with Owner. Clearly mark location of permanent emergency shut off, including directions at fuel dispensing box with letters at least 2 inches high and arrow at least 2 inches by 6 inches.

.6 Run 2C #12 teck90 from emergency shut off (stop button) to the control box of tank 1, provide relay and contactor as required.

.7 Run 2C #12 teck90 from emergency shut off (stop button) to the control box of tank 2, provide relay and contactor as required.

.8 Emergency shut off (stop button) is double contact (2NC), contacts rated 5A 120/240 VAC, accepting AWG 18-12 wires and must be weatherproof and water resistant.

2.15 Fire Extinguisher

.1 Provide outdoor rated fire extinguisher for the installation.

2.16 Spill Kits

.1 Provide two spill kits, one for each tank. Mount on the skid.

Part 3 Execution

3.1 REGISTRATION

.1 Permits must be obtained for the removal of existing and installation of the new ASTs.

.2 Contractor is responsible for all fees associated with PTMAA.

.3 The Contractor must be certified with PTMAA.

3.2 INSTALLATION

.1 Install tank in accordance with CAN/CSA-B139 and National Fire Code of Canada and manufacturer's recommendations and CCME PN 1326.

.2 Position tanks using lifting lugs and hooks, and where necessary use spreader bars. Do not use chains in contact with tank walls.

.3 Coordinate concrete pad and tank mounting provisions with concrete slab placement.

.4 Coordinate protection barrier locations with fuel dispensing cabinet.

.5 Install tank using installers certified to PTMAA.

.6 Provide copy of PTMAA Certificate to Operate to Departmental Representative at completion of work.

3.3 FIELD QUALITY CONTROL

.1 Test tanks for leaks to requirements of VFC Section 4.4 and in presence of authority having jurisdiction.

.2 Leak detection test of this system after tanks have been constructed, deficiencies addressed, tank registered with ECCC, ERP on site, fuel delivered and tank commissioned is required.

3.4 TOUCH-UP

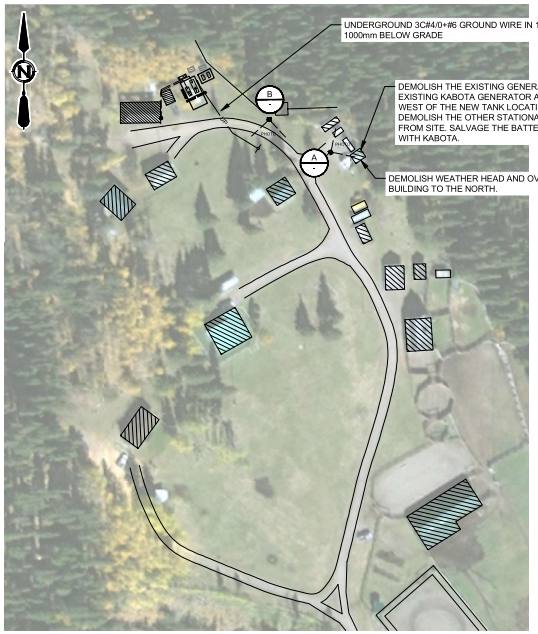
.1 Where coating is damaged, touch-up with original coating material, as directed by Departmental Representative.

3.5 LEAK DETECTION SYSTEM

.1 Install in accordance with manufacturer's recommendations.

END OF SECTION

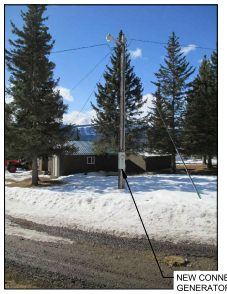
DRAWINGS



KEYPLAN

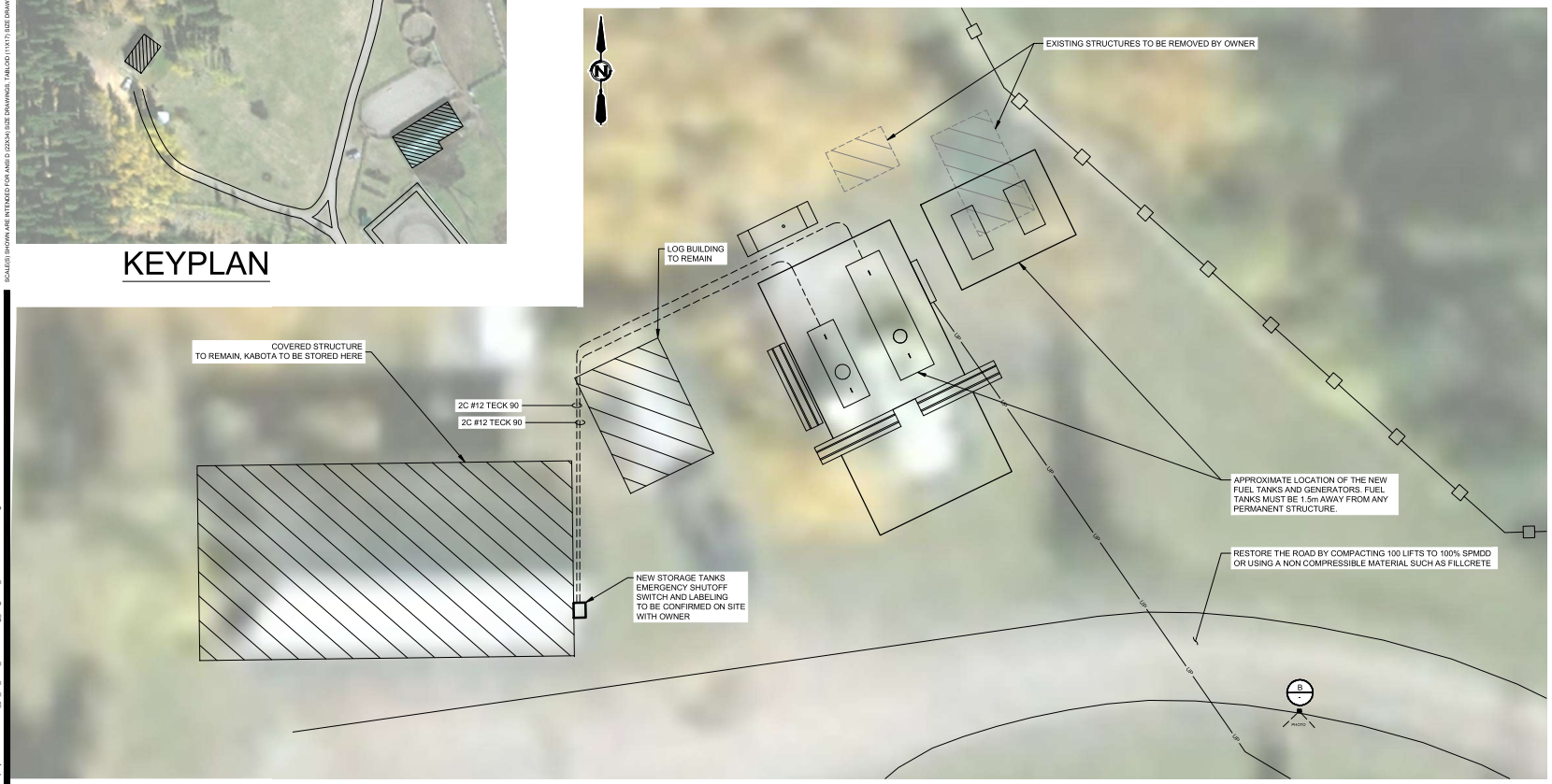
RELOCATE BOTH GENERATORS MOUNTED ON TRAILER/SKID TO LNE LOCATION.

A PHOTO



NEW CONNECTION POINT TO THE SITE. GENERATORS LOCATED TO THE NORTH.

B PHOTO



1 PLAN 1:100

Associated Engineering
BEST MANAGED COMPANIES Platinum Member

PROFESSIONAL ENGINEER ALBERTA SCOTT FRIEL 2019-03-08
APEGA PERMIT TO PRACTICE P 3979

ASSOCIATED ENGINEERING QUALITY MANAGEMENT 2019-03-11

REV	DATE	DESIGN	DRAWN	DESCRIPTION
0	2019MAR01	S.FRIEL	B. WYNNYK	ISSUED FOR TENDER

YA HA TINDA HORSE RANCH

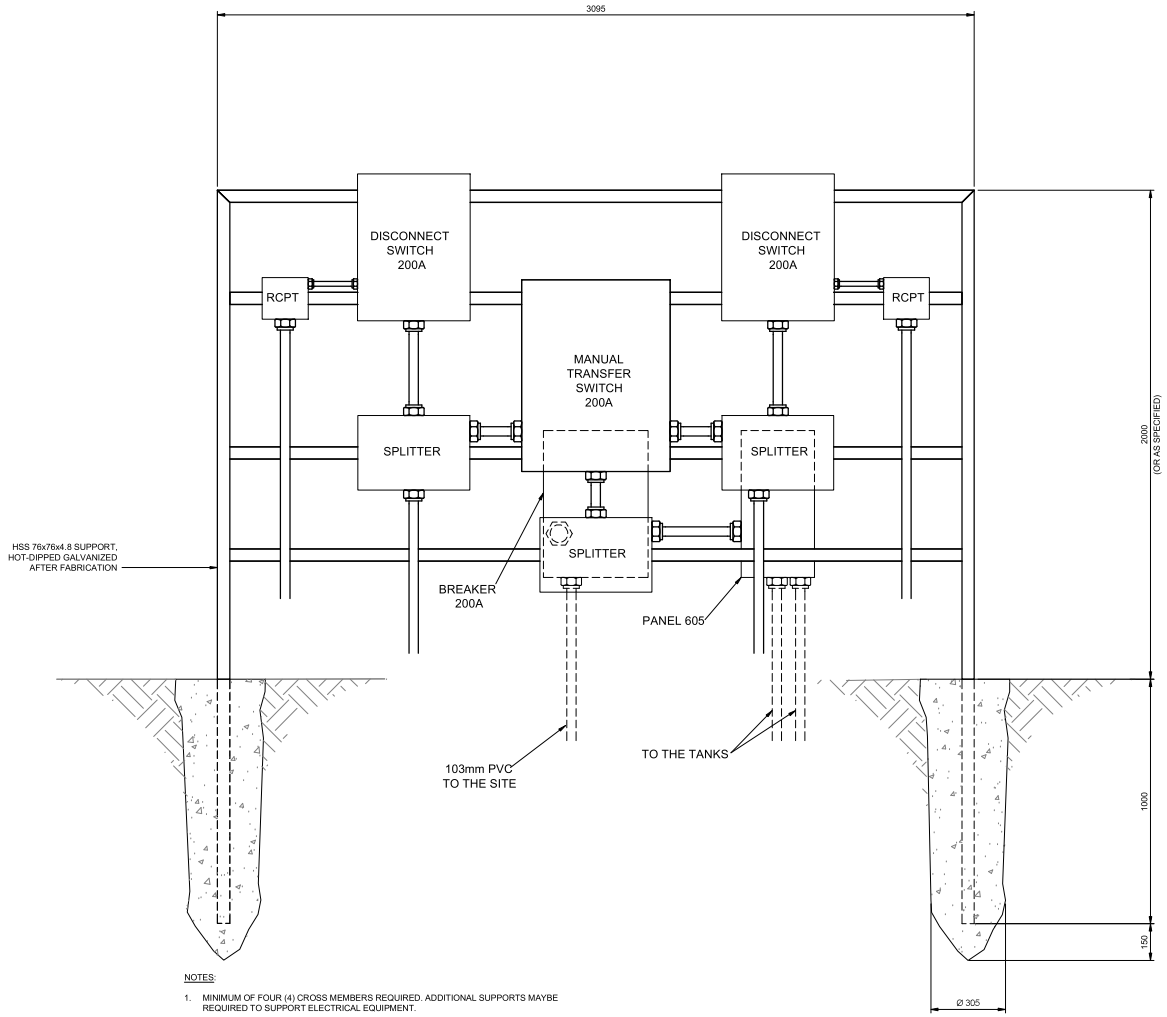
GENERATOR BUILDING AND FUEL STORAGE FACILITY

2018-4096

SCALE: AS SHOWN

CIVIL
SITE PLAN

DRAWING	REVISION	SHEET
4096-00-C-101	0	1 / 4



NOTES:

1. MINIMUM OF FOUR (4) CROSS MEMBERS REQUIRED. ADDITIONAL SUPPORTS MAYBE REQUIRED TO SUPPORT ELECTRICAL EQUIPMENT.
2. ALL CHANNELS, SUPPORTS, ETC. SHALL BE FINISHED W/ B-LINE DURA-GREEN EPOXY.
3. PROVIDE 150mm CONDUIT EXPANSION JOINTS FOR ALL UNDERGROUND CONNECTIONS.

ELEVATION NTS
PANEL SUPPORT

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BEST MANAGED COMPANIES Platinum member

PROFESSIONAL ENGINEER ALBERTA SCOTT FRIEL 2019-03-08
APEGA PERMIT TO PRACTICE P 3979

REV	DATE	DESIGN	DRAWN	DESCRIPTION
0	2019MAR08	S.FRIEL	M.TARABISHI	ISSUED FOR TENDER

YA HA TINDA HORSE RANCH

GENERATOR BUILDING AND FUEL STORAGE FACILITY

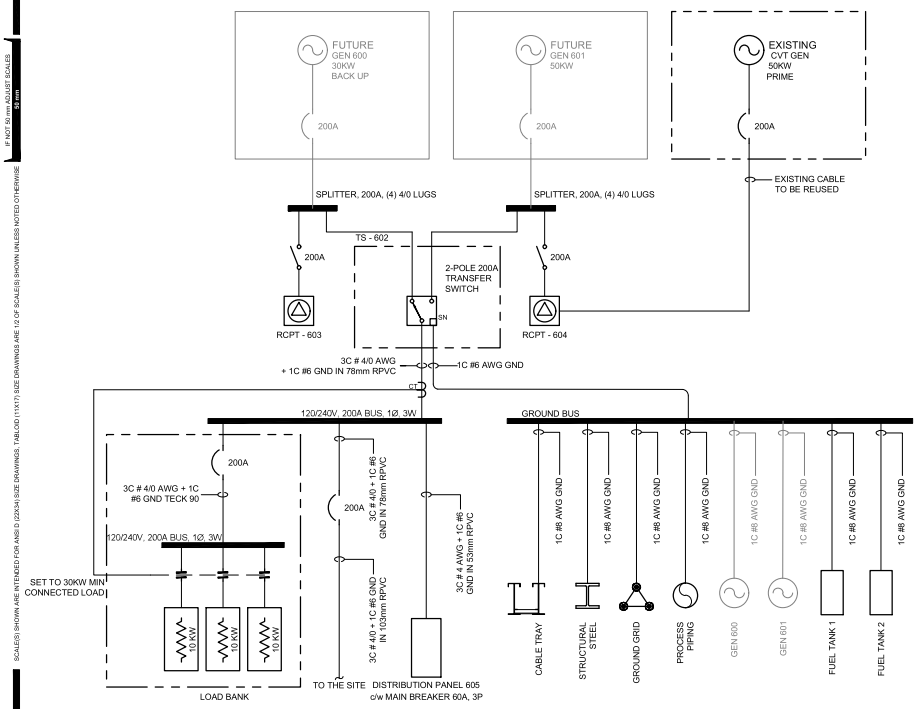
2018-4096

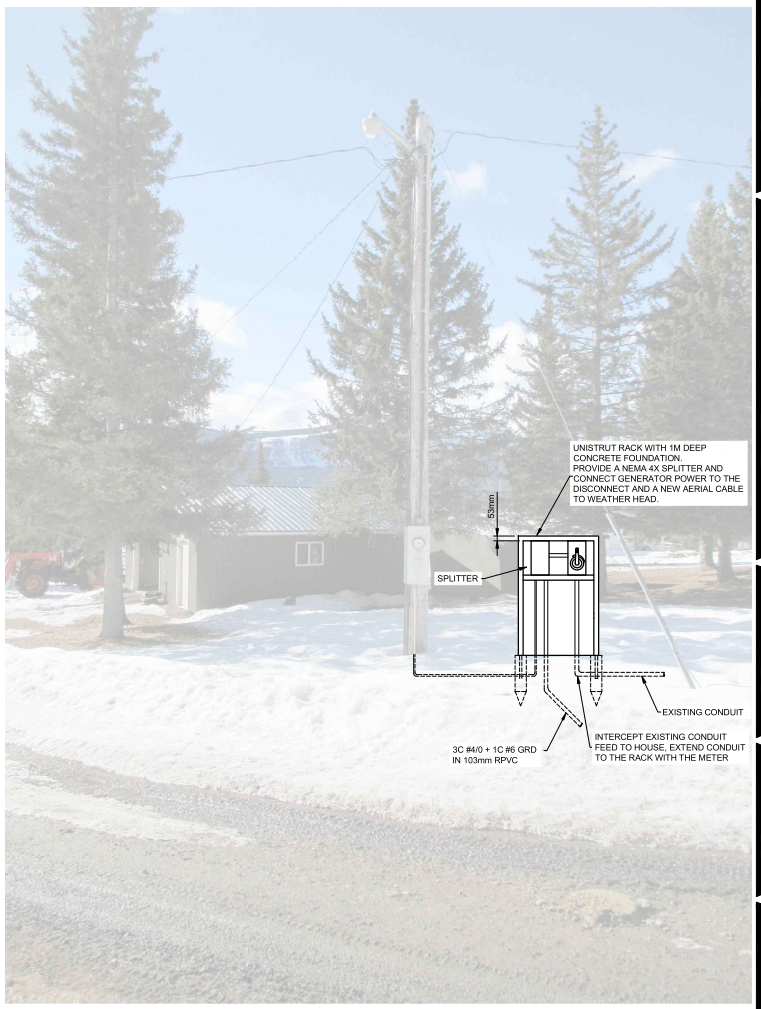
SCALE: AS SHOWN

ELECTRICAL
PANEL SUPPORT

DRAWING	REVISION	SHEET
4096-00-E-201	0	4 / 4

PLOT DATE: 3/8/2019 11:33:29 AM
SAVE DATE: 3/5/2019 9:09:05 AM SAVED BY: FRIELS
DWG PATH: \\s-wpg-hs-01\projects\2018\4096\00_ya_ha_tinda_ranch\working_dwgs\4600_electrical\4096-00-e-201.dwg





PANEL PNL-605 SCHEDULE

LOCATION:
MOUNTING:
INCOMING LUGS:
MANUFACTURER:
VOLTAGE: 120/240VAC
BUS RATING: 60A
MAIN BREAKER: 60A
FEEDER:
PHASE: 1
WIRE: 3

CCT No.	DESCRIPTION	WATTAGE		BKR AMPS	BUS A	BUS B	BKR AMPS	WATTAGE		DESCRIPTION	CCT No.
1	TANK 1	500		15	A						2
3	TANK 2		500	15		B					4
5					A						6
7						B					8
9					A						10
11						B					12
	SUBTOTALS:	500	500					0	0		

NOTES:

1 CONTRACTOR TO RUN 3C #12 TECK90 + GND TO EACH TANK
2
3
4

PHASE A TOTAL - 500 W
PHASE B TOTAL - 500 W
PANEL LOAD TOTAL - 1000 W

Associated Engineering
BEST MANAGED COMPANIES Platinum member

PROFESSIONAL ENGINEER ALBERTA SCOTT FRIEL 2019-03-08
APEGA PERMIT TO PRACTICE P 3979

REV	DATE	DESIGN	DRAWN	DESCRIPTION
0	2019MAR08	S.FRIEL	M.TARABISHI	ISSUED FOR TENDER

YA HA TINDA HORSE RANCH

GENERATOR BUILDING
AND FUEL STORAGE FACILITY

2018-4096

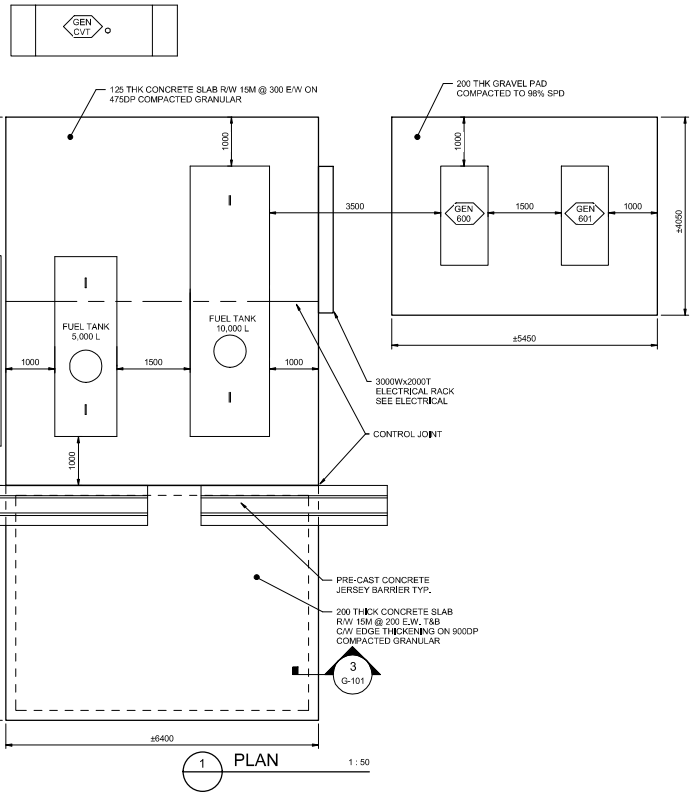
SCALE: AS SHOWN

ELECTRICAL
SINGLE LINE DIAGRAM

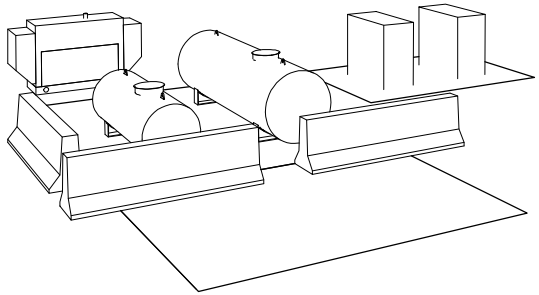
DRAWING	REVISION	SHEET
4096-00-E-601	0	3 / 4

IF NOT 50 mm ADJUST SCALES
50 mm

SCALES SHOWN ARE INTENDED FOR ANSI D (22X34) SIZE DRAWINGS. TABLOID (11X17) SIZE DRAWINGS ARE 1/2 OF SCALES SHOWN UNLESS NOTED OTHERWISE



1 PLAN 1 : 50



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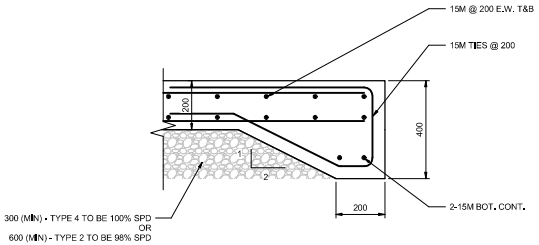
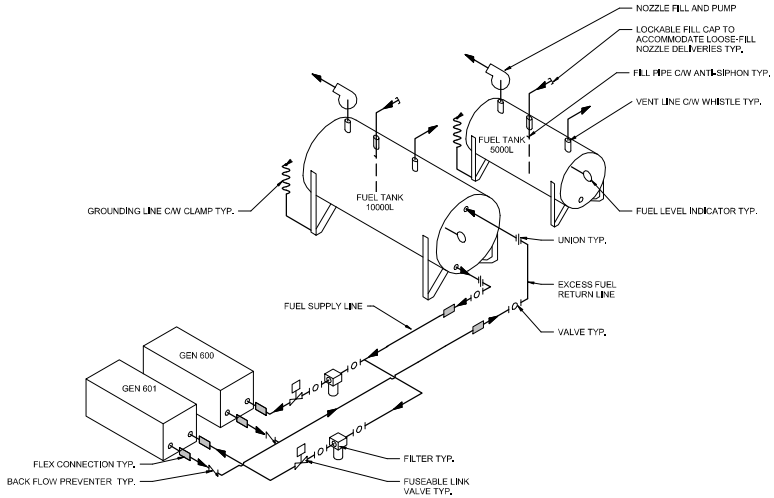


3 DETAIL 1 : 10
EDGE THICKENING



4 SCHEMATIC 1 : 1
FUEL PIPING
DIAGRAM

Associated Engineering
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Platinum member

PROFESSIONAL ENGINEER ALBERTA
RICHARD J. WYNNYK
2019-03-11

PROFESSIONAL ENGINEER ALBERTA
SCOTT FREIL
2019-03-08

APEGA
PERMIT TO PRACTICE
P3979

REV	DATE	DESIGN	DRAWN	DESCRIPTION
0	2019MAR08	SFRW	B. WYNNYK	ISSUED FOR TENDER

YA HA TINDA HORSE RANCH

GENERATOR BUILDING
AND FUEL STORAGE FACILITY

2018-4096

SCALE: AS SHOWN

GENERAL
PLAN, ELEVATIONS
SCHEMATIC AND DETAILS

DRAWING	REVISION	SHEET
4096-00-G-101	0	2 / 4

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DATE: 3/8/2019 11:30:15 AM

APPENDIX A

GEOTECHNICAL INVESTIGATION (MORTON & JAGODICH, 2018)

February 20, 2018

MORTON & JAGODICH INCORPORATED

CIVIL, STRUCTURAL, GEOTECHNICAL ENGINEERS & GEOSCIENTISTS

COMPLIANCE AUDIT OF STORAGE TANK

FINAL GEOTECHNICAL INVESTIGATION REPORT

YA HA TINDA RANCH, AB

Submitted By:

Morton & Jagodich Incorporated
300 -1202 1st St SW
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Allnorth
8 Manning Close NE
Suite 300
Calgary, AB, T2E 7N5

Owner:

Parks Canada
635 8th Ave SW
Calgary, AB, T2P 3M3

Project No: MJI2017081

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

APPENDICIES

1. INTRODUCTION

1.1 Background

Morton Jagodich Incorporated (MJI) was retained by Allnorth on behalf of Parks Canada to perform a site-specific geotechnical investigation including presentation of field investigation findings and design recommendations. The investigation is related to foundation systems for fuel storage tanks found at the Ya Ha Tinda Ranch in Clearwater County, AB. The site is approximately 250m x 250m in size.

The scope of work included three (3) geotechnical boreholes (inclusive of sampling) for the site-specific investigation, laboratory testing of soil samples, and preparation of this geotechnical recommendation report. The scope of this report is to provide recommendations for geotechnical elements of the project in order install the aforementioned infrastructure.

The analysis and recommendations presented in this report are based on the data obtained from boreholes drilled at specific locations. This report does not reflect any variations which may occur between the borehole locations. It is well known that variations in soil and groundwater conditions exist on most sites between borehole locations. The nature and extent of variations may not become evident until the course of construction. If variations become evident, it will be necessary to re-evaluate of the recommendations presented in this report in accordance with on-site observations during the construction process.

1.2 Site Location

The project site requiring geotechnical investigation is located at Ya Ha Tinda Ranch in Alberta's Banff National Park. The approximate location of the site is provided in **Figure 1** below. The site and the as-built borehole locations are also shown in the drawings in **Appendix A**.

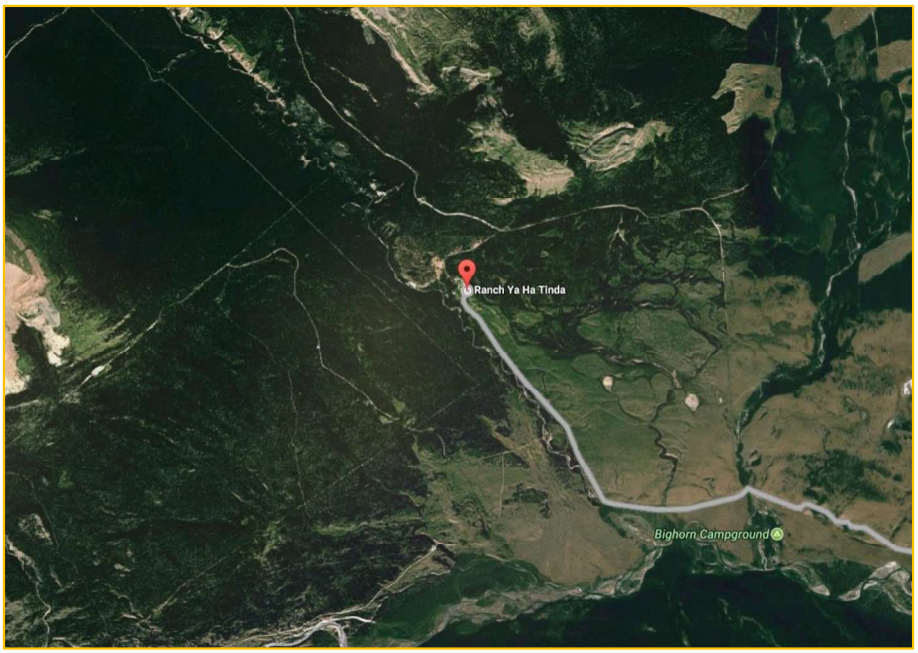


Figure 1: Approximate Project Site Location

The proposed investigation program involved drilling three boreholes (BH-01 to BH-03) using solid and hollow stem augers to the depth of approximately 10 m to 15 m.

Table 1: Borehole Locations

Borehole	Location	Northing (m)	Easting m)	Elevation (masl)
BH-01	YA HA TINDA RANCH, AB	5,734,706	597,837	1,702
BH-02		5,734,695	597,826	1,701
BH-03		5,734,694	597,845	1,700

1.3 Regional Geology of the Project Site

Surficial geology defined in the general area of Ya Ha Tinda area consists of sediments deposited above Cretaceous bedrock called the Yahatinda Formation. The project site is founded on colluvial deposits from the nearby mountainous area as well as the moraine deposits of past

glaciation. As such, the near surface deposits within the site mostly includes cobbles, gravel, and sand. Most of these surficial materials present were deposited during the Pleistocene age.

Surficial materials also include undulating to hummocky till plains, morainal deposits. Local fluvial deposits occur in areas west of the project site. The fine-textured glaciofluvial and glaciolacustrine deposits were reworked by wind, possibly soon after the end of glaciation prior to the establishment of ground cover vegetation. Coarse-textured fluvial accumulations occur along the adjacent Red Deer River and organic and lacustrine deposits occur in low areas. Preglacial valleys have been infilled in some areas with sediments including bouldery materials, preglacial glaciofluvial materials and glacial sediments and till. The Bedrock of the area may consist of YahaTinda Formation bedrock of Devonian Strata.

1.4 Scope of Work

MJI conducted a robust desktop study prior to mobilization for the geotechnical investigation. During this process, our geotechnical engineering team reviewed:

- Site layout and plans;
- In-house Geotechnical/subsurface condition database for expected site condition;
- Geotechnical/subsurface condition data available in the public domain.

Upon completion of the desktop study, field crews initiated the geotechnical investigation component of this project which included the following:

1. Coordination with the client prior to drilling regarding underground utility locates and permissions to access lands/roads for the drilling borehole sites.
2. Conducting a site geotechnical investigation by drilling three (3) boreholes to the depths of 10 m to 15 m deep auger boreholes using a truck-mounted rig.
3. Identification of the depth of topsoil or Muskeg and soil logging during drilling operations.
4. Backfill of all boreholes using the native material.
5. Conducting a laboratory testing program on selected soil/bedrock samples collected during the site investigation for soil/rock classification and determine the engineering properties.
6. Preparation of a geotechnical evaluation report that documents the findings from the site investigation and laboratory testing program, and provide geotechnical recommendations to support the design and construction of geotechnical elements for the project.

7. Provision of engineering design recommendations for foundation systems for above ground storage tanks.

2. GEOTECHNICAL SITE INVESTIGATION

2.1 Planning

At the time of site investigation, the borehole locations were marked together by MJI and Allnorth. The site is located at Ya Ha Tinda Ranch in Clearwater County, AB. The locations of the boreholes are shown in the Drawings in **Appendix A**.

2.2 Utility Locating

The underground utility locates were completed by MJI for all the borehole locations. All the locations were marked before completing utility locating. The Ya Ha Tinda site manager was also consulted about any existing underground utility lines in the vicinity of the proposed borehole locations. Based on the results of underground utility locations, the approximate proposed test locations were adjusted.

2.3 In-Situ Testing

The geotechnical investigation program at this site consisted of drilling three (3) boreholes. The borehole drilling at the site was carried out on September 20, 2017, using a truck mounted rig which was operated by JED Drilling out of Red Deer, AB. The rig was capable of auguring through the overburden and conducting Standard Penetration Tests (SPT's). The hollow stem testing was not utilized at this site due to larger amount cobble and boulder expected at the project site. Installing hollow stem within such soil matrix is very challenging. The scope of work included drilling three boreholes to the depth of 10 m.

However, due to auger refusal at the bedrock. the boreholes were drilled to depths of 6.00 m to 6.25 m through the overburden soil and terminated at top of the bedrock.

Boreholes were logged by MJI Geotechnical Engineer, P. Roshani, E.I.T. The samples were reviewed by P. Balasingam, P.Eng. The boreholes were logged based on observations of drill cuttings and drilling behavior. This included visual classification of soils/bedrock and interpretation of subsurface moisture and groundwater conditions. The soils were classified in accordance with the Modified Unified Soil Classification (MUSC) system. Standard Penetration Tests (SPT) were conducted at regular intervals of 1.5 m and where Engineer find it suitable to get an indication of the soil consistency. The SPT blow counts for 300 mm penetration (SPT "N" blow counts) were recorded. Soil samples were collected at regular intervals or where stratigraphy changed. The samples included disturbed grab samples from the solid stem augers and split spoon samples.

One standpipe was installed in boreholes BH-03. The other boreholes were backfilled with drill cuttings, sand. The boreholes were caped with the bentonite layer to reduce infiltration. Borehole logs are presented in **Appendix B**.

2.4 Laboratory Testing

Soil samples collected during the site investigation were tested at the Solum materials testing laboratory located in Calgary, AB for soil classification and determination of engineering properties. The assigned laboratory testing includes the determination of moisture content, Atterberg Limits, and particle size distributions. The laboratory testing also included electrochemical tests such as soluble sulphate contents, pH, resistivity, and chloride content. The test results are shown in the borehole logs in **Appendix B.** Laboratory test results are also presented in **Appendix C**. **Table 2** summarizes the laboratory tests that are assigned on the collected soil samples.

Table 2: Summary of Assigned Laboratory Testing

Type of Tests	Number of Test	ASTM Standard
Moisture Contents	All Samples	D2216
Atterberg Limits	3	D4318
Grain Size Analyses	3	D422
pH	1	G51

Resistivity	1	G187
Soluble Sulfates	1	N/A
Chloride Content	1	N/A

3. SUBSURFACE STRATIGRAPHY

3.1 General

The subsurface soil at the project site generally consisted of firm to very stiff clay till/ clay layer underlain by compact to dense gravel layer that in turn overlie very weak, highly weathered shale. The thickness of the clay till layer ranged from 3.00 m to 3.5 m. Cobble and boulders sized particles were frequently observed during the investigation.

Based on the behavior of the drill rig during the investigation, it is expected that the boulders are located within the clay till layer at the project site. To confirm the existence of boulders within the clay till matrix, a test pit program may be conducted. A Test pit program can generally identify the subsurface conditions more precisely in a boulder soil matrix.

Detailed descriptions of the subsurface conditions encountered at the borehole locations are provided in the borehole logs in **Appendix B**. A description of the terms and symbols used in the logs is also included therein. A summary of the various soil/bedrock units encountered at the site during drilling boreholes and their engineering properties are presented in the following sections.

3.2 SAND

Approximately 1.5 m to 3.00 m thick layer of sandy material was encountered on top of the till soils. The sand matrix generally consisted of gravel with some silt, and trace clay with trace organics. The encountered sand layer was compact to dense in consistency, with N values ranging between 11 and 31 blows per foot (bpf). The moisture content of the layer varied from damp to wet.

To verify the soil index properties, Particle size distribution and Atterberg Limit Tests were assigned to samples from this layer. A summary of index test results is provided in **Table 3**.

Table 3: Results of Particle Size Distribution and Atterberg Limits Tests

Boreholes	Depth (m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Liquid Limits (%)	Plastic Limits (%)
BH-03	5.25	61.5	20.4	10.9	7.2	-	-

3.3 Glacial Clay Till

The clay till layer consists of silty to sandy clay with some gravel and occasional pebbles, and cobbles. Rafted sandstone bedrock also was found within the clay till matrix. The clay till layer ranged in thickness between 3.0 m and 3.5 m. The soil was found to be moist to wet, and low to medium in plasticity. Due to the existence of cobbles and gravel, and sloughing at time of drilling, the SPT couldn't be conducted.

Particle size distribution and Atterberg limits tests were assigned on samples from this layer to determine the particle size distribution. A summary of grain size and other index test results are provided in **Table 4**.

Table 4: Results of Particle Size Distribution and Atterberg Limits Tests

Boreholes	Depth (m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Liquid Limits (%)	Plastic Limits (%)
BH-01	3.75	-	-	-	-	33	22
BH-02	5.25	-	40.4	26.1	33.5	-	-
BH-03	3.75	-	-	-	-	35	22

3.4 Gravel

Gravel was encountered in all boreholes at varying depths. The thickness of the gravel layer ranged from 1.00 m to 1.5 m. The moisture content of the layer varied from damp to moist. The material is considered dense. Particle size distribution tests were assigned on samples from this layer to determine the index properties of the layer. A summary of grain size analysis is provided in **Table 5.** Index test result is appear to be sand dominant due to the existence of sand lenses within the larger gravel layer.

Table 5: Results of Particle Size Distribution and Atterberg Limit Tests

Boreholes	Depth (m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Liquid Limits (%)	Plastic Limits (%)
BH-01	1.5	2.7	59.3	17.1	20.9	NP	NP

3.5 Bedrock

Bedrock was encountered underneath the gravel in all borings. The bedrock consists of very weak shale interlayered with sandstone sand layers. The shale layer is very weak, wet, blocky and highly weathered/disintegrated to a soil-like formation at an approximate depth of 6.00 m in all borings.

3.6 Soil Profile

The upper layer of the soil in the project area consists of sand and clay Till layers that are underlain by highly weathered, extremely weak shale bedrock. As the depth increased a higher number of SPT blow counts were generally observed.

The estimation of consistency can be derived from SPT blow count and the depth. **Figure 2** presents the profile for SPT – N value vs depth for boreholes. Some of the SPT blow count that were recoreder during the investigation are not shown in the figure below since the SPT barrel was appear to be sitting on boulders. As a result, the SPT blowcounts are not representative of the the actual soil consistency or compactness.

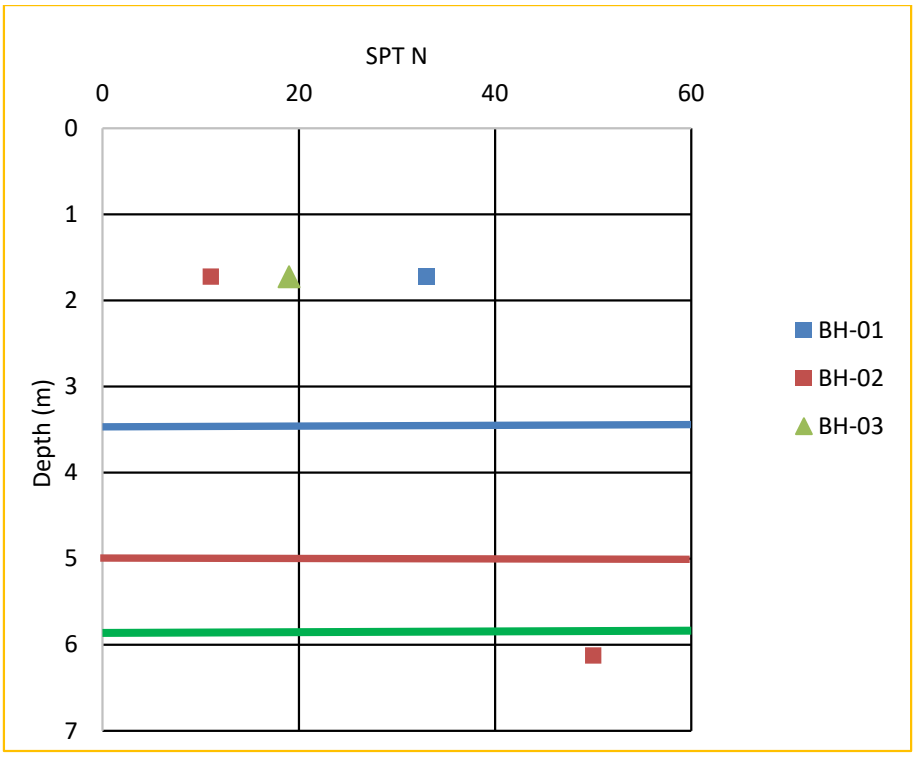


Figure 2: Profile for SPT – (N) Value vs Depth for Boreholes at the Project Site

3.7 Groundwater Conditions

Groundwater depths were measured within the standpipe installed in one borehole (BH-03) on September 20, 2017, immediately after drilling. The measured groundwater depth is summarized in **Table 6**.

Table 6: Groundwater Level Depths from Ground Surface

Borehole Number	Groundwater Depth Immediately after Drilling (m)
BH-03	5.5

The groundwater level is expected to fluctuate seasonally in response to precipitation. As such, the groundwater level at shallower depths should be used in design calculations.

3.8 Soil Chemistry

Electrochemical tests were assigned to soil samples from select boreholes to determine water-soluble sulphate contents, pH, resistivity, and soluble chloride content. A summary of these test results is presented in **Table 7**. The electrochemical test results indicate that soil is mildly corrosive.

Table 7: Soil Electrochemical Test

Borehole Number	Depth (m)	pH	Resistivity (ohm-m)	Sulphate (ppm)	Chloride (ppm)
BH-01	0.75	6.42	47.62	108	3.7

4. SITE SPECIFIC RECOMMENDATIONS

4.1 General

The main subsurface stratigraphy generally consisted of a layer compact sand that overlies firm to stiff clay till overlying a shale bedrock formation which was encountered in nearly all boreholes. Groundwater was encountered within the upper 5.5 m (**Table 6**). The primary geotechnical concerns for the site are:

1. **Sand Material –** Sand Material is observed in all boreholes with thickness ranges between 1.50 to 3.00 m. The sand layer contained trace amount of organic material in it.

2. **Silty clay/clay till** – The surficial silty clay is difficult to work with due to its sensitivity to changes in moisture content and potential for disturbance due to construction traffic. Exposed subgrade at shallow depths should be proof rolled, and backfilled with the suitably compacted material.

3. **Cobbles/Gravel** – Some cobbles size particles and larger diameter gravel were encountered during drilling. As such, care should be taken during pile driving (if required) to prevent any

potential pile damage and shallow refusal during driving. Pile shoes can be utilized to penetrate through cobble layers.

4. **Presence of shallow ground water** – Groundwater was encountered at the boreholes BH-01 a depth of 5.50 m from the ground surface. Sloughing was observed in all boreholes during drilling. If Cast in Place (CIP) concrete piles are considered as a foundation option, casing may be required to maintain a clean pile hole.

5. **Bedrock -** Presence of weak, friable "soil-like" shale bedrock at different depth interval's across the site.

4.2 Frost Depth

The site soil within the freezing front depth consists mainly of clayey/silty till overlying shale bedrock formation. According to the Canadian Foundation Engineering Manual's **Table 13.1**, the site materials are considered to have a moderate to high degree of frost susceptibility (F3 – F4). Based on the published Freezing Index Map of Canada, the project site is located within an area of approximate freezing Index of 2,593 degree-days °F (1,441 degree-days °C). Accordingly, the estimated depth of frost penetration within the surficial glacial till that should be used in foundation design is 3.0 m. This value should be applied to areas stripped of organics and kept bare of snow cover. Standard practice is to support shallow foundations and other frost sensitive facilities below the depth of frost penetration or provide suitable insulation to locally reduce the frost depth.

4.3 Variations in Subsurface Conditions

Our interpretations of soil conditions, as described in this report, are based on data obtained from our visual observations, sample borings, available laboratory test results, and our experience. Although we have allowed for minor variations in the subsurface conditions, our recommendations may not be appropriate for subsurface conditions other than those reported herein. It is possible that some undisclosed variations in soil conditions might occur outside the boring locations, especially the thickness of top soil, thickness and strength/consistency of clay till and the plasticity and strength of underlying bedrock formation.

4.4 Stripping and Clearing

As shown in **Appendix A**, borehole locations that were drilled at the site were generally in close proximity to one another. Stripping and clearing should be carried out to remove surficial soil containing organics. All vegetation, organics (topsoil/organic clay) or any other materials containing organics, if encountered during site grading, should be completely removed to expose the underlying, inorganic subgrade. Contaminated soils (if any) should also be excavated and disposed off-site; as recommended by an environmental professional and or guidelines.

4.5 Site Excavations

Excavation safety systems should be designed in accordance with Alberta Occupational Health and Safety (AOHS) code. The AOHS requirements do not generally require shallow excavations to depths of 1.2 m or less to be sloped back or braced. However, if sloughing and caving are experienced, we recommend that the slopes be cut back to a stable slope. Excavations deeper than 1.2 m are required to be sloped back or braced, according to AOHS regulations. Based on the subsurface conditions indicated in the provided borings, we recommend that all *temporary excavations* below 1.2 m within the unsuitable soils and surficial stiff to very stiff cohesive soils to be sloped as follows;

- 1.2 m to 3.0 to be slopes at 2.0-H:1-V;
- 3.0 m to 5.0 m to be sloped at 2.5-H:1-V

All excavations that are a greater than 5.0 m should be assessed by a geotechnical engineer on a case by case basis.

It is anticipated that dewatering may be necessary within excavations deeper than groundwater levels measured on September 20, 2017. A combination of sumps and pumps should be sufficient to control minor seepage and surface runoff within excavations. In the event that dewatering is required, it is recommended that groundwater levels be drawn down to at least 1.0 m below the bottom of excavations. Mechanical dewatering options such as a deep well point system are considered effective for excavation dewatering however it may take time to dewater excavated areas due to the relatively low hydraulic conductivity of the encountered soils, and dewatering system should be installed in advance of any excavation.

4.6 Subgrade Preparation

After clearing and stripping, the exposed subgrade should be scarified to a minimum depth of 500 mm, moisture conditioned to within 2% of the OMC, and compacted to at least 98% of the SPMDD. Following compaction, the subgrade should be proof-rolled to identify any soft spots. To conduct the proof roll test, it is recommended to use a fully loaded dump truck or water truck with a weight of at least 20 tons and a tire pressure of at least 480 kPa. It is not recommended using off-road earth moving equipment (*i.e.* loaders and scrapers), compactors, or track-mounted vehicles (*i.e.* bull dozers and front-end loaders) for proof-rolling. Proof-rolling specifications should require rut depths less than 25 mm and no visual evidence of pumping. If soft spots are encountered, those areas should be removed and replaced with properly placed and compacted structural granular Fill. After completion of the site preparation activities, the areas should be brought to design grade using properly placed and compacted structural clay Fill. All soft or weak areas should be over-excavated to expose the underlying competent soil to a maximum depth of 600 mm and backfilled using compacted general engineered Fill. The recommended gradations of Engineered Granular Fill materials are presented in **Table 8** below.

Table 8: Recommended Properties of Engineered Granular Fill

Grain Size (mm)	Percent Passing
	Engineered Structural Fill
80.0	100
38.0	--
20.0	40 – 90
10.0	--
5.0	20 – 60
1.25	--
0.160	0 – 15
0.080	2 – 10

Engineered common fill may be used to backfill the excavated areas to raise elevation to their design elevations. Common fill may consist of medium to low plasticity clays. Common Fill should have a liquid limit of less than 40, a plasticity index between 8 and 20, at least 60 percent of the material finer than the No. 200 Sieve, and be non-dispersive. Common fill should be free of deleterious materials such as topsoils, soft soils, frozen lumps, debris and high plasticity clay.

Soils excavated on-site that meets above described specifications can be used as engineered common fill to raise excavated areas to required design elevations. A qualified geotechnical engineer should inspect and approve the excavated materials prior being used as engineered common fill. General engineered fill should be moisture conditioned to within 2% of OMC and compacted to 98% of SPMDD. The fill should be placed in lifts not greater than 150 mm in thickness. The prepared subgrade should be graded to drain towards side ditches and/or natural drainage.

Over saturated areas will require dewatering by pumping out. Subgrade stabilization of such areas may be achieved by placing a layer of non-woven filter fabric (Nilex 4554 or equivalent) directly overlain geogrid (Nilex BX 1200 or equivalent) on the exposed subgrade prior to placing any fill.

If fill is being placed in the fall season, caution should be taken due to the possibility of frost in the underlying subgrade. Settlement of the subgrade could occur as the frost thaws if fill is placed on seasonally frozen soils. Probing should be carried out prior to construction to check that there are no frozen layers in the subgrade prior to grading operations.

Cut sections should be avoided in areas of high groundwater table to reduce difficulties associated with construction. The prepared subgrade should not be left exposed for extended periods of time to avoid wetting, drying, or freezing of the subgrade.

Full-time monitoring and compaction testing should be provided during any fill placement to confirm that it is placed in accordance with the recommendations in this report. Monitoring should be carried out by experienced geotechnical personnel.

4.7 Cold Weather Construction

Special circumstances should be considered during cold weather construction. Under special circumstances, with a consultation of a Geotechnical engineer, cold weather construction may be executed. Fill placement and compaction during extreme cold weather conditions incorporates a very high risk of unacceptable fill performance; particularly with regard to consolidation and differential settlements. As such, subgrade work under cold weather conditions is generally not recommended except under severely restricted criteria and construction constraints.

Even gravels, which give an appearance of being not affected by frozen conditions, can contain ice crystals which limit the achievable degree of compaction. A high degree of fill density and reliability can only be achieved when the fill soils are unfrozen and remain unfrozen during the entire compaction process. This may require that the compaction area is hoarded and heated and/or that the fills are preheated.

Under difficult circumstances and when construction must proceed if possible, past experience has occasionally shown that acceptable compaction and fill density can be achieved during cold weather conditions, provided the fill placed is kept unfrozen and temperatures during fill placement are not colder than -5°C to -10°C. This type of specialized approach requires the full co-operation of the contractor to help expedite completion of the work to the maximum extent possible. Shift work may be required to ensure that the fill is placed and compacted on a continuous basis, not allowing the underlying soil the opportunity to freeze before the next lift of fill is placed and compacted. Experience has also shown that fill with a moisture content near its OMC is much more favorable for expeditious compaction than fill that is wet.

In most cases when extremely cold temperatures prevail or may be forecasted, heating of the fill soils and hoarding and heating of the fill placement area will be necessary to achieve the required degree of compaction. It should also be noted that unless the fill placement area is hoarded and heated, the addition of water to the fill to promote its compaction (in the case of dry soils) would not be possible at freezing temperatures. If mass heating of fill stockpiles is to be considered, the application of heat will need to be controlled so the fill does not become overly dry, which would then necessitate the undesirable addition of water to facilitate its compaction.

Non-compliance with the above guidelines may result in significant fill settlement.

MJI suggests that use of ‘fillcrete’ be considered as an alternative to compacted fills if and when cold weather conditions become a concern.

4.8 Surface Drainage

Sufficient surface drainage should be provided during and after construction to reduce ponding of water near structures. It is understood that the finished surface of the structure will be flat; therefore, surface drainage within the structure footprint will be achieved by grading the prepared subgrade to a minimum gradient of 1.5 % sloping towards the side drain. All surface runoff within the developed area should infiltrate into the side drains.

The side drains/ditches should be properly graded to reduce ditch erosion and ponding. The native soils in the area are erosion susceptible; therefore, the longitudinal ditch gradient should not be steeper than 2%. To reduce the potential for ponding, the desirable minimum longitudinal gradient is 0.5% for ditches with the base width less than 3 m. In some areas, 0.5% may not be achievable. In these situations, longitudinal gradient flatter than 0.5% may be considered. However, the longitudinal gradients should not be flatter than 0.2% in any case.

Erosion protection for ditch slopes can be provided through the application of a layer of topsoil and grass seed. Erosion protection mats may be required to reduce ditch erosion in the short term. Silt fences may also be required during construction to reduce silt flow into the water bodies. Maximum ditch side-slopes of 3H: 1V are recommended for slope stability. Steeper ditch slopes may cause localized toe failures, especially in areas where longitudinal drainage causes undercutting of slope toe.

The use of riprap is recommended at locations where heavy erosion and scour is to be avoided. These locations may include entrance and egress locations of culverts. Where applied, all riprap should be placed on a medium weight, non-woven geotextile.

4.9 Strip and Spread Foundations

The main soil constituents in the project area are firm to stiff clay/clay till overlay of the very weak bedrock. The bearing surface in the upper part of the area is relatively similar for all boreholes (BH-01 to BH-03). Shallow foundations can be used for light to moderate loads provided that sufficient soil cover or insulation is provided to counteract frost forces. Strip and spread footings should be founded on undisturbed stiff to very stiff/compact inorganic clayey soils or structural fill as described in Section **4.6** and may be designed using the factored bearing capacities provided in **Table 8**.

For heated structures, the exterior footings should have a minimum soil cover of 2 m below the finished grade. Footings inside heated buildings should have at least 0.3 m of cover from the underside of the floor slab. For un-heated buildings, the base of footings should be below the seasonal frost depth specified in Section **4.2**.

Minimum footing widths should be 0.6 m for strip footings and 0.9 m for spread footings. Footings should be found at least 0.6 m above the groundwater table. If the footings are to be founded below the groundwater table the bearing capacity should be adjusted to account for the

groundwater table. A foundation drainage system should also be installed to remove groundwater from the base of the foundation.

Inspection of the bearing surface is recommended to ensure that the footings are placed on acceptable bearing stratum and to confirm assumptions made during design. Any soft, loose, or unsuitable soil encountered at the footing bearing elevation should be over-excavated, backfilled with compacted structural fill comprising well graded granular soils (or lean concrete) and compacted to 100% SPMDD.

The footings should not be placed on frozen subgrade. The footing subgrade should not be allowed to freeze after construction as well.

The foundation concrete should be poured right after the excavation to ensure that the exposed subgrade is not disturbed by construction traffic or weather conditions. Use of a mud slab is recommended to reduce the risk of disturbing the foundation base due to weather (wetting/drying) or construction equipment. Where shallow foundations are used in unheated areas, the backfill should include a minimum 1 m wide layer of dry frost stable granular material placed around the foundation columns to reduce the uplift due to frost heave. The upper 0.3 m of the backfill should consist of compacted low to medium plastic clay till to prevent infiltration of surface water.

Table 8: Bearing Resistance for Strip and Spread Footings

Soil Type	Factored ULS Bering Resistance (kPa)		SLS Bearing Resistance (kPa)	
	Strip Footings	Spread Footings	Strip Footings	Spread Footings
Compacted Engineered Fill	140	150	100	110
Firm to Stiff Clay	100	80	80	70

4.10 Gravel Pads as Tank Foundations

Steel tanks that have a high ratio of base width to height are normally flexible structures with a relatively high tolerance to total settlement. It is anticipated that a gravel pad tank foundation

founded on a competent subgrade is feasible. Assuming a bearing pressure on soil from the tank being not more than 100 kPa. The thickness of the gravel pad should be in the order of 0.6 m. The width of the gravel pad at the top of the subgrade should extend at least 2.0 m on all side of the tank circumference. At the top of the gravel pad, the edge of the pad should extend at least 1.8 m beyond the circumferential shell. 20 mm minus crushed gravel should be used for the gravel pad construction.

It is recommended that the top of the gravel pad be at least 0.3 m above the adjacent grade. The side slope along the perimeter of the gravel pad should slope not steeper than 2 H to 1.0 V. To maintain stability of the gravel slope over the long term and to prevent the ingress of free water into the gravel, the exposed gravel pad outside of the tank and along the slope should be surfaced with asphalt or an impermeable membrane.

The base of the granular pad should be founded either directly on competent subgrade that is prepared specification provided in **Section 4.6**. Weak and soft materials that are found near surface should be sub-excavated and replaced with structural fill prior to construction of the tank foundation.

It is anticipated that a liner will be used to contain a potential fluid leak. As a precaution, to prevent groundwater contamination, and potential for shallow groundwater on the site, perforated drainage pipes should be provided for lowering groundwater levels below the gravel pad. The combination of establishing the top of gravel pad elevation above the subgrade, together with constructing a sub-surface drainage system will substantially reduce the likelihood of long-term problems arising.

The following are general recommendations pertaining to the construction of the gravel pad for the oil tank:

- Gravel for the pads should be compacted in lifts compatible with the compaction equipment, but not more than 150 mm in compacted thickness.

- Gravel should be compacted to a minimum of 100 percent of the SPMDD.

- The construction of the gravel pads should be undertaken when the ambient air temperature is above 0°C since adequate compaction of gravels cannot be readily obtained during freezing temperatures.

- The ULS-factored static bearing resistance at the surface of the gravel pad foundation (determined using a geotechnical resistance factor of 0.5) may be taken as 250 kPa based on the assumption that the stiff silty clay or compact sand would be encountered beneath the tank.

- Site grading should be provided such that surface runoff is rapidly shed from the area in the vicinity of the tanks. A minimum slope of 2% is recommended for site surface grades to accommodate surface runoff and to minimize the potential of saturation of the gravel pad foundation.

- The use of flatter grades may be considered, however, the potential for areas of ponding to develop is increased with flatter grades. Frost heaving is generally not a design issue for tanks containing heated fluids because of beneficial heat loss through the tank bottom or foundations. However, for the tanks with unheated fluids, there is no beneficial heat loss to the gravel pad foundation. Alternatively, to reduce frost-related movements to tolerable levels, the frost susceptible soils within the predicted range of frost penetration may be removed prior to tank construction and replaced with properly drained, non-frost susceptible soils. The depth of frost penetration will depend on the duration of exposure to unheated conditions, with the worst-case being an entire winter of exposure.

- Construction of the tank foundation shall be inspected and approved by a Geotechnical engineer.

- Settlement magnitude depends on the compressibility characteristics of the foundation soils, loading intensity, and tank size. For flexible tanks on uniform soils, the settlement at the center is in general about 1.6 times that of the perimeter. The settlement at the center of the tank is expected to be 100 mm including the self-weight settlement of gravel fill, and this value should be confirmed based on actual tank sizes and loading conditions.

4.11 Driven Steel Pile Foundations

In areas of placed fill material or weak soils where installation or site preparation for shallow foundations may become uneconomical, deep foundations may be used to support structures. It is recommended using open-ended steel pipe piles or H-Piles to support the proposed tanks, and

related facilities as a foundation alternative, where required. Pre-drilling of piles is recommended due to the presence of cobble in the subsurface, pre-drilling of piles is recommended.

Due to variability in subsurface and depth-to-water conditions, installation of other types of deep foundations (such as cast-in-place drilled shafts, etc.) may be difficult and/or uneconomical. Thus, recommendations for alternate deep foundation types have not been provided. The geotechnical axial resistances for driven piles are provided in **Table 9**. The equation provided in **Section 4.12** can be used to calculate the axial capacity of piles**.** Additionally, general recommendations for design and construction of driven piles are provided in **Section 4.13.**

Table 9: Geotechnical Design Parameters for Driven Steel Piles

Type of Soil	Depth Below Existing Grade (m)	Unfactored Ultimate Skin Friction (kPa)	Unfactored Ultimate End Bearing (KPa)
Frost Zone	0 to 3 m	-	-
Clay till/ Gravel	3 to 6 m	80	-
Shale Bedrock	Below 6.0 m	100	1,000[1]

Note:

1. End bearing values cannot be relied upon for piles driven with pile shoe or end reinforcement

Steel piles designed based on the above design parameters should be driven to a minimum depth of 9 m to resist frost heave. Negative skin friction due to the settlement of fill and soft subgrade should be considered in the design of the piles. The skin friction should be neglected for the upper 3 m of the pile to account for soil desiccation effects and frost heave.

4.12 Pile Design

The ultimate geotechnical resistance of driven pile can be calculated using the following equation:

$$Q_u = q_s P_s L + q_t A_t$$

Where:

Q_u = unfactored ultimate geotechnical resistance of pile (kN);

q_s = unfactored ultimate skin friction between the pile and soil (kPa);

q_t = unfactored ultimate end bearing (kPa);

P_s = external perimeter of the pile section (m);

L = effective pile embedment length; and,

A_t = cross sectional area of the unplugged steel pile (m^2).

A resistance factor of 0.4 should be applied on the ultimate load capacity of a pile to obtain the factored load capacity. A resistance factor of 0.5 and 0.6 can be applied to the ultimate load capacity if piles are tested in the field by a Pile Driving Analyzer (PDA) and static load testing, respectively. These resistance factors are in accordance with National Building Code of Canada (2015) and Canadian Foundation Engineering Manual (2006).

4.13 General Recommendations

Driven steel pipe piles should be designed and constructed in accordance with the following additional recommendations:

- The minimum pile spacing should be 3 times the pile diameter measured center to center. Group effects should be considered if pile spacing is less than minimum recommended.

- Where steel piles are driven to practical refusal in the clay till, the allowable vertical load capacity is expected to be governed by the allowable design stress in the pile rather than the geotechnical design parameters.

- Practical refusal may be taken as 10 to 12 blows per each 25 mm interval for the last 300 mm pile penetration using an appropriately sized hammer. However, a WEAP analysis is required for confirmation.

- Once the piling equipment has been selected, the final set criteria should be determined using WEAP analysis. Once this analysis is complete, changes to the driving equipment and/or the pile section required to achieve the design loads may be determined.

- Pile capacities based on static design parameters are typically conservative.

- The minimum pile embedment in the native soil should be sufficient to counteract uplift due to frost heave. A Detailed discussion of the uplift forces due to frost heave is provided in **Section 4.9**.

- Due to the presence of cobble in the subsurface, pre-drilling of piles is highly recommended. Due to this recommendation, pipe piles are considered the preferred foundation solution.

- When pre-drilling is used, the pile-hole diameter should not be greater than 90% of the diameter or width of the pile.

- For pipe piles, only the exterior surface area in contact with the soil should be used in calculating the frictional resistance. The gross area at the pile tip may be taken as the area enclosed by the outer diameter of the pile section.

- In calculating the shaft friction capacity, the upper 3.0 m of the pile shaft, or any portion of the pile in contact with fill soils, whichever is greater, should be neglected due to the possibility of poor surface contact.

- Frost heave forces (adfreeze forces) would be counteracted by the dead load acting on the pile, the weight of the pile plus the frictional resistance on the shaft below the frost penetration zone.

4.14 Uplift Forces on Piles

The piles will be subject to uplift forces due to frost heave, tensile forces due to lateral loading, overturning movements, etc. Piles should be designed to resist these uplift forces. The resistance to uplift will be provided by pile self-weight, applied dead loads, and uplift skin friction. Factors such as seasonal frost depth, heating and insulation, and soil type should be taken into account when designing the pile against uplift.

The resistance to uplift may be calculated using the ultimate skin friction parameters provided in **Section 4.11 (Table 9)** of this report. A resistance factor of 0.3 should be applied on ultimate uplift resistance to obtain factored parameters.

4.15 Lateral Loading on Piles

When vertical piles are subjected to horizontal loads in addition to vertical loads, lateral capacity must be analyzed. Construction, seismic forces, and wind may impose short-term lateral loads on the foundation. Whereas long-term forces may be those acting on supports of an above ground depends upon the type of structural load caring by the pile.

Lateral load capacity of piles depends upon the pile stiffness and geotechnical engineering properties of the native soil or fill material within the upper few meters of the pile. Lateral pile analysis involves soil-structure interaction and requires soil and pile stiffness properties. Until the design grades, pile type, layout, and the nature of the backfill have been determined, it is not possible to provide detailed lateral resistance of the pile.

Typical practice is to design the piles for vertical loading and conduct a subsequent review of lateral capacity, pile head deflections, and bending moments by lateral pile analysis. However, there can be situations where the lateral capacity of the shaft section governs the pile shaft size. The geotechnical soil properties for lateral analysis are provided in **Table 10.**

Table 10: Geotechnical Soil Properties for Lateral analysis

Soil Type (m)	Depth Below Existing Grade (m)	Saturated Unit Weight, Y (kN/m^3)	Undrained Compressive Strength (KPa)	E_{50} (%) or K_{rm}
Frost Zone	0 to 1 m	18	-	-
Clay till/ Sand / Gravel	1 to 6 m	20	80	0.01
Shale Bedrock	Below 6 m	22	100	0.0005

4.16 Pile Load Test

Load tests can be used to evaluate the ultimate load capacity of the pile and its load-settlement behavior or to verify design assumptions. They can also be used to confirm acceptability of performance of the pile or to examine its structural integrity.

Pile Dynamic Analyzer (PDA) testing can be performed to monitor and confirm hammer and driving system performance, assess pile installation stresses and integrity, as well as to evaluate pile capacity. The design engineer should select the test method, type of piles to be tested, method of driving or installation, and loading. The piles and the installation procedures should be the same as those intended to be used for the construction of the foundation. Analysis of the data from the load tests should be performed by a pile testing specialist.

Pre-production load tests will generally consist of a single or multiple static load tests, depending on the number of piles to be installed, the range of design pile capacities, and the variation of subsurface conditions at the site. Static load testing is costly and applicable mainly for large projects. Pre-production testing may include a single static load test supplemented with several piles tested by the rapid or dynamic load test methods. Performing rapid or dynamic tests, such as a Pile Driving Analyzer® (PDA) test during the pre-production testing program will allow these methods to be calibrated against static load tests results prior to pile installation.

4.17 Geotechnical Resistance Factors

Geotechnical resistance factors for the design of deep and shallow foundations should be used in accordance with the ultimate limit state design method presented in Canadian Engineering Foundation Manual (2006). The geotechnical resistance factors for compression, tension, and lateral loading condition is provided in **Table 12**. For details refer to the Canadian Foundation Engineering Manual (CFEM) 2006 and National Building Code of Canada (NBCC) (2015).

Table 12: Geotechnical Resistance Factors

Foundation Type	Loading Conditions	Geotechnical Resistance Factor
Deep Foundation	Axial Compression – Using Semi-Empirical Methods	0.4
	Axial Tension – Using Semi-Empirical Methods	0.3
	Axial Compression – Using Dynamic Load Testing	0.5
	Axial Tension – Using Dynamic Load Testing	0.4
	Axial Compression – Using Static Load Testing	0.6
Shallow Foundation	Axial Compression	0.5
Deep & Shallow Foundations	Lateral	0.5

4.18 Estimated Tank Settlement

Based on the findings of the field exploration program, the center settlement is estimated for the proposed tanks. For this estimation, settlement analyses were performed assuming the sustained pressure of 100 kPa applied to the ground by the tank. Using the encountered subsurface stratigraphy and considering settlement on clay till layer, Tables 13 present summary result of the preliminary settlement analyses for the tank and the general assumptions regarding that for this estimation.

Table 13: Settlement of the Proposed Tanks

Assumed Design Grade Elevation, m	Estimated Settlement at Center, mm	Assumed Soil Description	Poisson's Ratio	Total Unit Weight, kN/m3	Comments
1700	120 to 200	4.50 m firm to stiff to very stiff Clay till and 1.0 to 2.00 m backfill with engineering Fill as described in section 4.9 to design elevation	0.35-0.40	19	Effective dewatering system needs to be used during site preparation, shallow foundations/ gravel pads are considered suitable to support tank as described in Section 4.9 and 4.10. In case of difficulties of controlling seepage, steel driven piles should be considered as alternative foundation system.

4.19 Frost Design and Considerations

Frost action must be considered during pile foundation design. Forces interacting with the pile include uplift due to frost heave on the underside of grade beams/pile caps and adhesion freezing forces (adfreeze) along the pile shaft within the seasonal frost zone. Therefore, the pile embedment below the seasonal frost zone should be sufficient to resist uplift forces due to frost heave. The minimum pile embedment to resist frost heave should be calculated using appropriate adfreeze stress on the pile shaft, dead loads on piles, and pile self-weight, and skin friction below seasonal frost zone. The estimated depth of frost penetration at the project site is provided in **Section 4.2** as 3.00 m. The adfreeze bond stresses on unheated pile shafts in seasonal frost zones is estimated to 100 kPa for steel piles.

An additional frost effect is adfreeze acting on the sides of the pile caps for unheated structures. This can be reduced by placing dry non-frost susceptible granular soil (with less than 5% fines) around pile caps/grade beams, providing good drainage, and applying a frost bond breaker to the faces of pile caps and grade beams.

Grade beams and pile caps in unheated areas should also be protected from frost heave by burying below the seasonal frost depth. Grade beams and pile caps that do not have adequate

soil cover should be protected from frost heave by providing a void form or a void space underneath. Placing a compressible void form or providing a void space between the ground and the underside of the grade beams/pile caps will reduce the potential for frost heave forces. If a void space is used, the minimum space between the bottom of the grade beams and ground surface should be 75 mm.

4.20 Sulphate and Corrosion

The summary of electrochemical test results and expected degree of corrosion and potential for sulphate attack of the surface soil on concrete is presented in **Table 7.** The soluble sulphate contents of soils tested at the site were less than 0.1 %. The potential degree of sulphate attack on concrete may be considered to be "low". Accordingly, Type GU (formerly known as Type 10) Portland cement can be used. However, it is common practice to use Type HS (formerly known as Type 50) Sulphate Resistant cement for any foundation concrete in contact with groundwater or subsurface soils. The Sulphate Resistant cement should be used at a maximum water-cement ratio of 0.45 and a minimum 28-day compressive strength of 32 MPa for all concrete structures in contact with the subsoils, groundwater and abutment fill. Air entrainment of 4 % to 6 % by volume is recommended for all concrete exposed to freezing temperatures, native soil, and/or groundwater.

The pH values ranged to 6.42 and resistivity values of the soil ranged to 4,762 ohm-cm. The corrosivity of the subsurface soils is considered mild (**Table 7**). Therefore, the designer should consider the appropriate level of corrosion allowance during the design.

4.21 Site Seismic Classification and Seismic Factors

Seismic loading should be considered in the design of structures. The level of importance of seismic loading at any site is related to factors such as the subsoil conditions and their soil behavior during an earthquake, the magnitude, duration, and frequency level of strong ground motion, and the probable intensity and likelihood of occurrence of an earthquake. The seismic loads used in the provisions of the NBCC 2015 are based on a 2% probability of exceedance in 50 years, i.e., a return period of 2,475 years. This means that within a 50-year period, there is a 2% probability that the ground motions specified in the NBCC will be exceeded.

Based on the requirements set out in the NBCC a determination of the soils relative response to the seismic activity is required. The NBCC deals with the seismic classification of soils based on

average properties of the top 30 m of the soil profile. This classification is based on the average standard penetration resistance, shear wave velocity, or undrained shear strength (Table 6.1 A, CFEM 2006). The soil profile at the site was determined from the average SPT "N" blow counts in the upper 15 m.

The SPT "N" blow counts in the upper 15 m of the soils has an average greater than 50. The average seismic shear wave velocity varies from 360 m/s to 760 m/s in the overburden material. Based on the average SPT "N" blow count, and the measured seismic shear wave velocity, site Class C is anticipated in the upper 30 m.

The parameters used to represent the seismic hazard for specific geographical locations are the 5% damped spectral acceleration values; S_a (T), for 0.2, 0.5, and 1.0 second periods and the Peak Ground Acceleration (PGA) value that has a 2 % probability of being exceeded in 50 years.

To determine the design spectral acceleration values for the site, the PHGA and the 5 % damped spectral acceleration values for the reference ground conditions (Site Class C, i.e., very stiff soil and soft rock with N60>50) were obtained using the NBCC 2015 seismic hazard value interpolator obtained from the Natural Resources Canada website.

Since the soil profile at the site is classified as Class C, the spectral response acceleration values were used resulting 5 % damped spectral accelerations for 2 % probability of exceedance in 50 years for soil profile Class C and D are presented in **Table 14**.

Table 14: NBCC Interpolated Seismic Hazard Values

Seismic Site Classification	S_a(0.2)	S_a(0.5)	S_a(1.0)	PHGA
C	0.274	0.180	0.096	0.127

5. DESIGN AND CONSTRUCTION REVIEW

Recommendations provided in this report assume that an appropriate level of monitoring will be provided during construction. All construction will be carried out by qualified construction contractors, experienced in earthworks and foundation construction in Alberta. Adequate levels of monitoring are required for:

- for deep foundations (piles) - full time inspection and design review during construction;

- for shallow foundations - inspection of all bearing surfaces prior to pouring of concrete; and
- for earthworks – full-time monitoring during compaction for quality control.

Qualified geotechnical personnel should carry out all such quality assurance monitoring. The main purpose of monitoring is to ensure that the recommendations provided in this report, which are based on the findings at discrete borehole locations, are relevant to other areas of the site.

6. CLOSURE

We appreciate the opportunity to deliver the geotechnical engineering services on this project and look forward to moving into the construction phase. If you have any questions, please do not hesitate to contact the undersigned.

Best Regards,

Morton & Jagodich Incorporated
Permit to Practice P11879
Prepared by:

P. Roshani, M.A.Sc., P.Eng.
Geotechnical Engineer

P. Balasingam, M.S., MBA., P.Eng., P.E.
Team Lead - Geotechnical Engineering

Reviewed by:

J. Jagodich, MBA, P.Eng., PMP
Principal

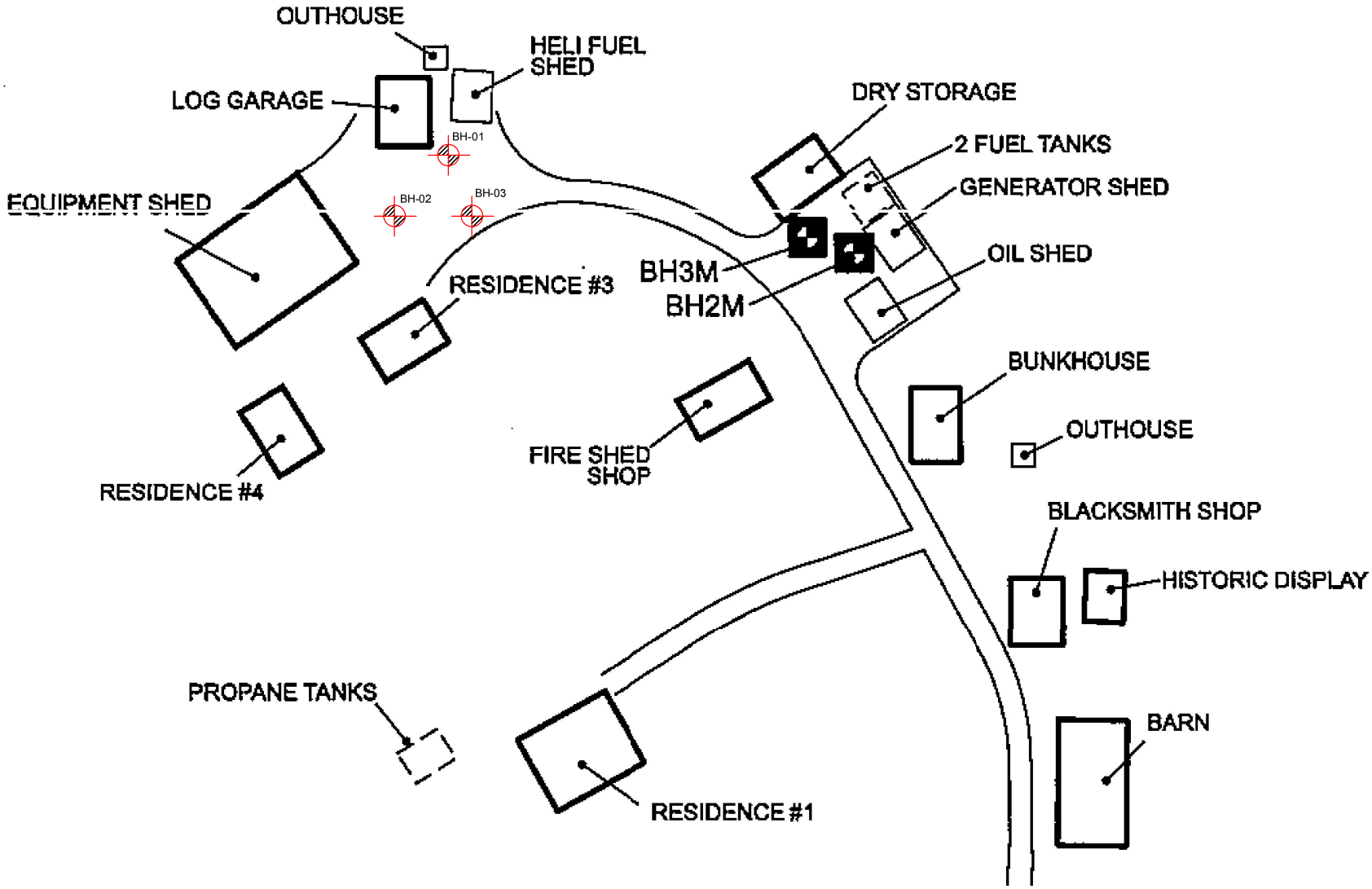
February 20, 2018

APPENDIX A: DRAWINGS

KEY PLAN

LEGEND

DRAWN: PR	CLIENT: Allnorth — 8 Manning Close NE Suite 300, CALGARY, ALBERTA T2E 7N5	PROJECT: COMPLIANCE AUDIT OF STORAGE TANK GEOTECHNICAL INVESTIGATION	
CHECKED: JJ		PROJECT No.: M□2017081	
ENGINEER: PB	MORTON JAGODICH Civil, Structural, & Geotechnical Engineers — 200 – 1202 1 ST SW, CALGARY, ALBERTA T2R 0V4, TEL: 1.844.DIAL.MJI, www.mortonjagodich.com	DATE: SEPTEMBER 2017	SCALE: NA
PROJECT MANAGER: JJ		TITLE: SITE MAP LOCATION	SHEET No.: 1/3



LEGEND

Borehole Locations

NOTE: BOREHOLE LOCATIONS ARE APPROXIMATE AS TAKEN BY HANDHELD GPS UNIT

DRAWN: PR	CLIENT: Allnorth, 8 Manning Close NE Suite 300, Calgary, AB, T2E 7N5	PROJECT: COMPLIANCE AUDIT OF STORAGE TANK GEOTECHNICAL INVESTIGATION	
CHECKED: JJ		PROJECT No.: M□2017081	
ENGINEER: PB	MORTON JAGODICH Civil, Structural, & Geotechnical Engineers 200 – 1202 1 ST SW CALGARY, ALBERTA T2R 0V4 TEL: 1.844.DIAL.MJI www.mortonjagodich.com	DATE: SEPTEMBER 2017	SCALE: NA
PROJECT MANAGER: JJ		TITLE: ASBUILT BOREHOLE LOCATION	SHEET No.: 3/4

NOTES:

1. TRACK MOUNTED DRILL RIG WITH SOLID STEM AUGER WAS USED FOR PRO□ECT SCOPE.
2. SPT TESTING OR SAMPLING APPROXIMATELY EVERY 1.5 m.
3. SHALLOW BEDROCK WAS ENCOUNTERED.
4. CUTTINGS USED FOR BACKFILL OF DRILL HOLE.

TABLE 1 : AS-BUILT BOREHOLE LOCATIONS AND DEPTHS

BOREHOLE	LOCATION	NORTHING (M)	EASTING (M)	ELEVATION (M)
BH-01	***ya ha tinda RANCH, AB***	5734706	597837	1702
BH-02		5734695	597826	1701
BH-03		5734694	597845	1700

DRAWN: PR	CLIENT: Allnorth, 8 Manning Close NE Suite 300, CALGARY, ALBERTA T2E 7N5	PROJECT: COMPLIANCE AUDIT OF STORAGE TANK GEOTECHNICAL INVESTIGATION	
CHECKED: JJ		PROJECT No.: M□2017081	
ENGINEER: PB	Morton Jagodich, Civil, Structural, & Geotechnical Engineers; 200 – 1202 1 ST SW, CALGARY, ALBERTA T2R 0V4, TEL: 1.844.DIAL.MJI, www.mortonjagodich.com	DATE: SEPTEMBER 2017	SCALE: NA
PROJECT MANAGER: JJ		TITLE: AS-BUILT BOREHOLE LOCATION NOTES	SHEET No.: 3/3

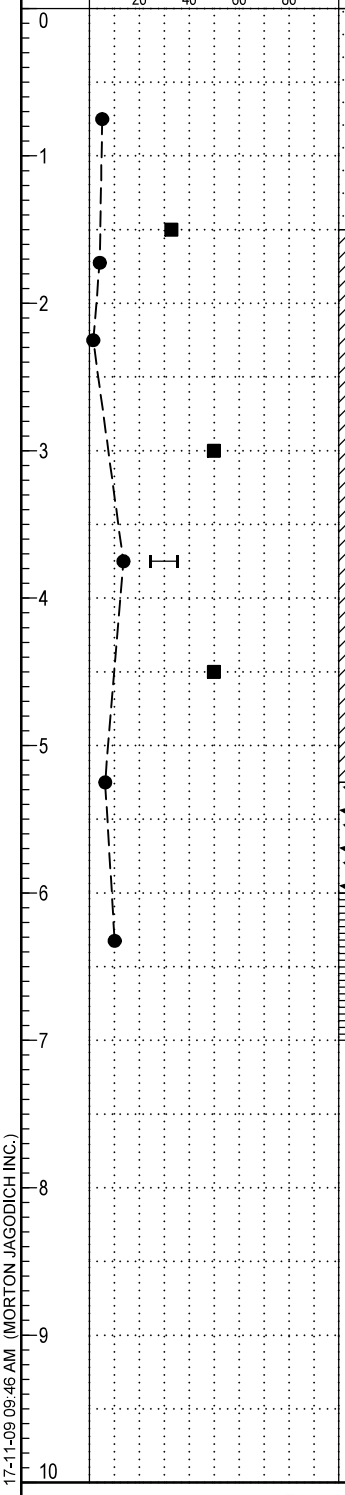
February 20, 2018

APPENDIX B: BOREHOLE LOGS

Project: Storage Tank Geotechnical Investigation	Area: YA HA TINDA RANCH, AB	Borehole No: BH-01
Driller & Method: JED, Solid Stem Auger/Coring	Northing: 593837	Project No: MJI2017081
Client: Parks Canada	Easting: 573470	Elevation: 668 m

SAMPLE TYPE: Shelby Tube | Core | SPT Test (N) | Grab Sample

BACKFILL TYPE: Bentonite Grout | Slough | Drill Cuttings | Cement Grout | Bentonite Chips | Sand



Depth (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	SPT (N)	TCR	SCR	RQD	OTHER TESTS COMMENTS	ELEVATION (m)
0	SAND (SP) - gravelly, trace clay, poorly graded, some organic, oxide, damp, compact, reddish brown		1					Sulphate = 0.0011 % Chloride = 0.0002 % pH = 6.34 Resistivity = 74.07 ohms - meter	668
1	- cobbles								667
	CLAY TILL (CL)- some sand, trace gravel, blocky structure, stiff to very stiff, damp, low plasticity		2	33					
2	- cobbles, gravelly, some sand		3						666
3	- sloughing		4	50				SPT Refusal on boulder	665
	- pockets of coal		5						
4									664
			6	50				SPT Refusal on boulder	
5	-silty, sandy		7						663
	GRAVEL (GP) - some clay, some sand, poorly graded, wet, compact to dense, dark brown							Gravel = 2.7% , Sand = 59.3 % , Silt = 17.1 % , Clay = 20.9 %	
6	- sand lenses								662
	SHALE (SH) - very weathered, weak, dark brown, wet		8					seepage of water	
7	END OF BOREHOLE -end of drilling at 7.0 m -backfilled with cuttings/bentonite -seepage at 6.00 m BGS -auger refusal at 6.75 m								661
8									660
9									659
10									

Allnorth — Parks Canada / Parcs Canada

MORTON JAGODICH Civil, Structural, & Geotechnical Engineers

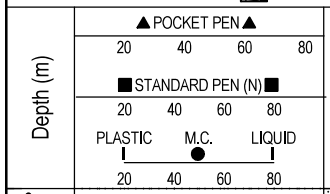
Start Date: 2017-09-20	Logged By: PR
Completion Date: 2017-09-20	Reviewed By: PB
Completion Depth: 7.00 m	Page 1 of 1

BANF.GPJ 17-11-09 09:46 AM (MORTON JAGODICH INC.)

Project: Storage Tank Geotechnical Investigation	Area: YA HA TINDA RANCH, AB	Borehole No: BH-02
Driller & Method: JED, Solid Stem Auger/Coring	Northing: 597826	Project No: MJI2017081
Client: Parks Canada	Easting: 573469	Elevation: 668 m

SAMPLE TYPE: Shelby Tube | Core | SPT Test (N) | Grab Sample

BACKFILL TYPE: Bentonite Grout | Slough | Drill Cuttings | Cement Grout | Bentonite Chips | Sand



Depth (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	SPT (N)	TCR	SCR	RQD	OTHER TESTS COMMENTS	ELEVATION (m)
0	SAND (SP) - gravelly, trace clay, some organic, poorly graded, oxide, damp, compact, reddish brown		1						
1									667
	CLAY TILL (CL)- some sand, trace gravel, blocky structure, stiff to very stiff, damp, low plasticity		2	11					
2			3						666
3	- cobbles, gravelly, some sand - sloughing		4	50				SPT Refusal on boulder	665
			5						
4									664
			6	50				SPT Refusal on boulder	
5	- silty, sandy - seepage		7					Sand = 40.4 % , Silt = 26.1 % , Clay = 33.5 %	663
	GRAVEL (GP) - some clay, some sand, poorly graded, wet, compact to dense, dark brown								
6	SHALE (SH) - very weathered, weak, dark brown, wet		8	50				SPT Refusal on boulder	662
	END OF BOREHOLE -end of drilling at 6.25 m -backfilled with cuttings/bentonite -seepage at 5.00 m BGS -auger refusal at 6.25 m								
7									661
8									660
9									659
10									

Allnorth | Parks Canada | Parcs Canada | MORTON JAGODICH Civil, Structural, & Geotechnical Engineers

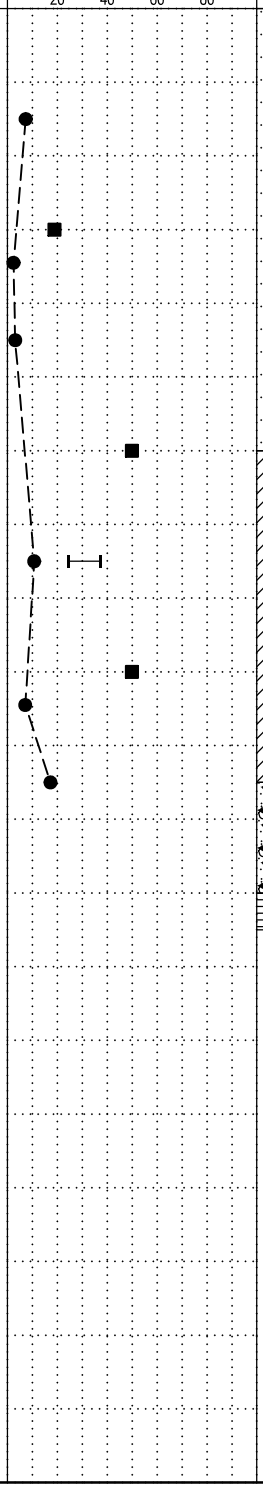
Start Date: 2017-09-20	Logged By: PR
Completion Date: 2017-09-20	Reviewed By: PB
Completion Depth: 6.25 m	Page 1 of 1

BANF.GPJ 17-11-09 09:46 AM (MORTON JAGODICH INC.)

Project: Storage Tank Geotechnical Investigation	Area: YA HA TINDA RANCH, AB	Borehole No: BH-03
Driller & Method: JED, Solid Stem Auger/Coring	Northing: 597845	Project No: MJI2017081
Client: Parks Canada	Easting: 573469	Elevation: 668 m

SAMPLE TYPE: Shelby Tube; Core; SPT Test (N); Grab Sample

BACKFILL TYPE: Bentonite Grout; Slough; Drill Cuttings; Cement Grout; Bentonite Chips; Sand



SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	SPT (N)	TCR	SCR	RQD	OTHER TESTS COMMENTS	ELEVATION (m)
	SANS (SP) - gravelly, trace clay, poorly graded, some organic, oxide, damp, compact, reddish brown		1						667
	- cobbles, gravelly		2	19				Gravel = 61.5 % , Sand = 20.4 % , Silt = 10.9 % , Clay = 7.2 %	666
			3						
	CLAY TILL (CL)- some sand, trace gravel, blocky structure, stiff to very stiff, damp, low plastic		4	50				SPT Refusal on boulder	665
	- sloughing		5						664
	- silty, sandy		6	50				SPT Refusal on boulder	663
	GRAVEL (GP)- some clay, some sand, wet, compact to dense, dark brown		7						
	- seepage noted								662
	SHALE (SH) - very weathered, weak, dark brown, wet								
	END OF BOREHOLE -end of drilling at 6.25 m -backfilled with cuttings/bentonite -seepage at 5.50 m BGS -auger refusal at 6.25 m								661 660 659

BANF.GPJ 17-11-09 09:46 AM (MORTON JAGODICH INC.)

Allnorth — Parks Canada / Parcs Canada

MORTON JAGODICH Civil, Structural, & Geotechnical Engineers

Start Date: 2017-09-20	Logged By: PR
Completion Date: 2017-09-20	Reviewed By: PB
Completion Depth: 6.25 m	Page 1 of 1

February 20, 2018

APPENDIX C: LABORATORY TEST RESULT

SOLUM CONSULTANTS LTD.
GEOTECHNICAL & MATERIAL TESTING LABORATORY

Geo-Lab Report
(R1)

October 16, 2017

Morton Jagodich
340 Midpark Way SE, Suite 150
Calgary, AB T2X 1P1

Attention: **Pirahas Balasingam**
Project No.: **MJI2017081**
Project Name: **Banf Geotechnical Investigation**
Solum Job No.: **05701170926(147)**

Sample Received on: September 26, 2017
# of Sample Rec'd: 1 bag

Test	Quantity	ASTM Designation
Moisture Content	18	D2216
Atterberg Limits	3	D4318
Particle-Size Analysis (Full Gradation)	3	D422(withdrawn 2016)
pH	1	G51
ER	1	G187
Water Soluble Sulphates & Chlorides	1	N/A

Saad A.M. Farag
Principal

9, 3620-29 Street NE,Calgary, AB T1Y 5Z8
ph:(403)250-3035 Fax:(403)250-3021 Email: solum@mymts.net

Laboratory Analysis Summary

SOLUM CONSULTANTS LTD.
GEOTECHNICAL & MATERIAL TESTING LABORATORY

#9, 3620 - 29 Street, N.E.
Calgary, Alberta T1Y 5Z8
Ph: (403)250-3035
Fax: (403)250-3021
Email: solum@mymts.net
www.solumconsultantsltd.com

Project Number:	MJI2017081
Client:	Morton Jagodich
Project Name:	Banf Geotechnical Investigation
Location:	Ya Ha Tinda
Tested By:	KC/SF
Reviewed By:	
Date Reviewed:	16-Oct-17 (dd-mm-yy)
Solum Job No.:	05701170926(147)

Results

Borehole ID	Sample ID	Depth (m)	Atterberg Limits				Particle Size Analysis					Soil Classification** Group Symbols
			Liquid Limit(%)	Plastic Limit(%)	Plastic Index(%)	Classification* (USCS)	Cobble Size (%) (75-300mm)	Gravel Size (%) (4.75-75mm)	Sand Size (%) (0.075-4.5mm)	Silt Size (%) (0.005-0.075 mm)	Clay Size (%) (<0.005mm)	
BH-01	S5	3.75 m	33	22	11	CL	---	---	---	---	---	---
BH-01	G8	5.25 m	---	---	---	---	0.0	2.7	59.3	17.1	20.9	---
BH-02	G2	1.50 m	---	---	---	NP	---	---	---	---	---	---
BH-02	SH	5.25 m	---	---	---	---	0.0	0.0	40.4	26.1	33.5	---
BH-03	S4	1.50 m	---	---	---	---	0.0	61.5	20.4	10.9	7.2	---
BH-03	G5	3.75 m	35	22	13	CL	---	---	---	---	---	---

* Note: Soil classification is for material less than 0.425 mm (material used for Atterberg Limits), this includes the fine sand, silt and clay fraction of the sample.

** Note: Soil classification is for the whole sample. Soil classification uses the Atterberg Limits results and the percent fines, percent sand and percent gravel as described in ASTM D2487.

WSH Labs (1992) Ltd.

3851B – 21 Street NE • Calgary, Alberta, Canada • T2E 6T5

Phone: (403) 250-9164 • Fax: (403) 291-4597 • www.wshlabs.com

SOLUM Consultants Ltd.	**Phone:**	(403) 250-3035	**File Number:**	100217
#9, 3620 - 29 Street NE	**Fax:**	(403) 250-3021		
Calgary, AB T1Y 5Z8	**E-Mail:**	solum@mymts.net	**PO Number:**	

Project:	MJI2017081	**Date Sampled:**	
	Solum #147	**Date Received:**	10/2/2017
Attention:	Saad A.M. Farag	**Date Reported:**	10/4/2017

RESULTS OF SOIL ANALYSIS

Lab Number	Sample ID	Sulphate (%)	Chloride (%)	Sulphate (ppm)	Chloride (ppm)
R7771	BH-01 G1 0.75m	0.0108	0.0004	108	3.7

WSH Labs (1992) Ltd. as per: _____

The analysis is based on a 1:1 water/soil ratio unless otherwise noted. The results above are related only to the items analyzed.

pH, ER & ORP Test Results

SOLUM™ CONSULTANTS LTD.

GEOTECHNICAL & MATERIAL TESTING LABORATORY

Project Number:	MJI2017081		
Client:	Morton Jagodich		
Project Name:	Banf Geotechnical Investigation		
Location:	Ya Ha Tinda		
Tested By:	KC / SF	Reviewed By:	SF
Date Tested:	07-Oct-17	(dd-mmm-yy)	
Solum Job No.:	05701170926(147)		

Test Results

Borehole ID	Sample ID	Depth (m)	pH	Electrical Resistivity (ohms-meter)	ORP (mV)
BH-01	G1	0.75 m	6.42	47.62	---

Note: pH - ASTM G51; ER - ASTM G187; Redox - ASTM G200

Water (Moisture) Content (ASTM D2216)

SOLUM CONSULTANTS LTD.

GEOTECHNICAL & MATERIAL TESTING LABORATORY

Project Number:	MJI2017081		
Client:	Morton Jagodich		
Project Name:	Banf Geotechnical Investigation		
Location:	Ya Ha Tinda		
Tested By:	KC/SF	Reviewed By:	SF
Date Tested:	16-Oct-17	(dd-mmm-yy)	
Solum Job No.:	05701170926(147)		

Sample Information

Borehole ID	BH-01	BH-01	BH-01	BH-01	BH-01	BH-01
Sample ID	0.75 m	1.50 m	2.25 m	3.75 m	5.25 m	6.75 m
Container ID	1	2	3	4	5	6
Wet Sample Weight +Tare (g)	78.15	108.22	76.72	87.02	90.26	77.44
Dry Sample Weight +Tare (g)	74.20	103.58	75.00	77.72	84.96	70.70
Weight of Water (g)	3.95	4.64	1.72	9.30	5.30	6.74
Tare (g)	11.77	16.32	12.13	15.09	14.19	11.20
Weight of Dry Soil (g)	62.43	87.26	62.87	62.63	70.77	59.50
Water Content (%)	6.3	5.3	2.7	14.8	7.5	11.3

Borehole ID	BH-02	BH-02	BH-02	BH-02	BH-02	BH-02
Sample ID	0.75 m	1.50 m	2.25 m	3.75 m	5.25 m	6.00 m
Container ID	7	8	9	10	11	12
Wet Sample Weight +Tare (g)	92.00	92.66	91.76	80.97	96.03	59.94
Dry Sample Weight +Tare (g)	85.88	90.48	81.87	74.38	88.12	53.48
Weight of Water (g)	6.12	2.18	9.89	6.59	7.91	6.46
Tare (g)	10.94	13.15	10.80	10.97	16.82	16.43
Weight of Dry Soil (g)	74.94	77.33	71.07	63.41	71.30	37.05
Water Content (%)	8.2	2.8	13.9	10.4	11.1	17.4

Borehole ID	BH-03	BH-03	BH-03	BH-03	BH-03	BH-03
Sample ID	0.75 m	1.50 m	2.25 m	3.75 m	4.25 m	5.25 m
Container ID	13	14	15	16	17	18
Wet Sample Weight +Tare (g)	73.77	102.05	88.97	108.44	64.82	81.74
Dry Sample Weight +Tare (g)	68.88	98.90	85.90	98.70	60.74	71.24
Weight of Water (g)	4.89	3.15	3.07	9.74	4.08	10.50
Tare (g)	11.29	11.04	14.52	16.97	11.71	14.02
Weight of Dry Soil (g)	57.59	87.86	71.38	81.73	49.03	57.22
Water Content (%)	8.5	3.6	4.3	11.9	8.3	18.4

Borehole ID						
Sample ID						
Container ID						
Wet Sample Weight +Tare (g)						
Dry Sample Weight +Tare (g)						
Weight of Water (g)						
Tare (g)						
Weight of Dry Soil (g)						
Water Content (%)						

Atterberg Limits (ASTM D4318) - Method A

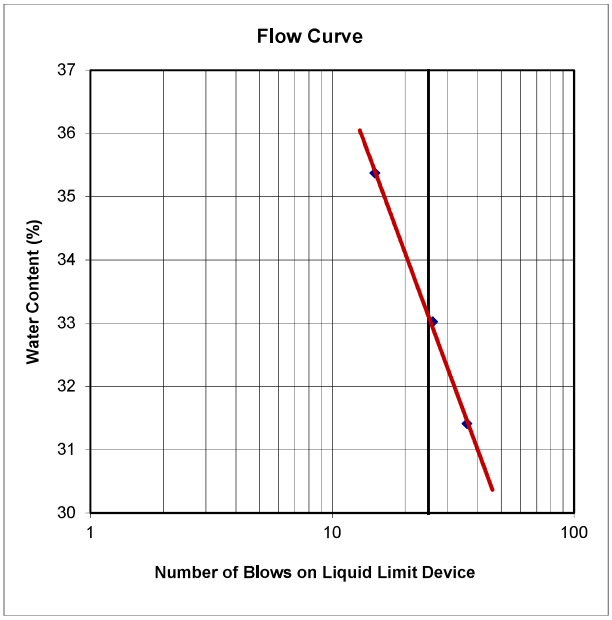
SOLUM CONSULTANTS LTD.
GEOTECHNICAL & MATERIAL TESTING LABORATORY

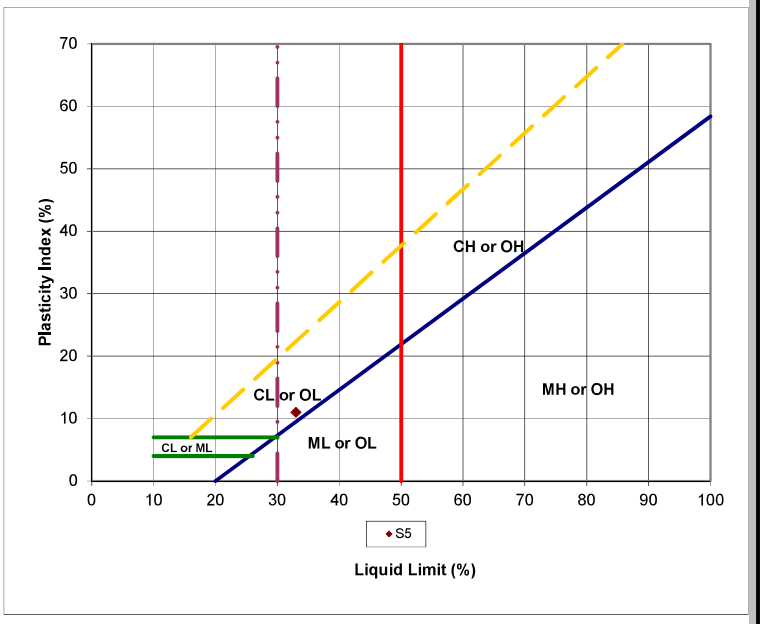
Project Number:	MJI2017081		
Project Name:	Banf Geotechnical Investigation		
Location:	Ya Ha Tinda		
Borehole ID:	BH-01		
Sample ID	S5	Depth:	3.75 m
Tested By:	KC	Reviewed By:	SF
Date Tested:	16-Oct-17	(dd-mmm-yy)	
Solum Job No.:	05701170926(147)		

Sample Information

	Liquid Limit (Air Dried) - Multipoint Method			Liquid Limit (Oven Dried)	
Container ID	1	2	3		
Number of Blows	15	26	36		
Wet Sample Weight +Tare (g)	28.96	27.50	29.34		
Dry Sample Weight +Tare (g)	24.45	23.26	25.09		
Weight of Water (g)	4.51	4.24	4.25		
Tare (g)	11.70	10.42	11.56		
Weight of Dry Soil (g)	12.75	12.84	13.53		
Water Content (%)	35.4	33.0	31.4		

	Plastic Limit		Results	
Container ID	4	5	Liquid Limit (Air Dried) (%)	33
Wet Sample Weight +Tare (g)	27.09	28.33	Liquid Limit (Oven Dried) (%)	---
Dry Sample Weight +Tare (g)	24.93	25.60	LL % Difference	---
Weight of Water (g)	2.16	2.73	Plastic Limit (%)	22
Tare (g)	14.92	13.06	Plasticity Index (%)	11
Weight of Dry Soil (g)	10.01	12.54	-40 Mesh Sieve (y/n)	y
Water Content (%)	21.6%	21.8%	Unified Soil Classification System	CL
Average Water Content (%)	21.7			





Atterberg Limits (ASTM D4318) - Method A

SOLUM CONSULTANTS LTD.

GEOTECHNICAL & MATERIAL TESTING LABORATORY

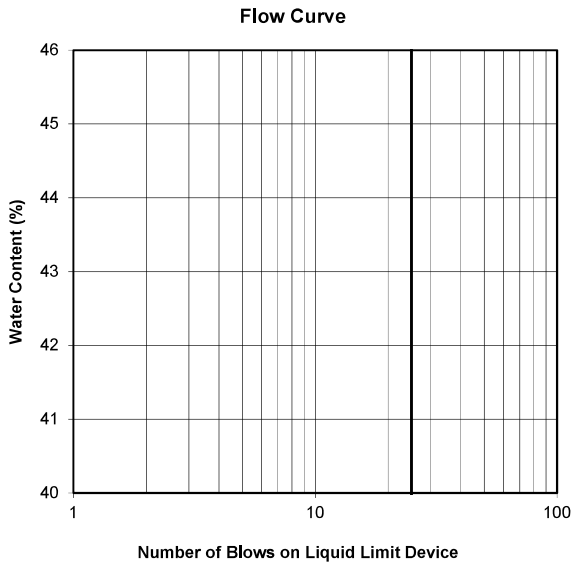
Project Number:	MJI2017081		
Project Name:	Banf Geotechnical Investigation		
Location:	Ya Ha Tinda		
Borehole ID:	BH-02		
Sample ID	G2	Depth:	1.50 m
Tested By:	KC	Reviewed By:	SF
Date Tested:	16-Oct-17	(dd-mmm-yy)	
Solum Job No.:	05701170926(147)		

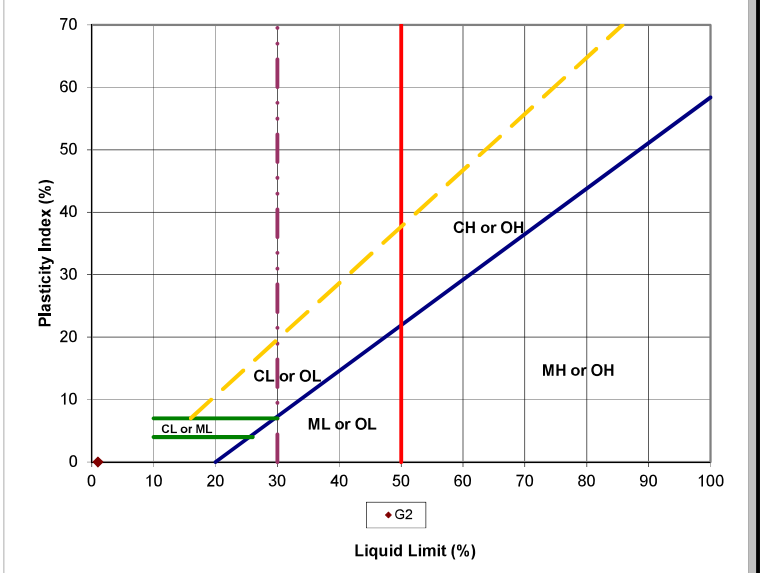
Sample Information

	Liquid Limit (Air Dried) - Multipoint Method			Liquid Limit (Oven Dried)	
Container ID	1	2	3		
Number of Blows					
Wet Sample Weight +Tare (g)					
Dry Sample Weight +Tare (g)					
Weight of Water (g)					
Tare (g)					
Weight of Dry Soil (g)					
Water Content (%)					

	Plastic Limit	
Container ID	4	5
Wet Sample Weight +Tare (g)		
Dry Sample Weight +Tare (g)		
Weight of Water (g)		
Tare (g)		
Weight of Dry Soil (g)		
Water Content (%)		
Average Water Content (%)		

Results	
Liquid Limit (Air Dried) (%)	---
Liquid Limit (Oven Dried) (%)	---
LL % Difference	---
Plastic Limit (%)	---
Plasticity Index (%)	---
-40 Mesh Sieve (y/n)	y
Unified Soil Classification System	NP





Atterberg Limits (ASTM D4318) - Method A

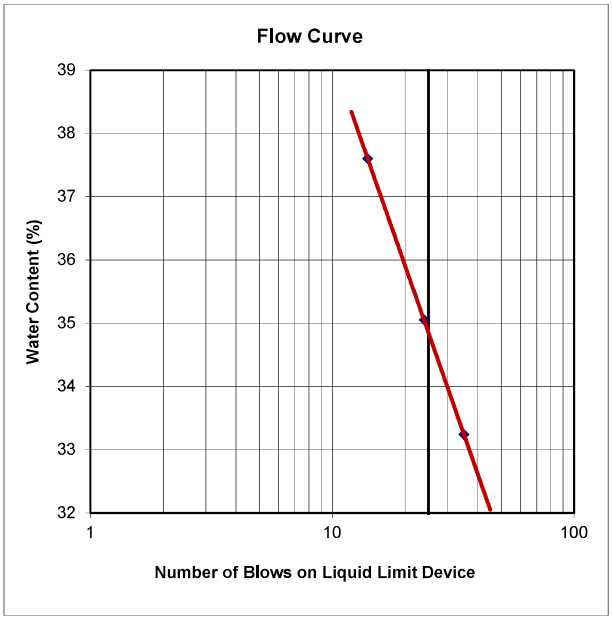
SOLUM CONSULTANTS LTD.
GEOTECHNICAL & MATERIAL TESTING LABORATORY

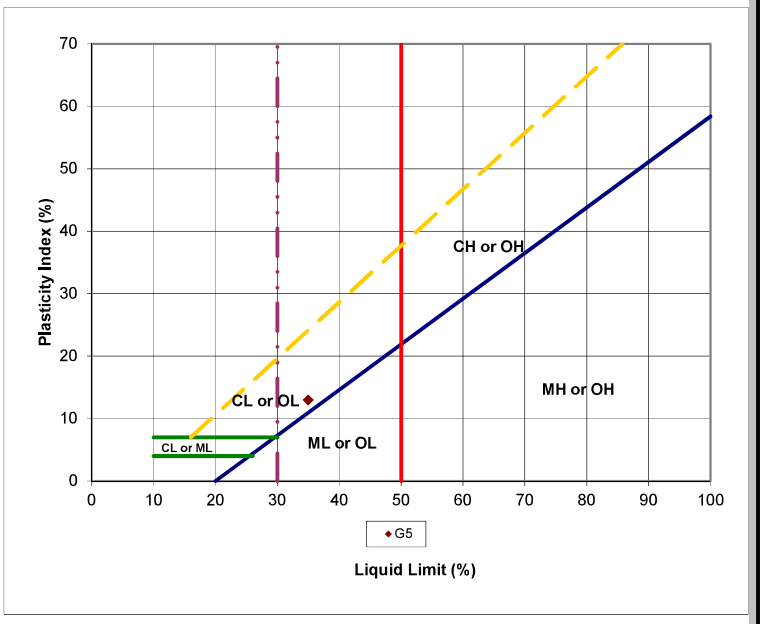
Project Number:	MJI2017081		
Project Name:	Banf Geotechnical Investigation		
Location:	Ya Ha Tinda		
Borehole ID:	BH-03		
Sample ID	G5	Depth:	3.75 m
Tested By:	KC	Reviewed By:	SF
Date Tested:	16-Oct-17	(dd-mmm-yy)	
Solum Job No.:	05701170926(147)		

Sample Information

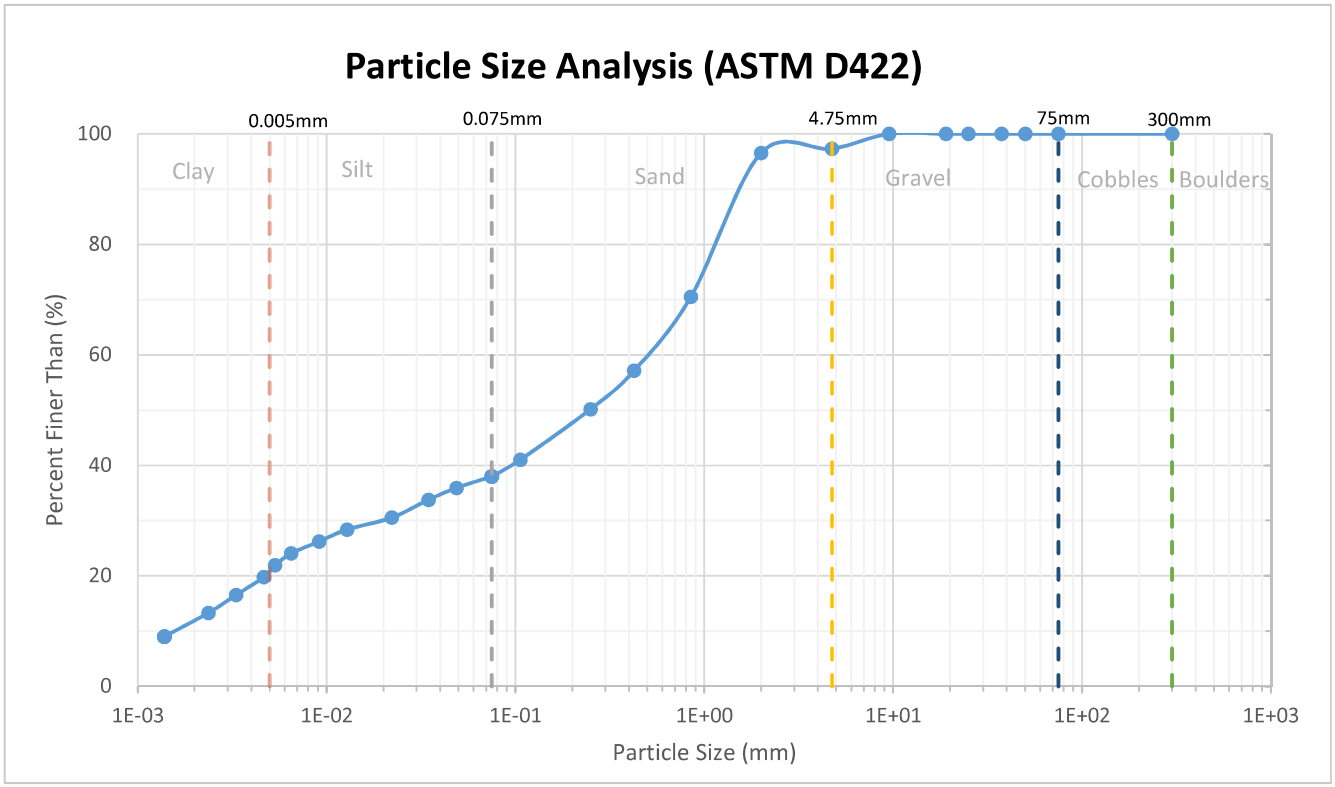
	Liquid Limit (Air Dried) - Multipoint Method			Liquid Limit (Oven Dried)	
Container ID	1	2	3		
Number of Blows	14	24	35		
Wet Sample Weight +Tare (g)	28.77	27.98	26.95		
Dry Sample Weight +Tare (g)	24.16	23.43	23.38		
Weight of Water (g)	4.61	4.55	3.57		
Tare (g)	11.90	10.45	12.64		
Weight of Dry Soil (g)	12.26	12.98	10.74		
Water Content (%)	37.6	35.1	33.2		

	Plastic Limit		Results	
Container ID	4	5	Liquid Limit (Air Dried) (%)	35
Wet Sample Weight +Tare (g)	27.25	28.93	Liquid Limit (Oven Dried) (%)	---
Dry Sample Weight +Tare (g)	25.05	26.14	LL % Difference	---
Weight of Water (g)	2.20	2.79	Plastic Limit (%)	22
Tare (g)	14.85	13.23	Plasticity Index (%)	13
Weight of Dry Soil (g)	10.20	12.91	-40 Mesh Sieve (y/n)	y
Water Content (%)	21.6%	21.6%	Unified Soil Classification System	CL
Average Water Content (%)	21.6			





SIEVE SIZE	PARTICLE-SIZE (mm)	PERCENT FINER (%)
3"	75.000	100.00
2"	50.000	100.00
1.5"	37.500	100.00
1"	25.000	100.00
0.75"	19.000	100.00
0.375"	9.500	100.00
No. 4	4.750	97.32
No. 10	2.000	96.55
No. 20	0.850	70.51
No. 40	0.425	57.13
No. 60	0.250	50.17
No. 140	0.106	41.00
No. 200	0.075	37.98
HYDROMETER	0.0487	35.92
	0.0346	33.77
	0.0221	30.54
	0.0128	28.38
	0.0091	26.23
	0.0065	24.07
	0.0053	21.92
	0.0047	19.77
	0.0033	16.53
	0.0024	13.30
	0.0014	8.99



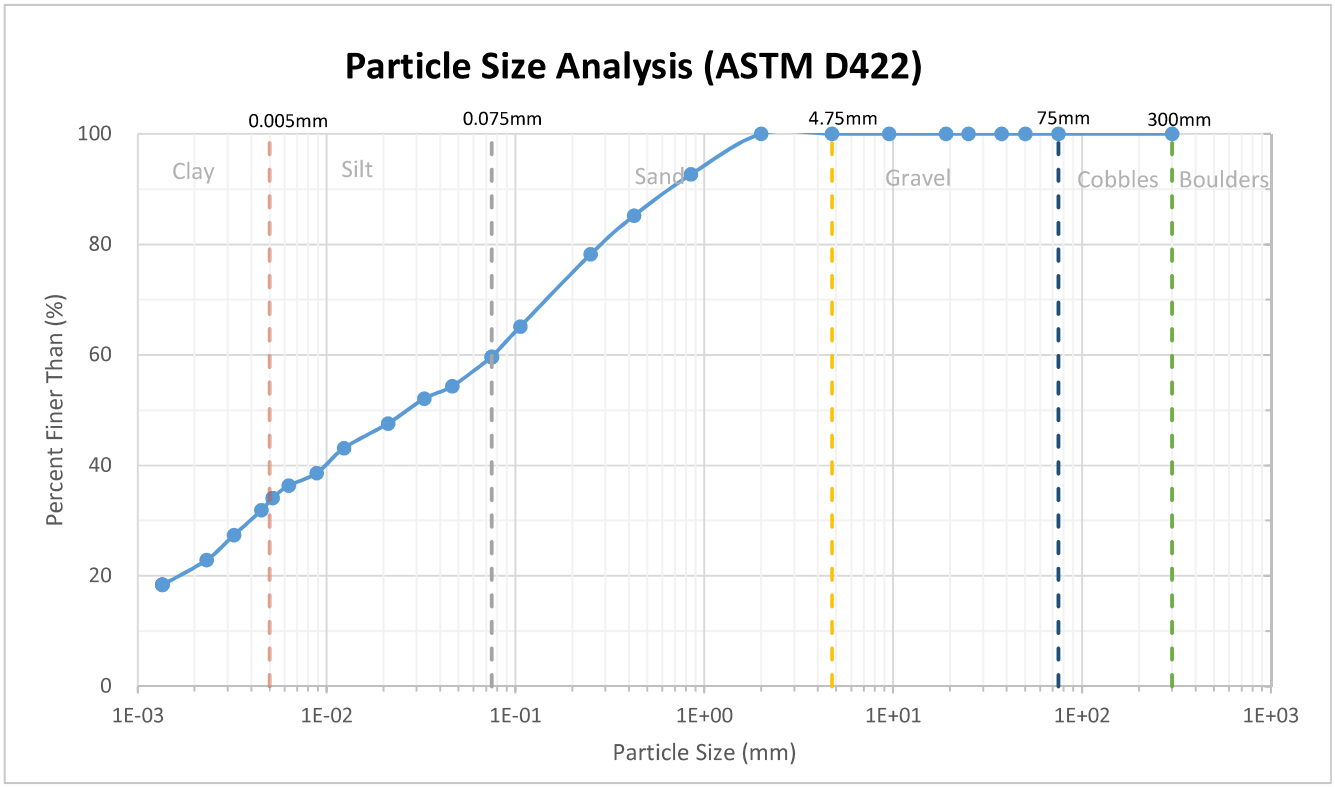
SOLUM CONSULTANTS LTD.
GEOTECHNICAL & MATERIAL TESTING LABORATORY

Banf Geotechnical Investigation

Project No.:	***MJI2017081***
Location:	***Ya Ha Tinda***
Solum Job No.:	***05701170926(147)***
Borehole ID:	***BH-01***
Sample ID:	***G8***
Depth:	***5.25 m***
Date Tested:	***16-Oct-17***

Particle Size (%)	
Cobbles:	0.0
Gravel:	2.7
Sand:	59.3
Silt:	17.1
Clay:	20.9

SIEVE SIZE	PARTICLE-SIZE (mm)	PERCENT FINER (%)
3"	75.000	100.00
2"	50.000	100.00
1.5"	37.500	100.00
1"	25.000	100.00
0.75"	19.000	100.00
0.375"	9.500	100.00
No. 4	4.750	100.00
No. 10	2.000	100.00
No. 20	0.850	92.67
No. 40	0.425	85.21
No. 60	0.250	78.22
No. 140	0.106	65.12
No. 200	0.075	59.61
HYDROMETER	0.0463	54.34
	0.0330	52.09
	0.0211	47.59
	0.0124	43.10
	0.0089	38.60
	0.0063	36.36
	0.0052	34.11
	0.0045	31.86
	0.0032	27.37
	0.0023	22.87
	0.0014	18.37



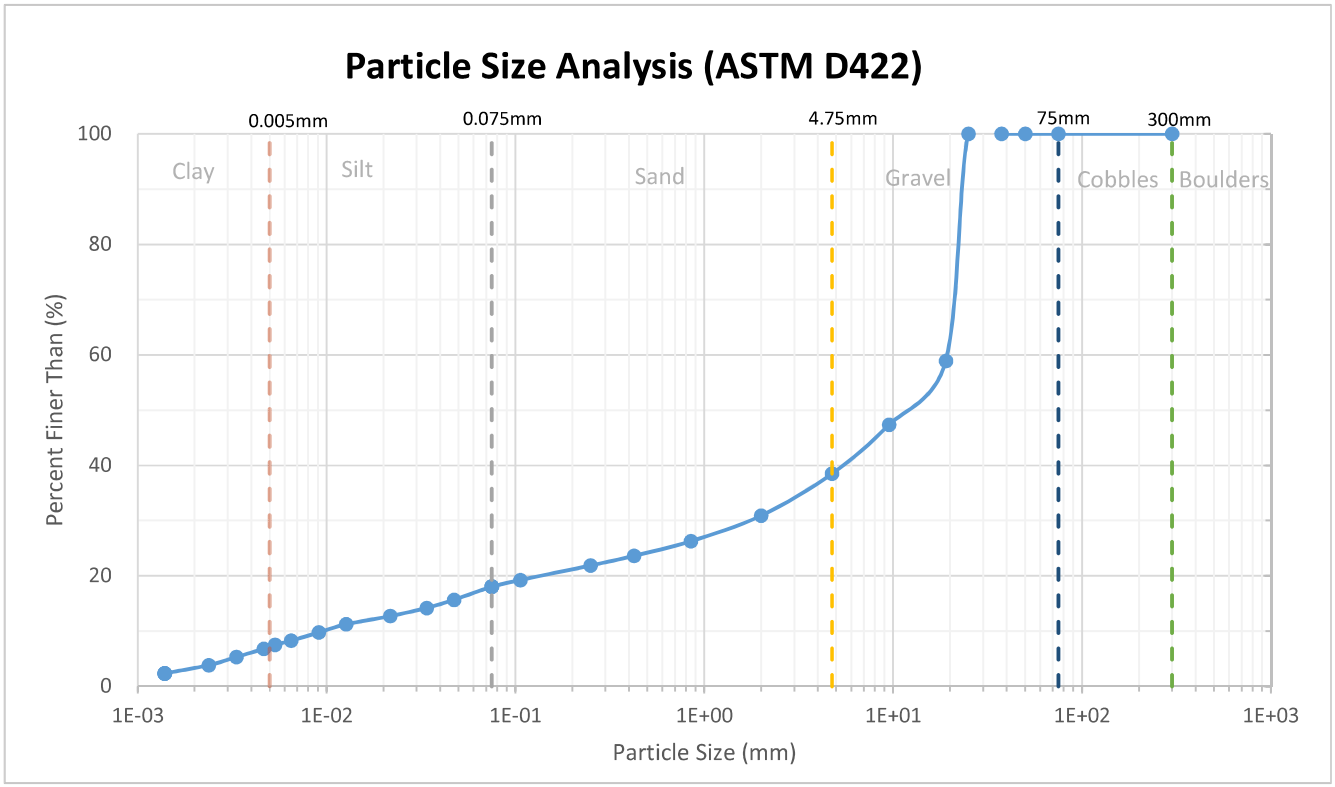
SOLUM CONSULTANTS LTD.
GEOTECHNICAL & MATERIAL TESTING LABORATORY

Banf Geotechnical Investigation

Project No.:	***MJI2017081***
Location:	***Ya Ha Tinda***
Solum Job No.:	***05701170926(147)***
Borehole ID:	***BH-02***
Sample ID:	***SH***
Depth:	***5.25 m***
Date Tested:	***16-Oct-17***

Particle Size (%)	
Cobbles:	0.0
Gravel:	0.0
Sand:	40.4
Silt:	26.1
Clay:	33.5

SIEVE SIZE	PARTICLE-SIZE (mm)	PERCENT FINER (%)
3"	75.000	100.00
2"	50.000	100.00
1.5"	37.500	100.00
1"	25.000	100.00
0.75"	19.000	58.91
0.375"	9.500	47.33
No. 4	4.750	38.49
No. 10	2.000	30.89
No. 20	0.850	26.28
No. 40	0.425	23.64
No. 60	0.250	21.87
No. 140	0.106	19.25
No. 200	0.075	18.07
HYDROMETER	0.0473	15.67
	0.0339	14.19
	0.0217	12.71
	0.0127	11.23
	0.0091	9.75
	0.0065	8.27
	0.0053	7.53
	0.0047	6.79
	0.0033	5.31
	0.0024	3.83
	0.0014	2.35



SOLUM CONSULTANTS LTD.
GEOTECHNICAL & MATERIAL TESTING LABORATORY

Banf Geotechnical Investigation

Project No.:	***MJI2017081***
Location:	***Ya Ha Tinda***
Solum Job No.:	***05701170926(147)***
Borehole ID:	***BH-03***
Sample ID:	***S4***
Depth:	***1.50 m***
Date Tested:	***16-Oct-17***

Particle Size (%)	
Cobbles:	0.0
Gravel:	61.5
Sand:	20.4
Silt:	10.9
Clay:	7.2

SOLUM™
CONSULTANTS LTD.
GEOTECHNICAL & MATERIAL
TESTING LABORATORY

STANDARD LABORATORY TERMS AND CONDITIONS

1.0 Description of Services to be Performed by Solum Consultants Ltd. (Solum)
Solum shall provide geotechnical and material laboratory testing services on samples in accordance with these terms and conditions and executed Laboratory Testing Request Forms. Solum shall perform its work in accordance with accepted laboratory standards and accepted standard operating procedures. Solum reserves the right to modify methods as necessary based upon experience and/or current scientific literature. If the Client requests a manner of analysis that varies from standard operating or recommended procedures, the Client shall not hold Solum responsible for the results. Such variations of analysis will be noted on the reports. Solum reserves the right to subcontract laboratory testing if a particular test cannot be performed by Solum.

2.0 Reports, Confidentiality and Third Parties
Laboratory reports provided by Solum will be composed of a cover page, tables and figures if applicable. Reports will be e-mailed in PDF format to the individual(s) specified on the Laboratory Testing Request Forms. Laboratory reports may also be faxed or mailed to the Client upon request. Except as required by law, Solum shall not disclose testing results or reports to any party other than the Client, unless the Client, in writing, requests information to be provided to a third party. Solum shall abide by any additional confidentiality requirements requested by the Client provided that such requirements are provided to Solum at or before execution of the testing.
Information provided by Solum is intended for Client use only. Any use by a third party, of reports or documents authored by Solum, or any reliance on or decisions made by a third party based on the findings described in said documents, are the sole responsibility of such third parities, and Solum accepts no responsibility of damages suffered by any third party as a result of decisions made or actions conducted.

3.0 Laboratory Testing Request Form (Chain of Custody)
The laboratory testing request form must be completed by the Client and be accompanied with the samples. Other form of COC may be accepted; however, the condition of Solum COC is still applied. Testing will not commence until the laboratory testing request form has been completed. If requested by the Client, Solum shall provide a copy of the laboratory testing request form with the report.
No persons other than the designated representatives for each Laboratory Testing Request Form are authorized to act regarding changes to the testing request form. Any changes or amendments of the laboratory testing request form must be in writing and be completed by the originator.

4.0 Acceptance, Contamination and Disposal of Samples
Loss or damages to samples remains the responsibility of the Client until Solum representatives acceptance of samples by notation on the laboratory testing request form.
As to any samples that are suspected of containing hazardous substances, the Client will specify the suspected or known substance and level of contamination. This information is to be stated on the laboratory testing request form and be accompanied with the samples before testing can commence. Solum may refuse acceptance of samples if it determines they present a risk to health and safety.
Samples accepted by Solum shall remain the property and liability of the Client while in the custody of Solum. Solum will discard all non-contaminated samples after two weeks of submitting lab report or a month from the date of receiving the samples without additional retention period at a fixed disposal charge, or if requested by the Client, samples may be returned to the Client at no cost to Solum. If requested by client, Solum will store samples provided the client agrees to pay for the storage charge. Contaminated material may be returned/shipped to the Client at the Client's expense or Solum will discard samples with disposal rates varying for samples containing higher levels of contamination, refer to price list.
Soil samples requested to be stored will be stored inside the lab up to the expiration of storage period. Soil samples will be discarded upon the expiration date of the storage period unless client requests either extending storage period or return samples back to client at no cost to Solum.

5.0 Indemnification/Hold Harmless
Solum shall protect, indemnify and save harmless Client, and its directors, officers, employees, agents, representatives, invitees and subcontractors, and at Client's request, investigate and defend such entities form and against all claims, demands and causes of action, of every kind and character, without limitation, arising in favour of or made by third parties, on account of bodily injury, death or damage to or loss of their property resulting from any negligent act or wilful misconduct of Solum.
The Client shall protect, indemnify and save harmless Solum, and its directors, officers, employees, agents, representatives, invitees and subcontractors, and at Solum's request, investigate and defend such entities form and against all claims, demands and causes of action, of every kind and character, without limitation, arising in favour of or made by third parties, on account of bodily injury, death or damage to or loss of their property resulting from any negligent act or wilful misconduct of Client.

6.0 Limitation of Liability
The total liability of Solum or its staff whether based in contract or tort, will be limited to the lesser of the fees paid or actual damages incurred by the Client. Solum will not be responsible for any consequential or indirect damages even if caused by negligence of Solum. Solum will only be liable for damages resulting form negligence of Solum. All claims by the Client shall be deemed relinquished if not made within one year after the testing date. No warranty is either expressed or implied, or intended by any agreement or by furnishing oral or written reports or findings.

7.0 Termination of Testing Work Order
The Client may order work suspended or terminated upon seven days advance written notice. If work is suspended, Solum shall receive, upon resumption, an adjustment in the cost of services to compensate for additional costs incurred due to the interruption of services. Upon suspension or termination, Solum shall preserve samples provided that the Client agrees to pay the sample storage charge.

8.0 Pricing, Payments and Invoicing
Invoices will be based on most current Solum laboratory testing rates; rates may change without notice. Solum invoices shall be paid within thirty (30) days of receipt of the invoice. Amounts not paid when due shall bear interest at the rate of 18% per annum from the date due until the date of payment.

February 20, 2018

APPENDIX D: SEISMIC ANALYSIS

2015 National Building Code Seismic Hazard Calculation

INFORMATION: Eastern Canada English (613) 995-5548 français (613) 995-0600 Facsimile (613) 992-8836
Western Canada English (250) 363-6500 Facsimile (250) 363-6565

September 22, 2017

Site: 51.7537 N, 115.5813 W User File Reference:

Requested by: ,

National Building Code ground motions: 2% probability of exceedance in 50 years (0.000404 per annum)

Sa(0.05)	Sa(0.1)	**Sa(0.2)**	Sa(0.3)	**Sa(0.5)**	**Sa(1.0)**	**Sa(2.0)**	**Sa(5.0)**	**Sa(10.0)**	**PGA (g)**	**PGV (m/s)**
0.159	0.237	**0.274**	0.243	**0.180**	**0.096**	**0.044**	**0.015**	**0.0049**	**0.127**	**0.097**

Notes. Spectral (Sa(T), where T is the period in seconds) and peak ground acceleration (PGA) values are given in units of g (9.81 m/s^2). Peak ground velocity is given in m/s. Values are for "firm ground" (NBCC 2015 Site Class C, average shear wave velocity 450 m/s). NBCC2015 and CSAS6-14 values are specified in **bold** font. Three additional periods are provided - their use is discussed in the NBCC2015 Commentary. Only 2 significant figures are to be used. ***These values have been interpolated from a 10-km-spaced grid of points. Depending on the gradient of the nearby points, values at this location calculated directly from the hazard program may vary. More than 95 percent of interpolated values are within 2 percent of the directly calculated values.***

Ground motions for other probabilities:

Probability of exceedance per annum	0.010	0.0021	0.001
Probability of exceedance in 50 years	40%	10%	5%
Sa(0.05)	0.014	0.056	0.093
Sa(0.1)	0.021	0.083	0.138
Sa(0.2)	0.026	0.100	0.162
Sa(0.3)	0.026	0.091	0.146
Sa(0.5)	0.019	0.066	0.106
Sa(1.0)	0.012	0.036	0.057
Sa(2.0)	0.0058	0.018	0.027
Sa(5.0)	0.0018	0.0057	0.0093
Sa(10.0)	0.0008	0.0022	0.0033
PGA	0.011	0.045	0.074
PGV	0.012	0.037	0.058

References

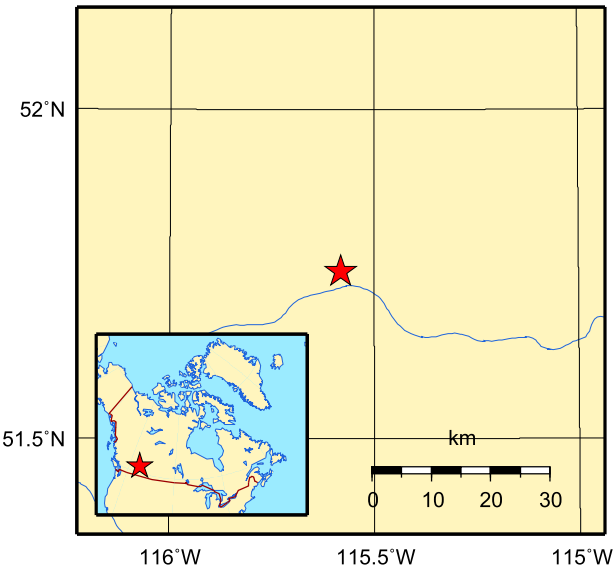
National Building Code of Canada 2015 NRCC no. 56190;
Appendix C: Table C-3, Seismic Design Data for Selected Locations in Canada

User's Guide - NBC 2015, Structural Commentaries NRCC no. xxxxxx (in preparation)
Commentary J: Design for Seismic Effects

Geological Survey of Canada Open File 7893 Fifth Generation Seismic Hazard Model for Canada: Grid values of mean hazard to be used with the 2015 National Building Code of Canada

See the websites *www.EarthquakesCanada.ca* and *www.nationalcodes.ca* for more information

Aussi disponible en français



APPENDIX E: SITE PHOTOS

Photo 1 - BH01 - Facing North West

Photo 2- BH02- Facing West

Photo 3 - BH03 - Facing South East

Photo 4 - BH-01 - Facing South

Photo 5 - BH-01 - Facing North East

Photo 6 - BH01 - Facing South

DRAWING SHEET SIZE: 22" x 34"

REV	DESCRIPTION	BY	MM/DD/YYYY	CHKD	APPD
1	ISSUED FOR REVIEW	PR	09/19/2017	PB	JJ

PERMIT/ STAMP

morton jagodich
Civil, Structural & Geotechnical Engineers
300 - 1202 1st ST SW
CALGARY, ALBERTA T2R 0V4
TEL: 1.844.DIAL.MJI
www.mortonjagodich.com

Allnorth
8 Manning Close NE Suite 300
Calgary, AB, T2E 7N5

ENGINEERING RECORD			
DRAWN:	PR	DATE:	09/19/2017
CHECKED:	PB	DATE:	09/19/2017
ENGINEER:	PB	DATE:	09/19/2017
PROJECT MANAGER:	JJ	DATE:	09/19/2017

COMPLIANCE AUDIT OF STORAGE TANK
GEOTECHNICAL INVESTIGATION
Site Photo

SCALE: AS SHOWN

REV.

February 20, 2018

APPENDIX F: SAMPLE PHOTOS

Photo 1 - BH-01- Sand D-0.75 m

Photo 2 - BH-01- Glacial Clay Till, D-1.50 m

Photo 3 - BH-03- Glacial Clay Till - D-3.00 m

Photo 4 - BH-02- Gravel, D-5.00 m

Photo 5 - BH-2-Shale Bedrock, D-6.00 m

Photo 6 - BH-02- Sand, D-1.50 m

Photo 7 - BH-02- Top Soil, D-0.75 m

Photo 8 - BH-03- Sand, D-1.50 m

DRAWING SHEET SIZE: 22" x 34"

REV	DESCRIPTION	BY	MM/DD/YYYY	CHKD	APPD
1	ISSUED FOR REVIEW	PR	09/19/2017	PB	JJ

PERMIT/ STAMP

MORTON JAGODICH
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TEL: 1.844.DIAL.MJ
www.mortonjagodich.com

Allnorth
8 Manning Close NE Suite 300
Calgary, AB, T2E 7N5

ENGINEERING RECORD			
DRAWN:	PR	DATE:	09/19/2017
CHECKED:	PB	DATE:	09/19/2017
ENGINEER:	PB	DATE:	09/19/2017
PROJECT MANAGER:	JJ	DATE:	09/19/2017

COMPLIANCE AUDIT OF STORAGE TANK
GEOTECHNICAL INVESTIGATION
SAMPLE PHOTO

SCALE: AS SHOWN

REV.

APPENDIX B

ENVIRONMENT CANADA STORAGE TANK SYSTEM IDENTIFICATION FORM

Environment Canada | Environnement Canada

Environment Canada (EC) Storage Tank System Identification Form

Identification of storage tank systems for the *Storage Tank Systems for Petroleum Products and Allied Petroleum Products Regulations*

ENVIRONMENT CANADA USE ONLY	
ID number	Date entered into FIRSTS
Date first received	Entered by
Subsequent date received (due to incomplete information, if applicable)	Comments

Instructions

This form will help identify storage tank systems (STS) that are subject to the *Storage Tank Systems for Petroleum Products and Allied Petroleum Products Regulations* (STR). For information on these regulations, please refer to 'Tips and Tools' on the Environment Canada Web site: www.ec.gc.ca/rs-st or send a request to the address/fax number/e-mail on the last page.

Identifying a storage tank system may be completed on-line. It should take approximately 20 minutes to complete. It may also be mailed or faxed to EC. Please allow 3 weeks for delivery and processing.

To identify a STS on-line:

1. If you have an account in the Federal Identification Registry for Storage Tank Systems (FIRSTS), please go to step 2 below. If you do not have an account, please send an email requesting an account to **ec.registrereservoir-tankregistry.ec@canada.ca**. Please include the following information in your email:

   (1) confirmation that you or your company own a STS subject to the STR;

   (2) legal name of company and/or individual who owns the STS;

   (3) a name of an account administrator, if different from the company or individual (2).

   Please consult our website for more information at : www.ec.gc.ca/rs-st/default.asp?lang=En&n=19F7B473-1

2. ENTER YOUR INFORMATION ELECTRONICALLY in FIRSTS at www.ec.gc.ca/rfiss-firsts/secureprotege/LoginEntree.aspx. You will receive your identification number automatically once you have provided all of the required information.

To identify a STS by mail, fax or e-mail:

1. PLEASE COMPLETE A SEPERATE FORM FOR EACH STORAGE TANK SYSTEM. A system can be a single independent tank or several tanks that are interconnected by common piping. A compartment tank should have an Environment Canada number for each compartment since they may not be interconnected.
2. All relevant sections must be complete before an identification form can be processed by Environment Canada. Incomplete information will delay the process.
3. Optional information is marked with an asterisk (*).
4. When identifying a storage system installed after June 12, 2008, **do not** select "Unknown" in any section of the form; otherwise, your form will be incomplete.
5. Part VII of this form **must** be signed by the storage tank system owner or the owner's representative.
6. When completing the withdrawal from service for a STS, only Parts I, VI and VII must be completed.
7. Please see the last page for contact information and instructions on how to submit your completed form.

PART I: PURPOSE OF NOTIFICATION

✓ Check all that apply:

☐ System was installed on or after June 12, 2008 *(Complete Parts II, III, IV, V & VII)*	☐ Change in owner or operator address and location *(Complete Parts II & III respectively & Part VII)*
☐ System was installed before June 12, 2008, but has not been identified previously *(Complete Parts II, III, IV, V & VII)*	☐ New owner or operator *(Complete Parts II & VII)*
☐ Change to information that was previously provided (e.g. months of service, tank contents, technical information, and relocation). *(Complete Parts IV & VII)*	☐ System has been temporarily or permanently withdrawn from service and/or removed *(Complete Parts VI & VII)*
☐ Other (specify the reason)	

PART II: STORAGE TANK SYSTEM OWNER AND OPERATOR INFORMATION

Name of owner/company *(Legal name)*		Name of operating company or individual *(if different from owner)*	
Address of owner *(Civic address or post box, city, province/territory, postal code)*		Address of operating company or individual *(if different from owner)*	
Name of owner contact		Name of operator contact *(if different from owner contact)*	
* Title of owner contact		* Title of operator contact *(if different from owner contact)*	
Phone number (including area code) ( )	* Fax number (including area code) ( )	Phone number (including area code) (*if different from owner*) ( )	* Fax number (including area code) *(if different from owner)* ( )
E-mail address of owner contact		* E-mail address of operator contact *(if different from owner)*	
* Name of previous owner *(if applicable)*			
* System Location Categories of Owners/Operators *See: Section 2 of Storage Tank Regulations for details* *(Check the appropriate type.)*		☐ Federal entity (department, agencies, commission, etc.) ☐ Port operation ☐ Railway operation ☐ Aviation operation (Airport Authority) ☐ Aboriginal Land (Reserve) ☐ Third party on federal land ☐ Third party on Aboriginal Land ☐ Port tenants ☐ Airport tenants ☐ Railway tenants	

PART III: LOCATION OF STORAGE TANK SYSTEM AND DOCUMENTS

Write where applicable and/or ✓ check all that apply:

Facility name	Street address where tank system records are kept *(If there is no street address, please provide latitude and longitude in* 12°34.56' *format or a legal land description.)* ☐ Same location as the storage tank system
Street address where tank system is located *(If there is no street address, please provide latitude and longitude in* 12°34.56' *format or a legal land description.)*	Street address where emergency plan is kept *(If there is no street address, please provide latitude and longitude in* 12°34.56' *format or a legal land description.)* ☐ Same location as the storage tank system

PART IV: STORAGE TANK SYSTEM DESCRIPTION

✓ Check all that apply and write where applicable

	TANK 1	TANK 2	TANK 3	TANK 4	TANK 5
*** Owner's Tank Identification Number** (if any)					
EC Tank System Identification Number	**EC-**_____ **########** *(Not required if this is a request for a new identification number)*				
*** System Description** *(Description of storage tank system, design and other additional information to describe)*					
Year(s) of Installation of Tank(s)					
Date of Changes to Tank(s), if applicable *(DD/MM/YYYY)*					
Is System in Service all Year?	☐ Yes ☐ No (Please identify the month(s) during which the system is in service.)				
Type of Tank *(Check* **one** *option per tank.)*	☐ Aboveground ☐ Underground	☐ Aboveground ☐ Underground	☐ Aboveground ☐ Underground	☐ Aboveground ☐ Underground	☐ Aboveground ☐ Underground
Type of Piping *(Check* **one** *option per piping.)*	☐ Aboveground ☐ Underground ☐ Aboveground and Underground ☐ No Piping	☐ Aboveground ☐ Underground ☐ Aboveground and Underground ☐ No Piping	☐ Aboveground ☐ Underground ☐ Aboveground and Underground ☐ No Piping	☐ Aboveground ☐ Underground ☐ Aboveground and Underground ☐ No Piping	☐ Aboveground ☐ Underground ☐ Aboveground and Underground ☐ No Piping
Diameter of all Piping *(Specify units: millimetres or inches for all piping. If no piping, do not specify units.)*	☐ Inches ☐ mm	☐ Inches ☐ mm	☐ Inches ☐ mm	☐ Inches ☐ mm	☐ Inches ☐ mm
Nominal Tank Capacity *(Litres)*	**L**	**L**	**L**	**L**	**L**

	TANK 1	TANK 2	TANK 3	TANK 4	TANK 5
Describe how the Transfer Area[1] is Designed to Contain Spills.					
Product(s) Stored *(Check **one** option per tank)* *(A tank with several compartments not piped together must be identified individually so that each compartment has its own Environment Canada ID number.)*	**PETROLEUM PRODUCT**				
	☐ Heating Oil ☐ Waste Oil ☐ Diesel ☐ Jet Fuel ☐ Kerosene ☐ Bunker Oil ☐ Avgas ☐ Gasoline ☐ Other (specify)	☐ Heating Oil ☐ Waste Oil ☐ Diesel ☐ Jet Fuel ☐ Kerosene ☐ Bunker Oil ☐ Avgas ☐ Gasoline ☐ Other (specify)	☐ Heating Oil ☐ Waste Oil ☐ Diesel ☐ Jet Fuel ☐ Kerosene ☐ Bunker Oil ☐ Avgas ☐ Gasoline ☐ Other (specify)	☐ Heating Oil ☐ Waste Oil ☐ Diesel ☐ Jet Fuel ☐ Kerosene ☐ Bunker Oil ☐ Avgas ☐ Gasoline ☐ Other (specify)	☐ Heating Oil ☐ Waste Oil ☐ Diesel ☐ Jet Fuel ☐ Kerosene ☐ Bunker Oil ☐ Avgas ☐ Gasoline ☐ Other (specify)
	ALLIED PETROLEUM PRODUCT				
	☐ (Specify)	☐ (Specify)	☐ (Specify)	☐ (Specify)	☐ (Specify)

ULC or API Standard Number[2] *(Check **one** option per tank.)*	TANK 1	TANK 2	TANK 3	TANK 4	TANK 5
Aboveground					
API Specification 12B	☐	☐	☐	☐	☐
API Specification 12D	☐	☐	☐	☐	☐
API Specification 12F	☐	☐	☐	☐	☐
API Std 650	☐	☐	☐	☐	☐
ULC-C142.14	☐	☐	☐	☐	☐
ULC-C142.15	☐	☐	☐	☐	☐
ULC-C142.17	☐	☐	☐	☐	☐
ULC-C142.20	☐	☐	☐	☐	☐
ORD-C142.5	☐	☐	☐	☐	☐
ULC-C80-1	☐	☐	☐	☐	☐
ULC-S601	☐	☐	☐	☐	☐
ULC-S601 and ULC-S653	☐	☐	☐	☐	☐
ULC-S602	☐	☐	☐	☐	☐
ULC-S653	☐	☐	☐	☐	☐
ULC-S655	☐	☐	☐	☐	☐
ORD-C142.18 (withdrawn; replaced by S601)	☐	☐	☐	☐	☐
ORD-C142.22 (withdrawn – rectangular portion part of S601)	☐	☐	☐	☐	☐

1 "Transfer area" means the area around the connection point between a delivery truck, railcar, aircraft or vessel and a storage tank system of which the tanks have an aggregate capacity of more than 2,500 L. Requirements regarding spill containment in product transfer areas state that transfer areas from systems with tank capacities of more than 2,500 L must be designed to contain spills that occur during the transfer process. In the case of new storage tank systems, transfer areas must be designed to be compliant **before they are put into service**. All storage systems over 2,500 L require a product transfer area designed to contain spills.

2 The standards list was updated in April 2013.

ULC or API Standard Number[2] *(Check **one** option per tank.)*	TANK 1	TANK 2	TANK 3	TANK 4	TANK 5
ULC-S630 (withdrawn; replaced by S601)	☐	☐	☐	☐	☐
ULC-S643 (withdrawn; replaced by S601)	☐	☐	☐	☐	☐
ORD-C142.21 (withdrawn)	☐	☐	☐	☐	☐
ORD-C142.23 (withdrawn)	☐	☐	☐	☐	☐
Underground					
ULC-S603	☐	☐	☐	☐	☐
ULC-S615	☐	☐	☐	☐	☐
ULC-S652	☐	☐	☐	☐	☐
ORD-C58.10 (withdrawn; replaced by S603)	☐	☐	☐	☐	☐
Bladders					
Collapsible fabric storage tank ("bladder")	☐	☐	☐	☐	☐
Unknowns[3]					
Unknown – underground tank	☐	☐	☐	☐	☐
Unknown – field erected vertical aboveground tank	☐	☐	☐	☐	☐
Unknown – shop-fabricated vertical aboveground tank	☐	☐	☐	☐	☐
Unknown – horizontal aboveground tank	☐	☐	☐	☐	☐

Construction Material *(Check **one** response that applies to the tank and check all options that apply to the piping.)*	1		2		3		4		5	
	TANK	PIPING	TANK	PIPING	TANK	PIPING	TANK	PIPING	TANK	PIPING
Concrete-encased steel	☐		☐		☐		☐		☐	
Fibreglass reinforced plastic (including thermoset tanks)	☐		☐		☐		☐		☐	
Fibreglass reinforced plastic ducted flexible (e.g. Enviroflex/Bufflex, Geoflex)		☐		☐		☐		☐		☐
Jacketed steel	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Steel	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Collapsible Fabric Storage Tank (i.e. polymer fabric, bladders)	☐		☐		☐		☐		☐	
Black iron		☐		☐		☐		☐		☐
Copper		☐		☐		☐		☐		☐
Galvanized steel		☐		☐		☐		☐		☐
Flexible metallic		☐		☐		☐		☐		☐
Non-metallic thermoplastic		☐		☐		☐		☐		☐
Polyethylene		☐		☐		☐		☐		☐
PVC		☐		☐		☐		☐		☐
Thermoset (rigid)		☐		☐		☐		☐		☐
Other (specify):										
* Has tank/piping been repaired?	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No

2 The standards list was updated in April 2013.
3 All systems installed after June 12, 2008, must follow a standard. Entering "unknown"is not an option.

Secondary Containment *(Check* **all** *that apply.)*	1		2		3		4		5	
	TANK	PIPING	TANK	PIPING	TANK	PIPING	TANK	PIPING	TANK	PIPING
Double walled	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Containment tank assembly	☐		☐		☐		☐		☐	
Concrete-encased steel assembly	☐		☐		☐		☐		☐	
Reinforced secondary containment liner for aboveground tanks	☐		☐		☐		☐		☐	
Non-reinforced secondary containment liner for aboveground tanks	☐		☐		☐		☐		☐	
Secondary containment liner (spray-on type) for aboveground tanks	☐		☐		☐		☐		☐	
Liner for underground tanks	☐		☐		☐		☐		☐	
Dike with impermeable liner	☐		☐		☐		☐		☐	
Impermeable liner with double bottom tank (e.g., field erected tanks)	☐		☐		☐		☐		☐	
Other impermeable barrier (specify):										

Cathodic/Corrosion Protection (Check **all** that apply.)	1		2		3		4		5	
	TANK	PIPING	TANK	PIPING	TANK	PIPING	TANK	PIPING	TANK	PIPING
Sacrificial anode	☐		☐		☐		☐		☐	
Impressed current system	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Non-corroding material	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Painted	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Coating – bonded plastic, resin, epoxy or polyurethane coated		☐		☐		☐		☐		☐
Unknown	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
None	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Oil-Water Separator Pumps *(Check* **one** *response that applies.)*	TANK 1	TANK 2	TANK 3	TANK 4	TANK 5
No oil-water separator	☐	☐	☐	☐	☐
Centrifugal	☐	☐	☐	☐	☐
Not centrifugal	☐	☐	☐	☐	☐
No pump	☐	☐	☐	☐	☐

Leak Detection ((ULC/ORD-C58.12 or ULC/ORD-C58.14) (ULC-S675.1 or ULC-S675.2)) (Check **all** that apply.)	1		2		3		4		5	
	TANK	PIPING	TANK	PIPING	TANK	PIPING	TANK	PIPING	TANK	PIPING
Internal monitoring										
Automatic tank gauging	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Continuous in-tank/piping leak detection	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Electronic line leak detection		☐		☐		☐		☐		☐
Inventory reconciliation	☐		☐		☐		☐		☐	
External monitoring										
Groundwater monitoring wells	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Vapour monitoring wells	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Visual inspection	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Continuous external leak monitoring (sensor cable system)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Interstitial monitoring										
Interstitial monitoring – double walled	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Other testing or programs										
Precision leak detection test	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Corrosion analysis program		☐		☐		☐		☐		☐
Tank (API Standard 653) or tank floor inspection	☐		☐		☐		☐		☐	
Other (specify)										

Sump – Leak Detection (Check **all** that apply)	TANK 1	TANK 2	TANK 3	TANK 4	TANK 5
No sump for storage tank system	☐	☐	☐	☐	☐
Visual inspection	☐	☐	☐	☐	☐
Continuous sump leak monitoring (petroleum product probe)	☐	☐	☐	☐	☐
Static liquid media leak detection test	☐	☐	☐	☐	☐
Other (specify)					

Spill Containment (Check **one** response that applies.)	TANK 1	TANK 2	TANK 3	TANK 4	TANK 5
Spill Containment Devices for Aboveground Tanks (ULC-S663) or (ORD-C142.19) (Withdrawn; replaced by ULC-S663)	☐ or ☐	☐ or ☐	☐ or ☐	☐ or ☐	☐ or ☐
Spill box at fill point – no standard (aboveground tank)	☐	☐	☐	☐	☐
Spill Containment Devices for Underground Tanks (ORD-C58.19)	☐	☐	☐	☐	☐
Spill box at fill point – no standard (underground tank)	☐	☐	☐	☐	☐
Other (specify)					

Overfill Prevention *(Check* **all** *that apply.)*	TANK 1	TANK 2	TANK 3	TANK 4	TANK 5
API RP 2350 – Overfill Protection for Storage Tanks In Petroleum Facilities (field erected tanks)	☐	☐	☐	☐	☐
Overfill alarm and overfill automatic shutoff	☐	☐	☐	☐	☐
CAN/ULC-S661(Overfill Protection Devices Storage Tanks) or ORD-C58.15 (Overfill Protection Devices Storage Tanks) (Withdrawn; replaced by ULC-S661)	☐ or ☐	☐ or ☐	☐ or ☐	☐ or ☐	☐ or ☐
Overfill ball float valve	☐	☐	☐	☐	☐
Method – trained personnel in attendance at all times	☐	☐	☐	☐	☐
Other (specify)					

* PART V: MISCELLANEOUS *

	TANK 1	TANK 2	TANK 3	TANK 4	TANK 5
Tank use (Example: heating, generating, waste, dispensing)					
Name of manufacturer					
Year manufactured (YYYY)					
Certificate number of person certified by province at time of installation, as applicable					

PART VI: WITHDRAWAL FROM SERVICE AND REMOVAL

✓ Check all that apply and write where applicable

Status of Tank and Piping *Complete* **applicable section only:** *Permanent withdrawal, removal or temporarily withdrawal)*	1		2		3		4		5	
	TANK	PIPING	TANK	PIPING	TANK	PIPING	TANK	PIPING	TANK	PIPING
EC Tank System Identification Number										
Temporary withdrawal from service[4] in accordance with sections 43 of Regulations *(Review Section 43 of the Regulations for details regarding mandatory return to service testing)*										
Start date (MM/YYYY)										
End date (MM/YYYY)										
Permanent withdrawal completed in accordance with sections 44 of Regulations (Check all that apply)										
Date permanently withdrawn from service (MM/YYYY)										
Withdrawn by approved person	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
Withdrawal records kept	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
Liquids/sludge removed and disposed	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
Vapours purged	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
No long-term harmful effects[5]	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
Fill pipe labelled	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
Physically removed	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
Removal completed in accordance with section 45 of Regulations (Check all that apply)										
Date removed (MM/YYYY)										
Removed by approved person	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
Removal records kept	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
** Certified person's certification number*										

4 If out of service more than two years, then permanent withdrawal is required

5 Has the withdrawal been done in a way such that there will be no immediate or long-term harmful effect on the environment and it will not constitute a danger to human life or health?

PART VII: OWNER'S CERTIFICATION

This section must be signed by the storage tank system owner or the owner contact

I hereby certify that the information provided with respect to the identification of tank system under section 28 of the Storage Tank Systems for Petroleum Products and Allied Petroleum Products Regulations is accurate and complete.

Name and Title (Type or Print)	Signature	_____/_____/_____ DD MM YYYY

SEND FORM TO ENVIRONMENT CANADA (Allow 3 weeks for processing)	
Send by **Fax** to: 819-938-4454	or Send by **Mail** to: Environment Canada – Storage Tank Program Waste Reduction and Management Division Environmental Stewardship Branch 351 St. Joseph Boulevard, Place Vincent Massey, 9th floor Gatineau, Quebec K1A 0H3
or Send a scanned version by **e-mail** to: ec.registrereservoir-tankregistry.ec@canada.ca	

QUESTION?

Telephone: 1-844-672-8038

APPENDIX C

ENVIRONMENTAL SITE ASSESSMENT (EGE, 2018)

February 20, 2018 File: 0125-095-02

Public Services and Procurement Canada
100 - 167 Lombard Avenue
Winnipeg, Manitoba
R3B 0T6

RE: Parks Canada Agency - Banff National Park, AB
Ya Ha Tinda Ranch - Fuel Tank Removal and Replacement
PSPC Project No.: R.089703.008

As part of the Terms of Reference (ToR) issued by Public Services and Procurement Canada (PSPC) for the Specification and Tender Documents for the Fuel Tank Removal and Replacement project at the Parks Canada Agency (PCA) Ya Ha Tinda Ranch (YHTR) facility in Banff National Park, Alberta, EGE Engineering Ltd. (EGE) is pleased to provide this Site Investigation report. The PSPC Project Number is R.089703.008.

As outlined in the ToR, dated July 2017, PCA is initiating work to prepare final 100% complete specifications and tender documents for the removal and replacement of two petroleum storage tanks and the investigation of the existing generator systems located at YHTR. The primary objective of the work is to complete specification documents and stamped (sealed) design drawings suitable for tendering and use by PSPC to retain a Contractor in order to complete the required work at the two locations (existing storage tank/generator location and new storage tank/generator location). The project objectives outlined in the ToR were as follows:

- Identify a new location for the storage tank system and generators;
- Investigate the requirement to replace and/or relocate the generators on-site;
- Complete a limited geotechnical/environmental investigation at the new location to ensure the site is suitable for the intended purpose;
- Produce final 100% complete, comprehensive and coordinated specifications and tender documents that are signed and stamped (sealed) by a licensed engineer with a permit to practice in the area of the work and suitable for tendering the work;
- Produce draft and final reports for the generator assessment and environmental and geotechnical investigations;
- Complete all regulatory requirements to install a new tank system (PCA EA, EIA and provincial requirements); and
- Complete a Class “A” cost estimate for installing the new system.

This report provides a factual summary of the Environmental Site Investigation phase of the work. A factual summary of the Geotechnical Investigation and the Generator Assessment are provided under separate cover.

1.0 SITE DESCRIPTION

The YHTR covers a large area of natural grassland and mixed forest north of the Red Deer River, with a small developed area used to operate the working horse ranch. The developed part of the site is located at 4-24-32-12 W5M and includes a number of structures, listed in the Phase I/II Environmental Site Assessment report for the site as: oil shed; generator shed; dry storage shed; helicopter fuel shed; log building; equipment shed; fire shed shop; blacksmith shop; barn; Quonset; bunkhouse; four residence units; a former log house used for historical displays; and a former outhouse.

The YHTR is operated by PCA for wintering and training working horses used to patrol Canada's western National Parks. The DFRP number for the YHTR is 30070. A location plan is provided as Figure 01 and a site layout plan for the YHTR is provided as Figure 02. The property is surrounded by natural areas, including:

- East - Scalp Creek and natural area;
- South - Natural area and seasonal non-serviced camping area;
- West - Natural area; and
- North - Natural area.

2.0 PROJECT OBJECTIVES

The objective of the work was to collect soil samples from the test holes drilled as part of the geotechnical investigation at the proposed location of the new fuel storage tanks and generators. The soil samples were to be screened in the field for combustible organic vapours and representative samples were to be collected for laboratory analysis of benzene, toluene, ethylbenzene and xylenes (the BTEX components) and the petroleum hydrocarbon (PHC) F1 to F4 Fractions.

3.0 SITE INVESTIGATION METHODOLOGIES

The geotechnical investigation was completed on September 20, 2017 and included drilling three test holes (TH-1 through TH-3) at the proposed location of the new fuel storage tanks and generators, along with a fourth test hole (TH-4) for environmental purposes only. The test holes were drilled at the following locations and to the following depths:

- TH-1 - 5.3 m east and 1.4 m north of the southeast corner of the log building. The test hole was drilled to a depth of 7.0 m below ground surface (mbgs);
- TH-2 - 6.3 m south and 3.0 m east of the southeast corner of the log building. The test hole was drilled to a depth of 6.25 mbgs;
- TH-3 - 12.2 m east and 4.4 m south of the southeast corner of the log building. The test hole was drilled to a depth of 6.25 mbgs and a standpipe piezometer was installed at this location; and
- TH-4 - 1.7 m west and 0.3 m north of the northwest corner of the helicopter fuel shed. The test hole was drilled to a depth of 1.5 mbgs.

Public and private utility clearances were completed in the area prior to the site investigation. The locations of the four test holes are shown on Figure 03. The GPS coordinates and measured distances from the site structures for each of the test holes are provided in Table 1. Photographs of the test hole drilling are provided below.


Photos 01 and 02: Drilling TH-1 east of the log building.


Photos 03 and 04: Drilling TH-2 south of the log building.


Photos 05 and 06: Drilling TH-3 southeast of log building.


Photos 07 and 08: Drilling TH-4 west of the helicopter fuel shed.

Representative soil samples were collected near surface (0.1 to 0.30 m and 0.60 to 0.80 m) and at approximately 0.60 to 0.80 m intervals thereafter to a depth of 5.0 m (1.3 m at TH-4). Additional samples were also collected at a depth of 7.0 m (TH-1) and at a depth of 6.25 m (TH-2 and TH-3). Soil samples were collected directly from the solid stem augers for field screening and selected samples were retained for laboratory analysis.

An organic vapour survey was completed on the collected soil samples, as a guide to identifying any areas of petroleum hydrocarbon contamination and in selecting representative samples for laboratory analysis. The soil samples were placed in plastic sample bags for field screening using the headspace method. A portion of the sample was also placed into a clean glass container, with minimum headspace, and retained for possible laboratory analysis. Disposable nitrile gloves were used during the sample handling.

The combustible organic vapour survey was carried out using an RKI Eagle 2 analyzer. Measurement was obtained by allowing the samples to volatilize for about 20 minutes at a temperature of approximately 20 degrees Celsius. The sample bag was then gently agitated for several seconds, punctured and the probe from the RKI analyzer inserted into the bag to measure the soil headspace vapour. The recorded combustible organic vapour concentrations, in parts per million (ppm) or percent of the lower explosive limit (% LEL), as measured by the headspace method are summarized in Table 2.

EGE submitted one soil sample from each of the four test holes plus one additional sample from TH-1 for vertical delineation, for analysis of the BTEX components and the PHC F1 to F4 Fractions. No blind duplicate soil samples were submitted for quality assurance/quality control (QA/QC) purposes due to the limited number of samples. The analytical report is provided in Attachment A.

The soil samples collected for analysis of the BTEX components and the PHC F1 Fraction were obtained using the VOC sampling requirements adopted by the federal government, as published in the CCME's *Guidance Manual for Environmental Site Characterization in support of Environmental and Human Health Risk Volume 4: Compendium of Analytical Methods for Contaminated Sites*. This involved field preservation in methanol immediately during sampling, using a sampling kit containing a plastic cut-off syringe to collect the soil sample, two 40 mL VOA vials pre-filled with 10 mL of methanol and a soil jar for moisture analysis. The cut-off syringe was used to collect about 5 g of soil that was extruded into the vial immediately after the sample collection surface had been exposed. Two vials were collected per sample to provide back-up and allow for laboratory QA/QC purposes (duplicates and matrix spikes). Disposable nitrile gloves were used during the sample handling.

3.1 Soil Description

A detailed discussion of the soil stratigraphy at the site is provided in the Geotechnical Investigation report, provided under separate cover. The Geotechnical Investigation report also includes the soil logs for each of the three deeper test holes. In general, the site consisted of a 1.5 to 3.0 m thick layer of sand that overlies a firm to very stiff clay till/clay soil The clay till is underlain by a compact to dense gravel layer that in turn overlies very weak, highly weathered shale.

The sand generally consisted of gravel with some silt and trace clay and trace organics. The thickness of the clay till layer ranged from 2.25 to 3.75 m. The clay till consisted of silty to sandy clay with some gravel and occasional pebbles and cobbles. The clay till was moist to wet with a low to medium plasticity. The gravel below the clay till was 0.75 m thick and was dense and moist.

Below the gravel unit, bedrock was encountered. The bedrock consisted of very weak shale that was wet, blocky and highly weathered/disintegrated to soil-like formation at about 5.25 mbgs in all test holes.

Based on the above, the surface soil (< 1.5 m) is predominantly coarse grained (sand) and the subsoil (> 1.5 m) is predominantly fine grained (clay till and shale).

4.0 REGULATORY ASSESSMENT CRITERIA

The Federal Government currently references the environmental assessment guidelines for soil outlined in the following Canadian Council of Ministers of the Environment (CCME) documents:

- CCME Canadian Environmental Quality Guidelines (CEQG), current version found at http://ceqg-rcqe.ccme.ca/en/index.html; and
- CCME Canada Wide Standards (CWS) for PHCs in Soil, January 2008.

The above documents were used to evaluate the applicable exposure pathways, land uses, key receptors and the predominant soil texture at the site. The assessment was conducted in accordance with current CCME guidelines and did not include the modification or recalculation of the formulas used to derive the default guideline values. No pathway elimination was undertaken, as the soil samples were meant to be a screening level assessment of background conditions at the proposed location for the new fuel storage tanks and generators.

Therefore, the lowest numerical soil quality guideline was selected for the BTEX components and the PHC F1 to F4 Fractions, based on the coarse or fine grained soil texture and surface soil depth (surface to 1.5 mbgs). There were no subsoil samples (below 1.5 mbgs) submitted for laboratory analysis. The YHTR has a full time occupied residence; therefore, the residential land use guidelines were selected. In addition, since the YHTR is located in a natural setting bounded by the Banff National Park, and working horses are present on-site and utilize pasture areas nearby, the agricultural and/or natural land use guidelines are also referenced in the analytical summary table (Table 3).

The Alberta Tier 1 soil quality guidelines have also been included for reference in Table 3.

5.0 SOIL QUALITY RESULTS

As noted earlier, four test holes (TH-1 through TH-4) were completed to provide data for use in the foundation design for the proposed fuel storage tanks and generators. The test hole locations are shown on Figure 03.

All of the collected soil samples were screened in the field for combustible organic vapours using an Eagle RKI 2 photo-ionization analyzer, as a guide to identifying zones of PHC impacted soil and in selecting soil samples for laboratory analysis. The field screening was completed with a combustible organic vapour detector and photoionization detector (PID). The results are provided in Table 2 and indicate that no vapours were detected.

Five soil samples were submitted for laboratory analysis of the BTEX components and the PHC F1 to F4 Fractions. The BTEX and PHC results are summarized in Table 3, and as noted, there were no detectable BTEX component or PHC F1 to F4 Fraction concentrations reported for the samples submitted.

6.0 CONCLUSION

Based on the visual observations during drilling, the vapour screening and the analytical data, the proposed location for the fuel storage tanks and generators is not impacted by petroleum hydrocarbons and is considered to be a clean site for construction of the new fuel storage tanks and generators.

We trust that this meets your needs at this time. Should you have any questions or require any additional information please contact the undersigned at (204) 896-8264 or Mr. Larry Bielus at (204) 226-7378.

Sincerely,

EGE ENGINEERING LTD.

P. David Klassen, P.Geo.
Senior Geoscientist

PROFESSIONAL GEOSCIENTIST ALBERTA
P. D. KLASSEN
2018-02-20
PDK

PERMIT TO PRACTICE
EGE ENGINEERING LTD.
Signature
Date 2018-02-20
PERMIT NUMBER: P9462
The Association of Professional Engineers, Geologists and Geophysicists of Alberta

TABLES

Table 1 - Test Hole Locations - GPS Coordinates

Site Investigation - Ya Ha Tinda Ranch - Banff National Park, AB

Test Hole	GPS Coordinates (11U)		Test Hole Location
	Northing	Easting	
TH-1	5734720	597832	5.3 m east, 1.4 m north of southeast corner of log building
TH-2	5734712	597830	6.3 m south, 3.0 m east of southeast corner of log building
TH-3	5734714	597839	12.2 m east, 4.4 m south of southeast corner of log building
TH-4	5734733	597834	1.7 m west, 0.3 m north of northwest corner of fuel shed

Notes:

1. GPS accuracy +/- 2.0 m.

Table 2 - Combustible Organic Vapours in Soil
Site Investigation - Ya Ha Tinda Ranch - Banff National Park, AB

Test Hole	Date of Drilling (yyyy-mm-dd)	Sample Depth (m)	Soil Texture (Coarse/Fine)	Vapour Concentration (ppm)	Lab Analyses
TH-1	2017-09-20	0.20	C	0	BTEX, PHC F1-F4
		0.70	C	0	
		1.30	C	0	BTEX, PHC F1-F4
		2.10	F	0	
		2.80	F	0	
		3.60	F	0	
		4.30	F	0	
		5.00	F	0	
		7.00	F	0	
TH-2	2017-09-20	0.20	C	0	
		0.70	C	0	BTEX, PHC F1-F4
		1.30	C	0	
		2.10	F	0	
		2.80	F	0	
		3.60	F	0	
		4.30	F	0	
		5.00	F	0	
		6.25	F	0	
TH-3	2017-09-20	0.20	C	0	BTEX, PHC F1-F4
		0.70	C	0	
		1.30	C	0	
		2.10	C	0	
		2.80	C	0	
		3.60	F	0	
		4.30	F	0	
		5.00	F	0	
		6.25	F	0	
TH-4	2017-09-20	0.20	C	0	BTEX, PHC F1-F4
		0.70	C	0	
		1.30	C	0	

Notes:

ppm = parts per million

All vapour readings were obtained with an RKI Eagle 2 Combustible Gas Detector set with methane elimination on.

Table 3 - Summary of Petroleum Hydrocarbon Results in Soil

Site Investigation - Ya Ha Tinda Ranch - Banff National Park, AB

Sample Location	Date Sampled (yyyy-mm-dd)	Sample Depth (m)	Vapour Concentration (ppm)	Parameter							
				Benzene	Toluene	Ethylbenzene	Xylenes	F1	F2	F3	F4
Coarse Grained Surface Soil (< 1.5 m depth)											
CCME CEQG [3] and CWS for PHC [4] - Agricultural and Residential				**0.030 (GW)**	**0.10 (FWL)**	**0.082 (GW)**	**11 (GW)**	**30 (INH-S)**	**150 (INH-S, ESC)**	**300 (ESC)**	**2,800 (ESC)**
AB Tier 1 [5] - Natural Areas				**0.078**	**0.12**	**0.14**	**1.9**	**210**	**150**	**300**	**2,800**
AB Tier 1 [5] - Agricultural and Residential				**0.073**	**0.12**	**0.14**	**1.9**	**24**	**130**	**300**	**2,800**
TH-1	2017-09-20	0.20	0	< 0.0050	< 0.020	< 0.010	< 0.040	< 10	< 10	< 50	< 50
		1.30	0	< 0.0050	< 0.020	< 0.010	< 0.040	< 10	< 10	< 50	< 50
TH-2	2017-09-20	0.70	0	< 0.0050	< 0.020	< 0.010	< 0.040	< 10	< 10	< 50	< 50
TH-3	2017-09-20	0.20	0	< 0.0050	< 0.020	< 0.010	< 0.040	< 10	< 10	< 50	< 50
TH-4	2017-09-20	0.20	0	< 0.0050	< 0.020	< 0.010	< 0.040	< 10	< 10	< 50	< 50

Notes:

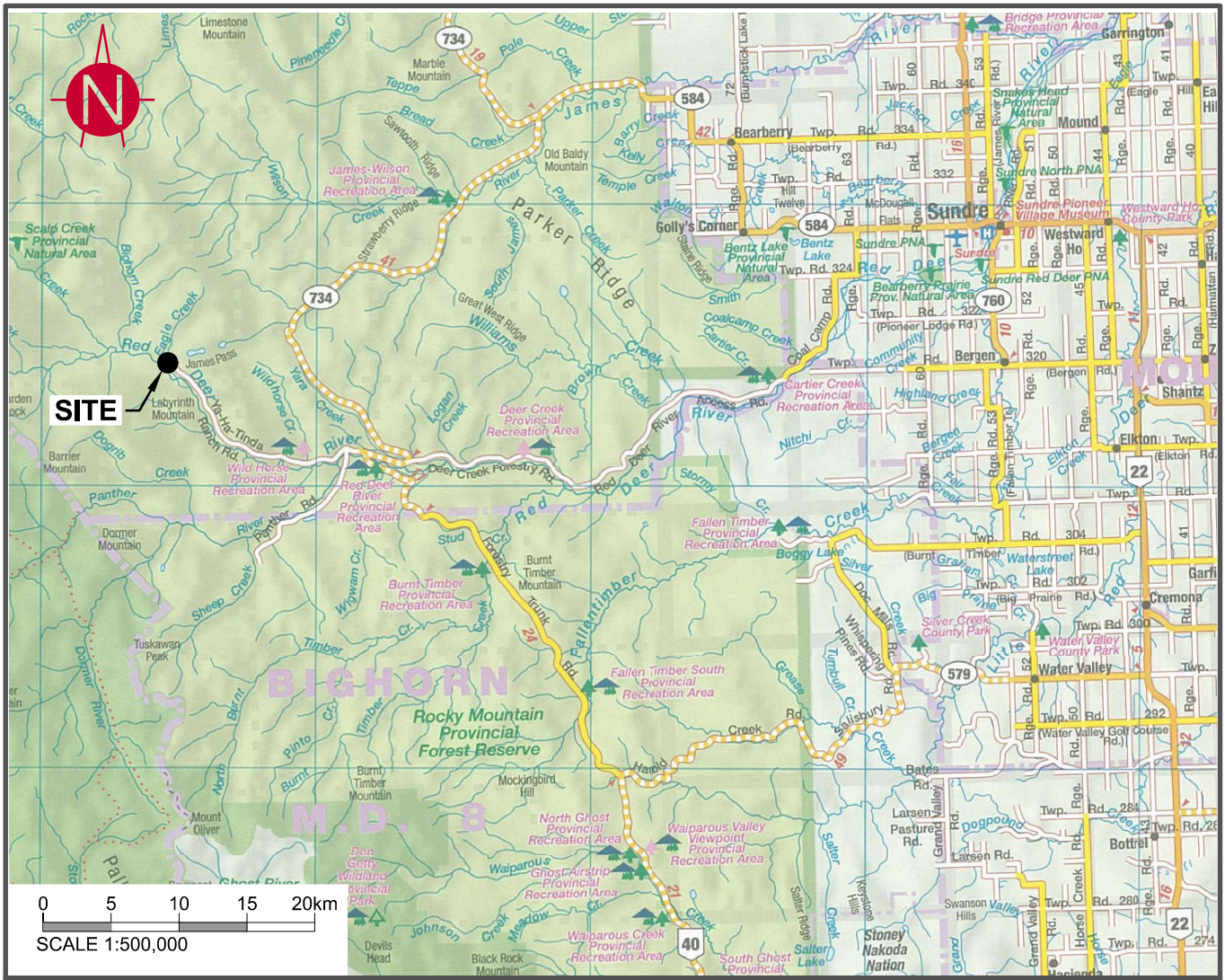
1. All concentrations expressed in milligrams per kilogram (mg/kg).
2. The symbol < indicates a concentration less than the laboratory method detection limit.
3. CCME CEQG = Canadian Environmental Quality Guidelines (obtained December 2017 from http://ceqg-rcqe.ccme.ca). Limiting pathways: (FWL) = groundwater (aquatic life); (GW) = groundwater (drinking water).
4. CCME CWS for PHC = Canada Wide Standard for Petroleum Hydrocarbons in Soil, January 2008.
   Limiting pathways: (ESC) = ecological soil contact; (GW) = protection of potable groundwater; (INH-S) = vapour inhalation (indoor air, slab-on-grade).
5. AB Tier 1 = Alberta Tier 1 Soil and Groundwater Remediation Guidelines, February 2016.

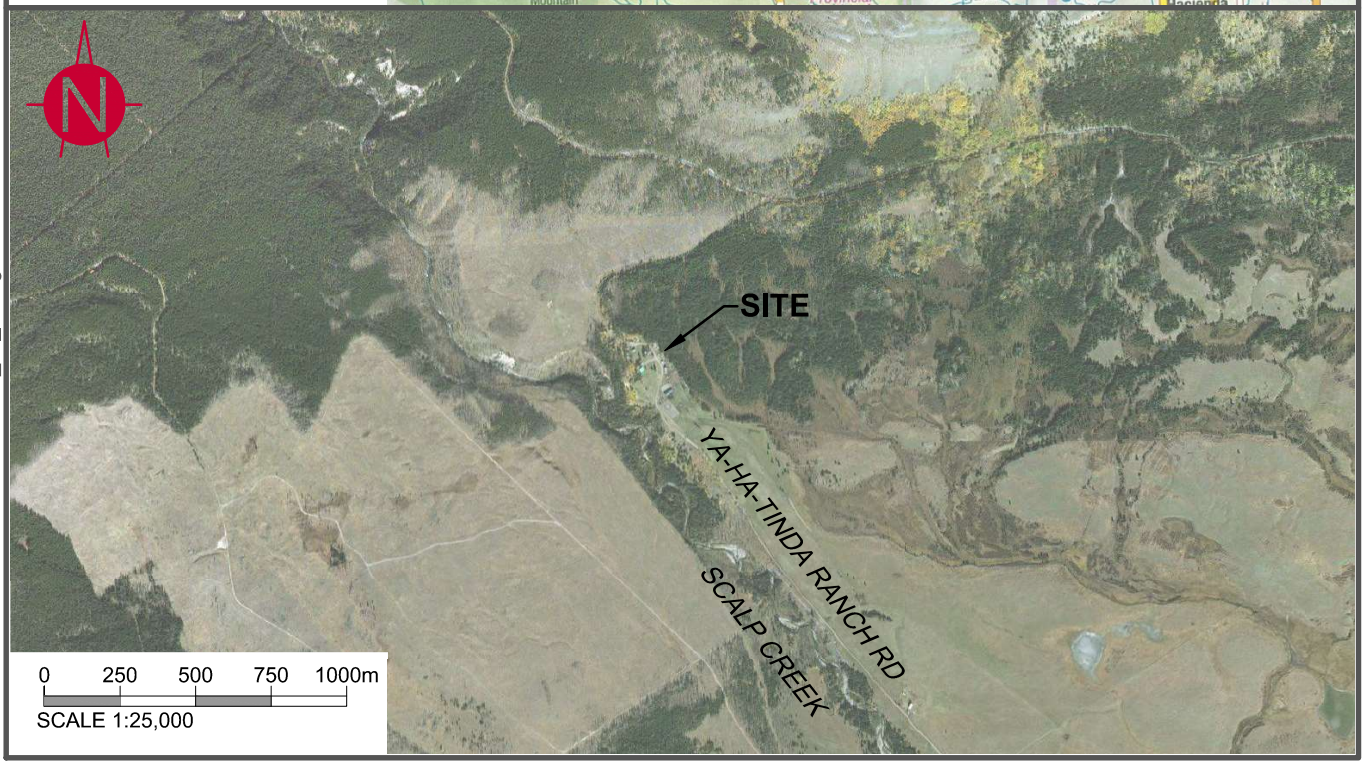
FIGURES

8.5" x 11"

PLOT: 12/2/2017 6:17:20 PM

EGE FILE NAME: 0125-095-02-YHTR EI_01_X.dwg





EGE

Public Services and Procurement Canada

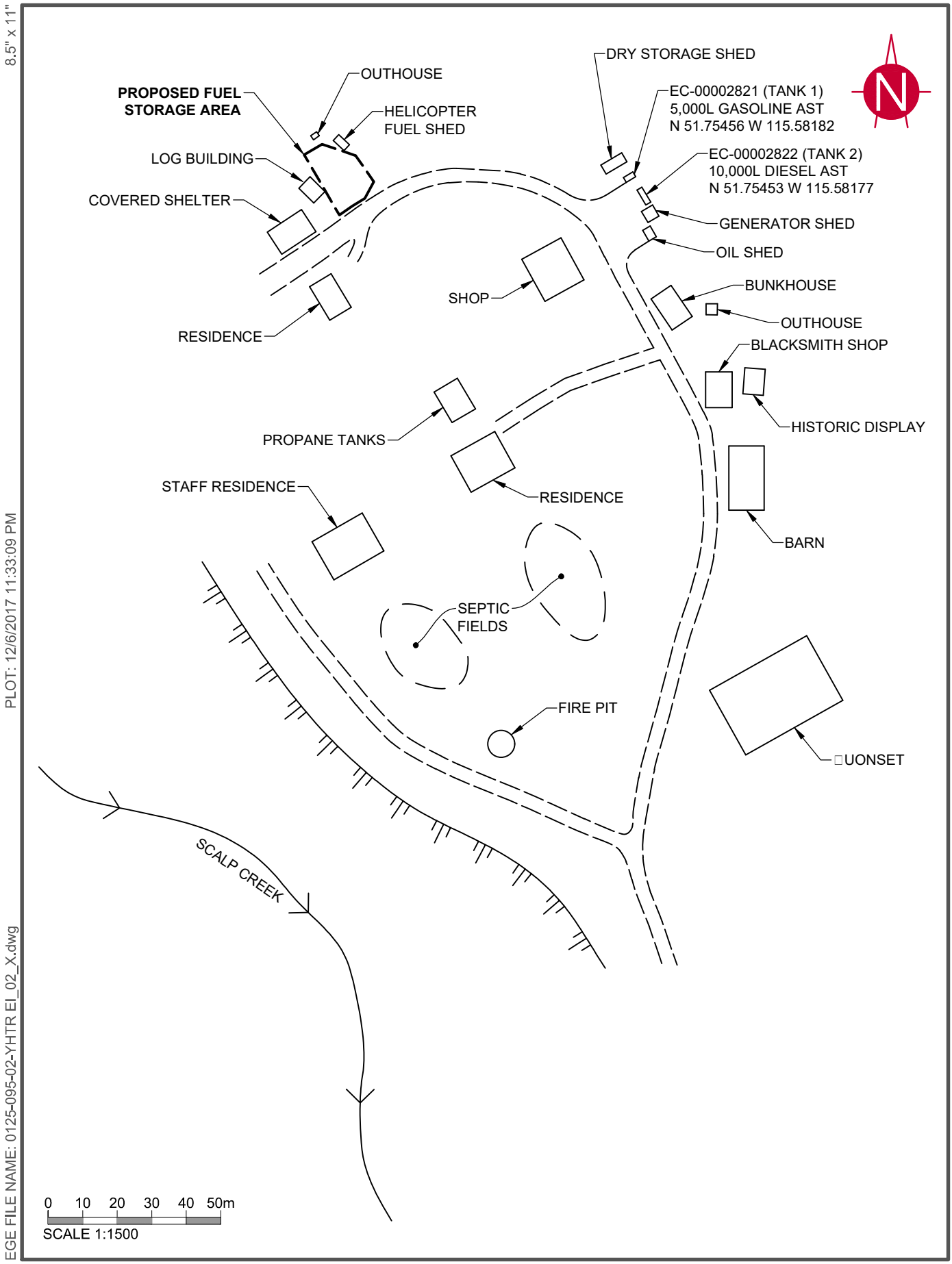
Ya Ha Tinda Ranch - Clearwater County, AB

Environmental Investigation

Parks Canada Agency

Location Plan

Figure 01



EGE

Public Services and Procurement Canada
Ya Ha Tinda Ranch - Clearwater County, AB
Environmental Investigation
Parks Canada Agency

Site Layout

Figure 02

EGE

Public Services and Procurement Canada
Ya Ha Tinda Ranch - Clearwater County, AB
Environmental Investigation
Parks Canada Agency

Test Hole Locations

Figure 03

ATTACHMENT A

ANALYTICAL REPORT

Maxxam
A Bureau Veritas Group Company

Success Through Science®

Your Project #: 0125 095 02
Site#: YA HA TINDA RANCH
Site Location: TANK REPLACEMENT
Your C.O.C. #: 535990-01-01

Attention:ANDREW PASSALIS

EGE ENGINEERING LTD.
511 PEPPERLOAF CRESCENT
WINNIPEG, MB
CANADA R3R 1E6

Report Date: 2017/09/27
Report #: R2451008
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B781571
Received: 2017/09/20, 17:50

Sample Matrix: Soil
Samples Received: 5

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
BTEX/F1 by HS GC/MS/FID (MeOH extract) (1)	1	N/A	2017/09/23	AB SOP-00039	CCME CWS/EPA 8260c m
BTEX/F1 by HS GC/MS/FID (MeOH extract) (1)	4	N/A	2017/09/26	AB SOP-00039	CCME CWS/EPA 8260c m
CCME Hydrocarbons (F2-F4 in soil) (2)	4	2017/09/22	2017/09/22	AB SOP-00036	CCME PHC-CWS m
CCME Hydrocarbons (F2-F4 in soil) (2)	1	2017/09/22	2017/09/24	AB SOP-00036	CCME PHC-CWS m
Moisture	5	N/A	2017/09/22	AB SOP-00002	CCME PHC-CWS m

Remarks:

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported: unless indicated otherwise, associated sample data are not blank corrected.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise agreed in writing.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested.
This Certificate shall not be reproduced except in full, without the written approval of the laboratory.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) No lab extraction date is given for F1BTEX & VOC samples that are field preserved with methanol. Extraction date is date sampled unless otherwise stated.
(2) All CCME results met required criteria unless otherwise stated in the report. The CWS PHC methods employed by Maxxam conform to all prescribed elements of the reference method and performance based elements have been validated. All modifications have been validated and proven equivalent following Alberta Environment's Interpretation of the Reference Method for the Canada-Wide Standard for Petroleum Hydrocarbons in Soil, Validation of Performance-Based Alternative Methods September 2003. Documentation is available upon request. Modifications from Reference Method for the Canada-wide Standard for Petroleum Hydrocarbons in Soil-Tier 1 Method: F2/F3/F4 data reported using validated cold solvent extraction instead of Soxhlet extraction.

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Your Project #: 0125 095 02
Site#: YA HA TINDA RANCH
Site Location: TANK REPLACEMENT
Your C.O.C. #: 535990-01-01

Attention:ANDREW PASSALIS

EGE ENGINEERING LTD.
511 PEPPERLOAF CRESCENT
WINNIPEG, MB
CANADA R3R 1E6

Report Date: 2017/09/27
Report #: R2451008
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B781571
Received: 2017/09/20, 17:50

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Jennifer Stephenson, B.Sc, Technical Specialist
Email: jstephenson@maxxam.ca
Phone# (403) 291-3077

==========

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Maxxam Job #: B781571
Report Date: 2017/09/27

EGE ENGINEERING LTD.
Client Project #: 0125 095 02
Site Location: TANK REPLACEMENT
Sampler Initials: AP

AT1 BTEX AND F1-F4 IN SOIL (VIALS)

Maxxam ID		SA1872		SA1873		SA1874	SA1875		
Sampling Date		2017/09/20		2017/09/20		2017/09/20	2017/09/20		
COC Number		535990-01-01		535990-01-01		535990-01-01	535990-01-01		
	UNITS	TH1-1	QC Batch	TH1-3	QC Batch	TH2-2	TH3-1	RDL	QC Batch
Physical Properties									
Moisture	%	9.9	8767587	10	8767587	9.3	9.9	0.30	8768072
Ext. Pet. Hydrocarbon									
F2 (C10-C16 Hydrocarbons)	mg/kg	<10	8767775	<10	8767775	<10	<10	10	8767775
F3 (C16-C34 Hydrocarbons)	mg/kg	<50	8767775	<50	8767775	<50	<50	50	8767775
F4 (C34-C50 Hydrocarbons)	mg/kg	<50	8767775	<50	8767775	<50	<50	50	8767775
Reached Baseline at C50	mg/kg	Yes	8767775	Yes	8767775	Yes	Yes	N/A	8767775
Field Preserved Volatiles									
Benzene	mg/kg	<0.0050	8768521	<0.0050	8768738	<0.0050	<0.0050	0.0050	8768738
Toluene	mg/kg	<0.020	8768521	<0.020	8768738	<0.020	<0.020	0.020	8768738
Ethylbenzene	mg/kg	<0.010	8768521	<0.010	8768738	<0.010	<0.010	0.010	8768738
Xylenes (Total)	mg/kg	<0.040	8768521	<0.040	8768738	<0.040	<0.040	0.040	8768738
m & p-Xylene	mg/kg	<0.040	8768521	<0.040	8768738	<0.040	<0.040	0.040	8768738
o-Xylene	mg/kg	<0.020	8768521	<0.020	8768738	<0.020	<0.020	0.020	8768738
F1 (C6-C10) - BTEX	mg/kg	<10	8768521	<10	8768738	<10	<10	10	8768738
F1 (C6-C10)	mg/kg	<10	8768521	<10	8768738	<10	<10	10	8768738
Surrogate Recovery (%)									
1,4-Difluorobenzene (sur.)	%	115	8768521	100	8768738	102	99	N/A	8768738
4-Bromofluorobenzene (sur.)	%	96	8768521	110	8768738	108	110	N/A	8768738
D10-o-Xylene (sur.)	%	116	8768521	87	8768738	87	87	N/A	8768738
D4-1,2-Dichloroethane (sur.)	%	115	8768521	101	8768738	103	100	N/A	8768738
O-TERPHENYL (sur.)	%	89	8767775	89	8767775	91	88	N/A	8767775

RDL = Reportable Detection Limit
N/A = Not Applicable

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Maxxam Job #: B781571
Report Date: 2017/09/27

EGE ENGINEERING LTD.
Client Project #: 0125 095 02
Site Location: TANK REPLACEMENT
Sampler Initials: AP

AT1 BTEX AND F1-F4 IN SOIL (VIALS)

Maxxam ID		SA1876		
Sampling Date		2017/09/20		
COC Number		535990-01-01		
	UNITS	TH4-1	RDL	QC Batch
Physical Properties				
Moisture	%	12	0.30	8768072
Ext. Pet. Hydrocarbon				
F2 (C10-C16 Hydrocarbons)	mg/kg	<10	10	8767690
F3 (C16-C34 Hydrocarbons)	mg/kg	<50	50	8767690
F4 (C34-C50 Hydrocarbons)	mg/kg	<50	50	8767690
Reached Baseline at C50	mg/kg	Yes	N/A	8767690
Field Preserved Volatiles				
Benzene	mg/kg	<0.0050	0.0050	8768738
Toluene	mg/kg	<0.020	0.020	8768738
Ethylbenzene	mg/kg	<0.010	0.010	8768738
Xylenes (Total)	mg/kg	<0.040	0.040	8768738
m & p-Xylene	mg/kg	<0.040	0.040	8768738
o-Xylene	mg/kg	<0.020	0.020	8768738
F1 (C6-C10) - BTEX	mg/kg	<10	10	8768738
F1 (C6-C10)	mg/kg	<10	10	8768738
Surrogate Recovery (%)				
1,4-Difluorobenzene (sur.)	%	101	N/A	8768738
4-Bromofluorobenzene (sur.)	%	108	N/A	8768738
D10-o-Xylene (sur.)	%	91	N/A	8768738
D4-1,2-Dichloroethane (sur.)	%	102	N/A	8768738
O-TERPHENYL (sur.)	%	100	N/A	8767690

RDL = Reportable Detection Limit
N/A = Not Applicable

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Maxxam Job #: B781571
Report Date: 2017/09/27

EGE ENGINEERING LTD.
Client Project #: 0125 095 02
Site Location: TANK REPLACEMENT
Sampler Initials: AP

GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	6.3°C

Results relate only to the items tested.

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Maxxam Job #: B781571
Report Date: 2017/09/27

QUALITY ASSURANCE REPORT

EGE ENGINEERING LTD.
Client Project #: 0125 095 02
Site Location: TANK REPLACEMENT
Sampler Initials: AP

			Matrix Spike		Spiked Blank		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
8767690	O-TERPHENYL (sur.)	2017/09/24	98	60 - 130	97	60 - 130	106	%		
8767775	O-TERPHENYL (sur.)	2017/09/22	92	60 - 130	92	60 - 130	93	%		
8768521	1,4-Difluorobenzene (sur.)	2017/09/23	97	60 - 130	100	60 - 130	112	%		
8768521	4-Bromofluorobenzene (sur.)	2017/09/23	90	60 - 130	95	60 - 130	102	%		
8768521	D10-o-Xylene (sur.)	2017/09/23	113	60 - 130	99	60 - 130	88	%		
8768521	D4-1,2-Dichloroethane (sur.)	2017/09/23	105	60 - 130	95	60 - 130	110	%		
8768738	1,4-Difluorobenzene (sur.)	2017/09/26	101	60 - 130	101	60 - 130	101	%		
8768738	4-Bromofluorobenzene (sur.)	2017/09/26	108	60 - 130	111	60 - 130	109	%		
8768738	D10-o-Xylene (sur.)	2017/09/26	89	60 - 130	85	60 - 130	74	%		
8768738	D4-1,2-Dichloroethane (sur.)	2017/09/26	100	60 - 130	101	60 - 130	104	%		
8767587	Moisture	2017/09/22					<0.30	%	2.0	20
8767690	F2 (C10-C16 Hydrocarbons)	2017/09/24	106	60 - 130	101	70 - 130	<10	mg/kg	NC	40
8767690	F3 (C16-C34 Hydrocarbons)	2017/09/24	113	60 - 130	110	70 - 130	<50	mg/kg	6.4	40
8767690	F4 (C34-C50 Hydrocarbons)	2017/09/24	114	60 - 130	109	70 - 130	<50	mg/kg	9.5	40
8767775	F2 (C10-C16 Hydrocarbons)	2017/09/22	91	60 - 130	90	70 - 130	<10	mg/kg	NC	40
8767775	F3 (C16-C34 Hydrocarbons)	2017/09/22	93	60 - 130	92	70 - 130	<50	mg/kg	NC	40
8767775	F4 (C34-C50 Hydrocarbons)	2017/09/22	90	60 - 130	90	70 - 130	<50	mg/kg	NC	40
8768072	Moisture	2017/09/22					<0.30	%	1.7	20
8768521	Benzene	2017/09/23	89	60 - 140	97	60 - 130	<0.0050	mg/kg	NC	50
8768521	Ethylbenzene	2017/09/23	91	60 - 140	101	60 - 130	<0.010	mg/kg	4.4	50
8768521	F1 (C6-C10) - BTEX	2017/09/23					<10	mg/kg	8.6	30
8768521	F1 (C6-C10)	2017/09/23	100	60 - 140	89	60 - 130	<10	mg/kg	8.6	30
8768521	m & p-Xylene	2017/09/23	94	60 - 140	103	60 - 130	<0.040	mg/kg	NC	50
8768521	o-Xylene	2017/09/23	94	60 - 140	104	60 - 130	<0.020	mg/kg	NC	50
8768521	Toluene	2017/09/23	90	60 - 140	100	60 - 130	<0.020	mg/kg	NC	50
8768521	Xylenes (Total)	2017/09/23					<0.040	mg/kg	NC	50
8768738	Benzene	2017/09/26	87	60 - 140	81	60 - 130	<0.0050	mg/kg	NC	50
8768738	Ethylbenzene	2017/09/26	87	60 - 140	89	60 - 130	<0.010	mg/kg	NC	50
8768738	F1 (C6-C10) - BTEX	2017/09/26					<10	mg/kg	NC	30
8768738	F1 (C6-C10)	2017/09/26	84	60 - 140	77	60 - 130	<10	mg/kg	NC	30
8768738	m & p-Xylene	2017/09/26	86	60 - 140	87	60 - 130	<0.040	mg/kg	NC	50

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Maxxam Job #: B781571
Report Date: 2017/09/27

QUALITY ASSURANCE REPORT(CONT'D)

EGE ENGINEERING LTD.
Client Project #: 0125 095 02
Site Location: TANK REPLACEMENT
Sampler Initials: AP

			Matrix Spike		Spiked Blank		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
8768738	o-Xylene	2017/09/26	83	60 - 140	86	60 - 130	<0.020	mg/kg	NC	50
8768738	Toluene	2017/09/26	86	60 - 140	84	60 - 130	<0.020	mg/kg	NC	50
8768738	Xylenes (Total)	2017/09/26					<0.040	mg/kg	NC	50

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Maxxam Job #: B781571
Report Date: 2017/09/27

EGE ENGINEERING LTD.
Client Project #: 0125 095 02
Site Location: TANK REPLACEMENT
Sampler Initials: AP

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Dennis Ngondu, B.Sc., P.Chem., QP, Supervisor, Organics

Janet Gao, B.Sc., QP, Supervisor, Organics

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Maxxam
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Maxxam Analytics International Corporation o/a Maxxam Analytics
4000 19st N.E, Calçary, Alberta Canada T2E 6P8 Tel:(403) 291-3077 Tol-free:800-563-6266 Fax:(403) 291-9468 www.maxxam.ca

718

CHAIN OF CUSTODY RECORD

Page 1 of 1

INVOICE TO:		REPORT TO:		PROJECT INFORMATION:		Laboratory Use Only:	
Company Name:	#2748 EGE ENGINEERING LTD.	Company Name:		Quotation #:	B70468	Maxxam Job #:	Bottle Order #: 535990
Attention:	ANDREW PASSALIS	Attention:		P.O. #:			
Address:	511 PEPPERLOAF CRESCENT WINNIPEG MB R3R 1E6	Address:		Project:	0125 095 02	COC #: C#535990-01-01	Project Manager: Kristi Bilodeau
				Project Name:	TANK REPLACEMENT		
Tel:	(204) 612-0944 x Fax: (204) 837-6473 x	Tel:	Fax:	Site #:	YA HA TINDA RANCH		
Email:	andrew.passalis@gmail.com	Email:		Sampled By:	A. PASSALIS		

Regulatory Criteria:
- ☐ ATI
- ☒ CCME
- ☐ Other

Special Instructions

SAMPLES MUST BE KEPT COOL (< 10°C) FROM TIME OF SAMPLING UNTIL DELIVERY TO MAXXAM

ANALYSIS REQUESTED (PLEASE BE SPECIFIC)

Turnaround Time (TAT) Required:

Please provide advance notice for rush projects

Regular (Standard) TAT: ☒
(will be applied if Rush TAT is not specified):
Standard TAT = 5-7 Working days for most tests..
Please note: Standard TAT for certain tests are > 5 days - contact your Project Manager for details

Job Specific Rush TAT (if applies to entire submission) ☐
Date Required:
Rush Confirmation Number: *(call lab for #)*

	Sample Barcode Label	Sample (Location) Identification	Date Sampled	Time Sampled	Matrix	Metals Field Filtered ? (Y / N)	BTEX/F1-F4	# of Bottles	Comments
1	~~TH1-1~~	TH1-1	2017/09/20		SOIL		X	3	
2	~~TH1-3~~	TH1-3					X	3	
3	~~TH2-2~~	TH2-2					X	3	
4	~~TH3-1~~	TH3-1					X	3	
5		TH4-1					X	3	
6									
7									
8									
9									
10									

* RELINQUISHED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	RECEIVED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	# jars used and not submitted	Laboratory Use Only: Time Sensitive	Temperature (°C) on Receipt	Custody Seal Intact on Cooler?
Chris PASSALIS	2017/09/20	1740	Jianwei Zhou	17/09/20	17:50		☐	5/7/7	☐ Yes ☒ No

* UNLESS OTHERWISE AGREED TO IN WRITING, WORK SUBMITTED ON THIS CHAIN OF CUSTODY IS SUBJECT TO MAXXAM'S STANDARD TERMS AND CONDITIONS. SIGNING OF THIS CHAIN OF CUSTODY DOCUMENT IS ACKNOWLEDGMENT AND ACCEPTANCE OF OUR TERMS WHICH ARE AVAILABLE FOR VIEWING AT WWW.MAXXAM.CA/TERMS.
* IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORD. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.
** ALL SANPLES ARE HELD FOR 60 DAYS AFTER SAMPLE RECEIPT, FOR SPECIAL REQUESTS CONTACT YOUR PROJECT MANAGER

White: Maxxam Yellow Client

16-4-05

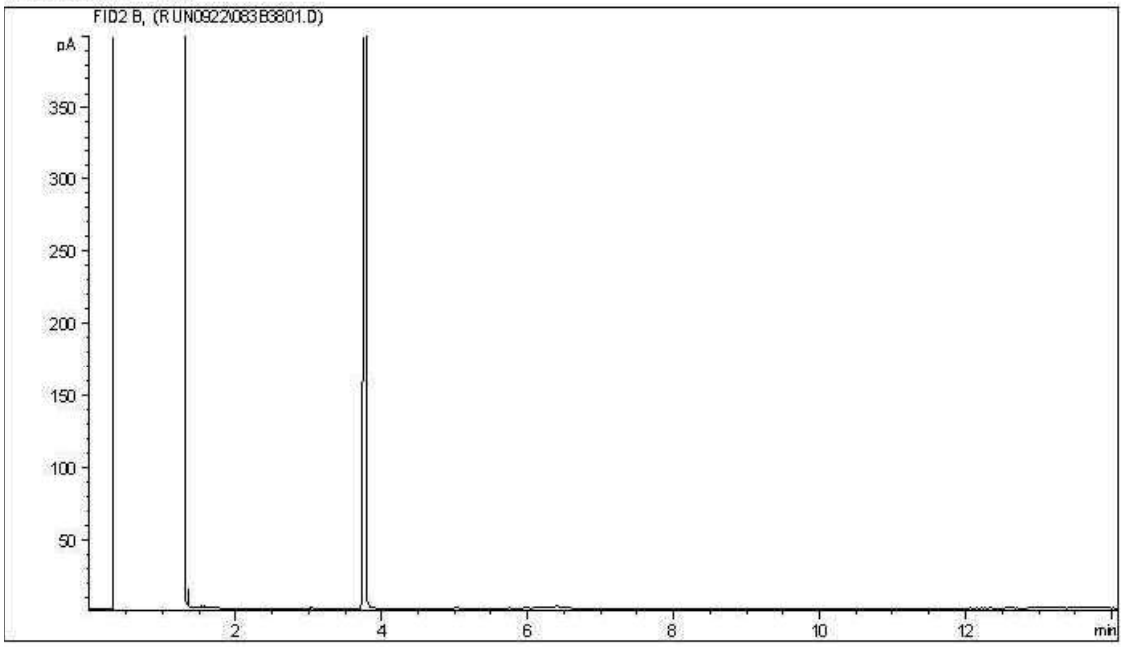
20-Sep-17 17:50
Kristi Bilodeau
B781571
JZ8 INS-0001

Maxxam Job #: B781571
Report Date: 2017/09/27
Maxxam Sample: SA1872

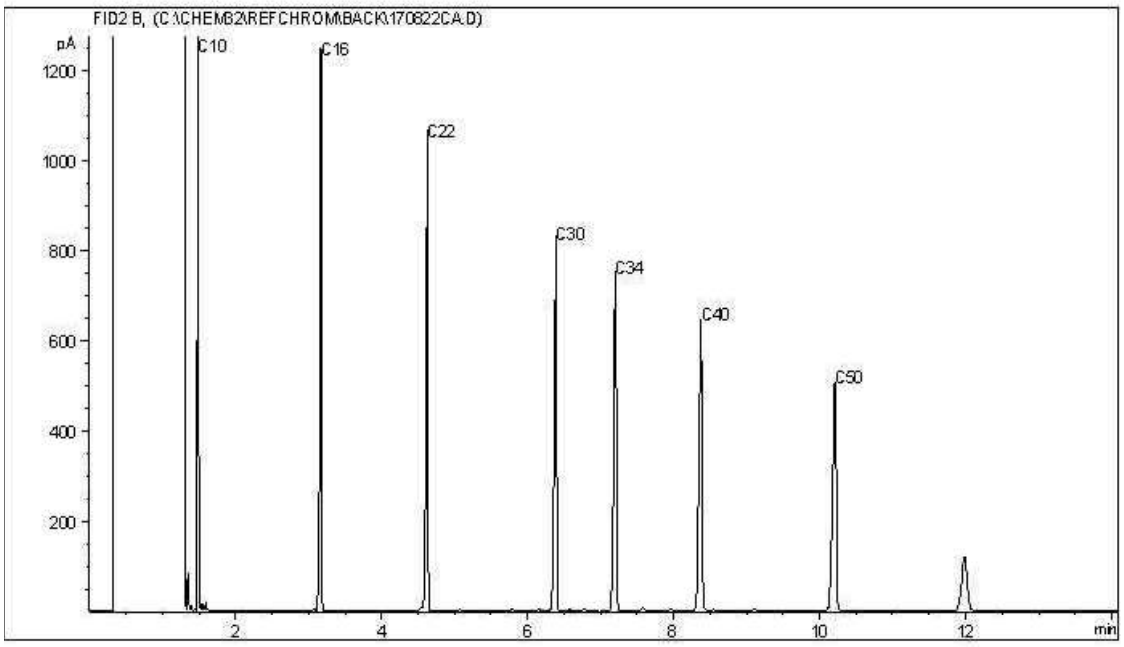
EGE ENGINEERING LTD.
Client Project #: 0125 095 02
Site Reference: TANK REPLACEMENT
Client ID: TH1-1

CCME Hydrocarbons (F2-F4 in soil) Chromatogram

Instrument: GC6



Carbon Range Distribution - Reference Chromatogram



TYPICAL PRODUCT CARBON NUMBER RANGES

Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

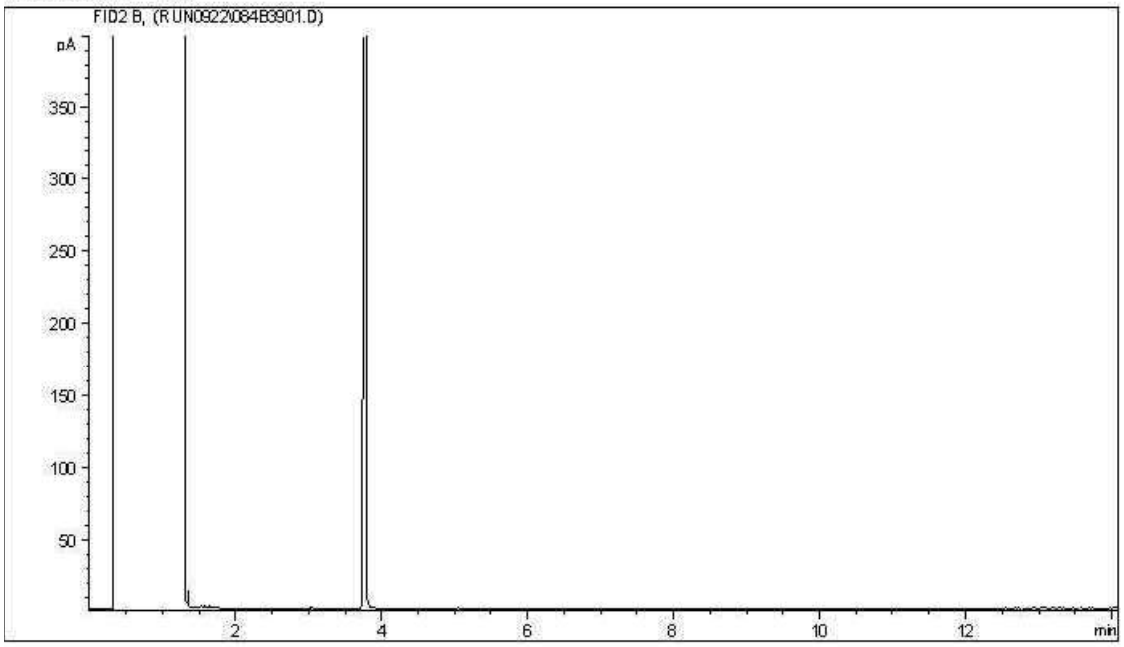
Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Maxxam Job #: B781571
Report Date: 2017/09/27
Maxxam Sample: SA1873

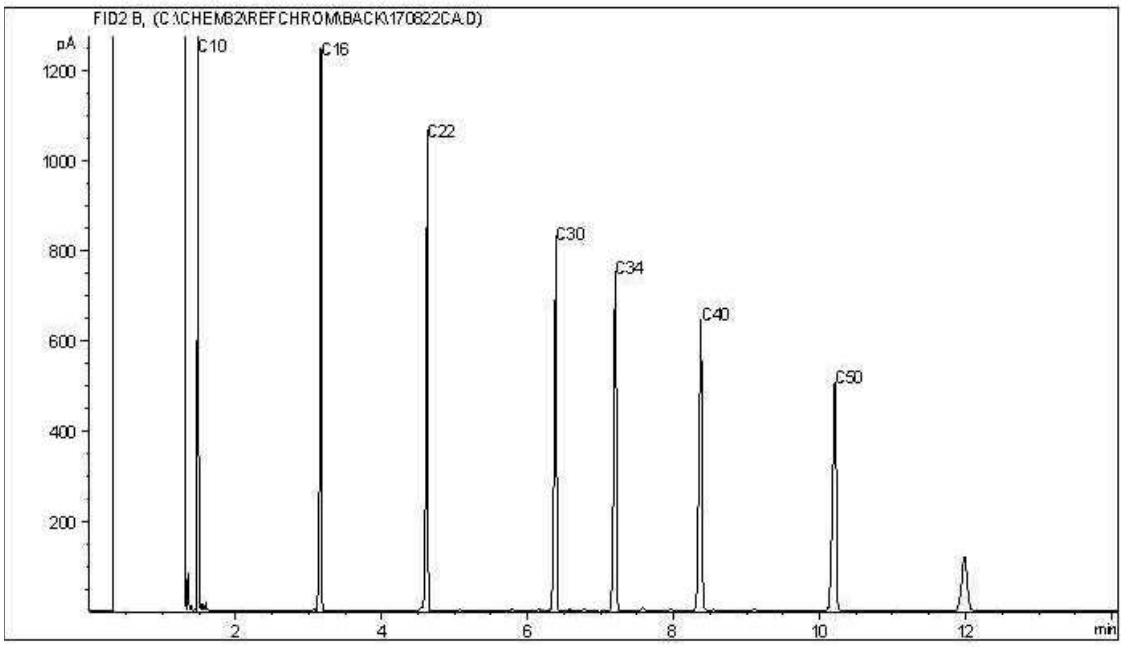
EGE ENGINEERING LTD.
Client Project #: 0125 095 02
Site Reference: TANK REPLACEMENT
Client ID: TH1-3

CCME Hydrocarbons (F2-F4 in soil) Chromatogram

Instrument: GC6



Carbon Range Distribution - Reference Chromatogram



TYPICAL PRODUCT CARBON NUMBER RANGES

Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

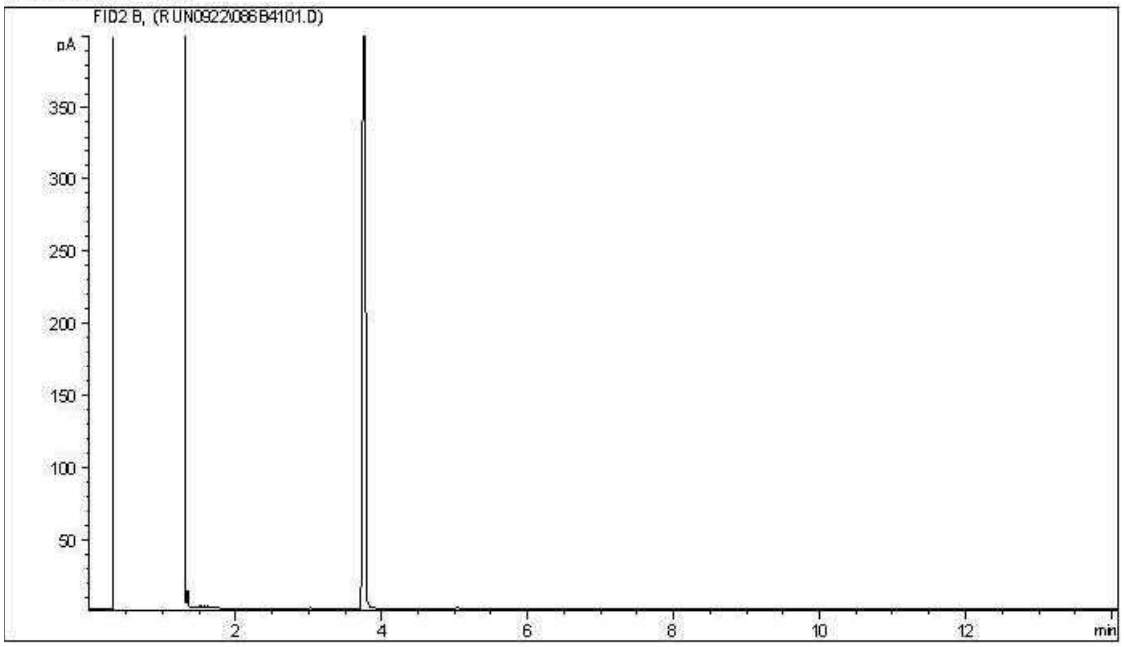
Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Maxxam Job #: B781571
Report Date: 2017/09/27
Maxxam Sample: SA1874

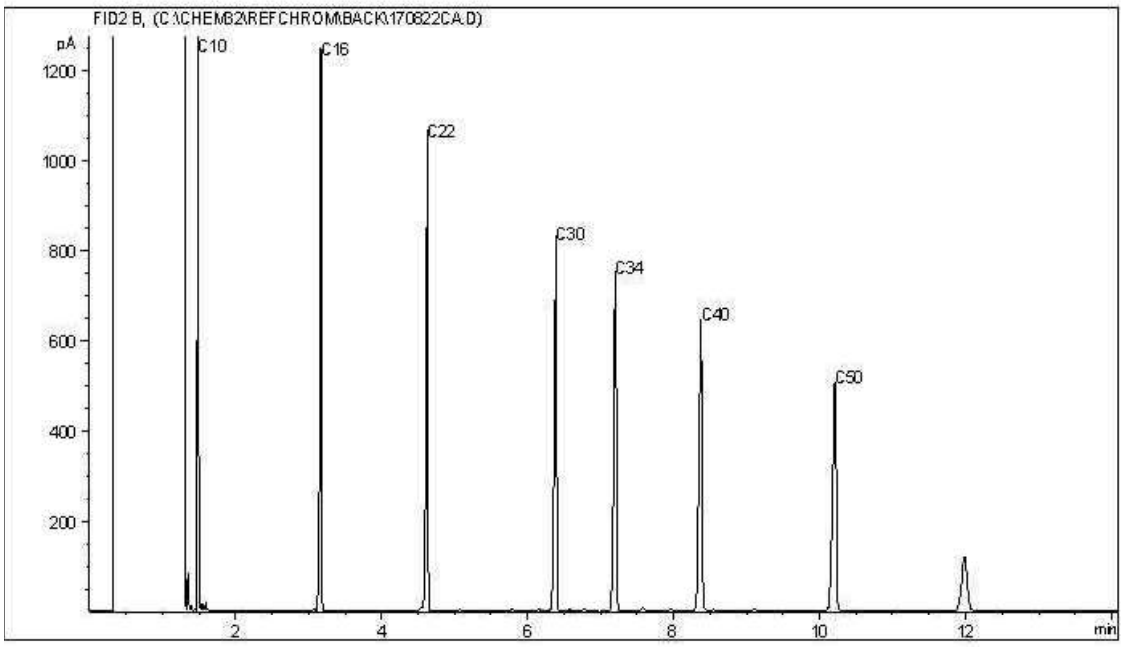
EGE ENGINEERING LTD.
Client Project #: 0125 095 02
Site Reference: TANK REPLACEMENT
Client ID: TH2-2

CCME Hydrocarbons (F2-F4 in soil) Chromatogram

Instrument: GC6



Carbon Range Distribution - Reference Chromatogram



TYPICAL PRODUCT CARBON NUMBER RANGES

Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

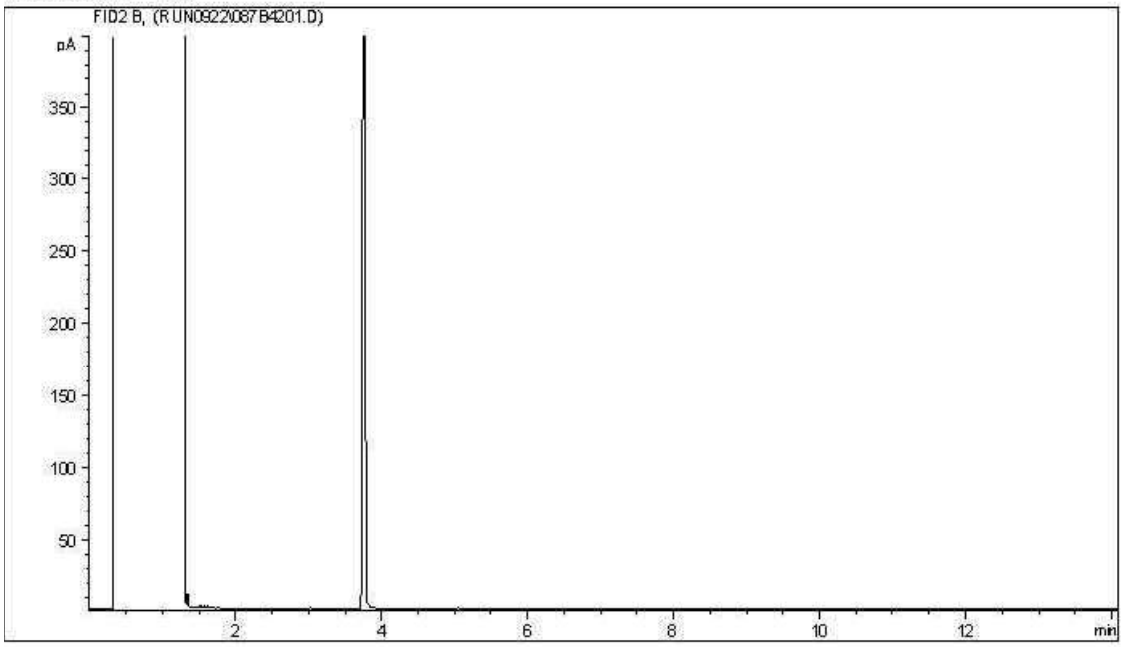
Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Maxxam Job #: B781571
Report Date: 2017/09/27
Maxxam Sample: SA1875

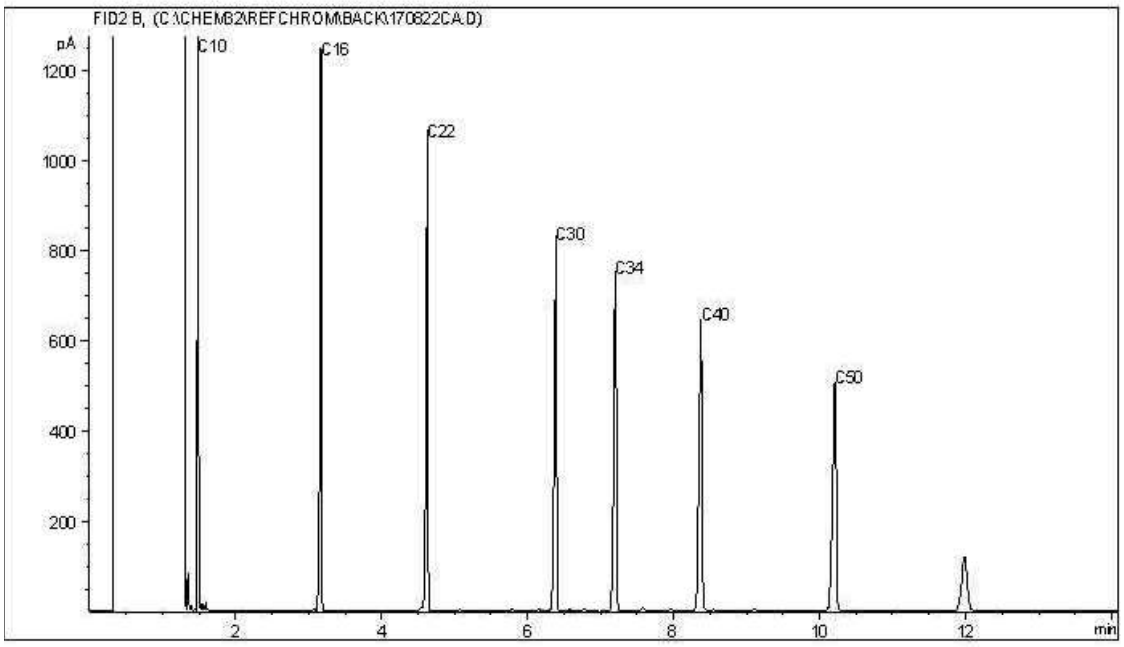
EGE ENGINEERING LTD.
Client Project #: 0125 095 02
Site Reference: TANK REPLACEMENT
Client ID: TH3-1

CCME Hydrocarbons (F2-F4 in soil) Chromatogram

Instrument: GC6



Carbon Range Distribution - Reference Chromatogram



TYPICAL PRODUCT CARBON NUMBER RANGES

Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

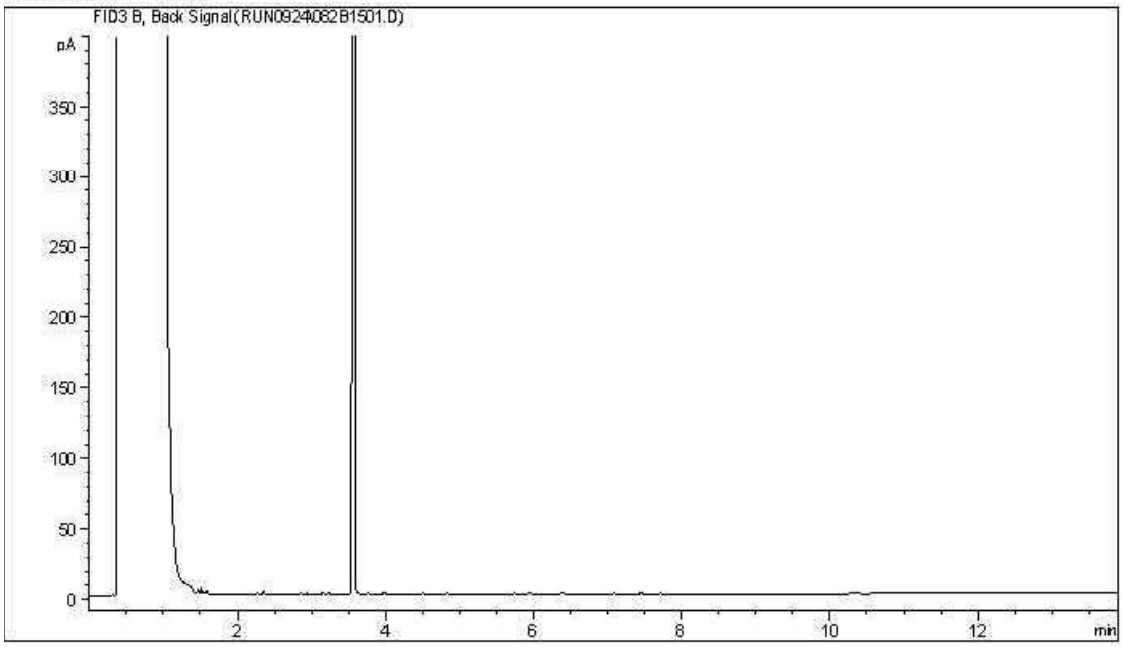
Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Maxxam Job #: B781571
Report Date: 2017/09/27
Maxxam Sample: SA1876

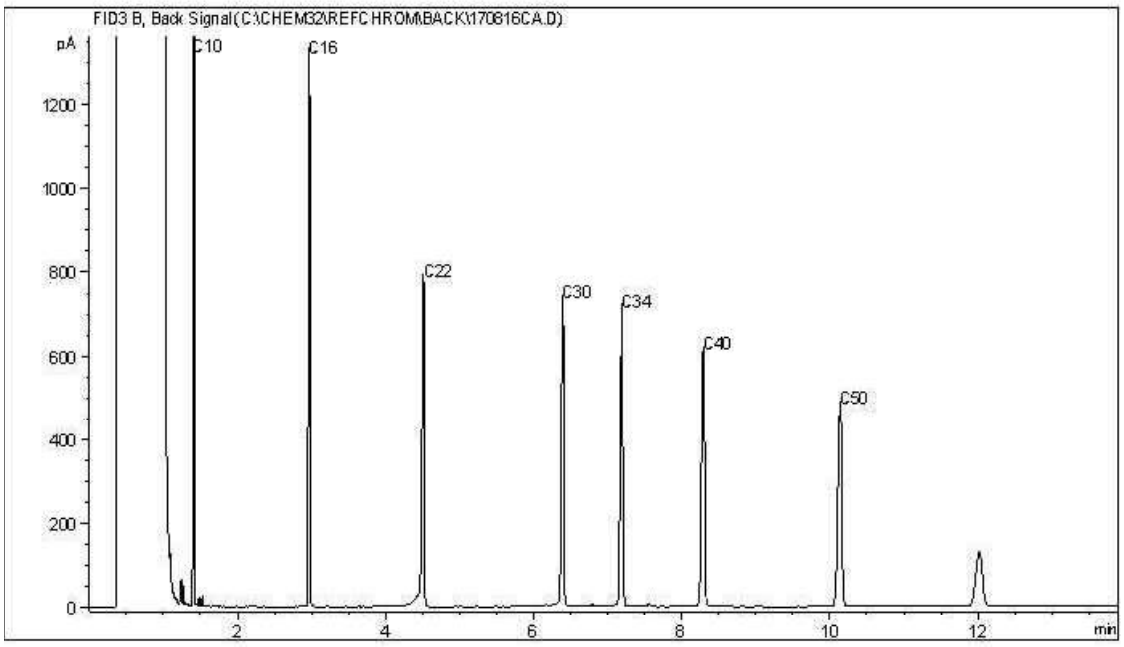
EGE ENGINEERING LTD.
Client Project #: 0125 095 02
Site Reference: TANK REPLACEMENT
Client ID: TH4-1

CCME Hydrocarbons (F2-F4 in soil) Chromatogram

Instrument: GC15



Carbon Range Distribution - Reference Chromatogram



TYPICAL PRODUCT CARBON NUMBER RANGES

Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

APPENDIX D

NATIONAL BEST MANAGEMENT PRACTICES FOR PETROLEUM STORAGE TANK SYSTEMS

National Best Management Practices for Petroleum Storage Tank Systems

Scope of Application:	This BMP applies to projects relating to permanent petroleum storage tanks (of all sizes) including: • removal of petroleum storage tank system, • replacement of petroleum storage tank system, and • upgrade of petroleum storage tank system. Associated activities included in the BMP include: • removal of a concrete or gravel base, • removal of contaminated soil, and • construction of physical product transfer area.
Exceptions:	In rare circumstances if contamination is discovered to have spread over some distance and the plume intersects with cultural resources or natural resources of concern, it will be necessary to stop work and conduct a BIA to determine the best course of action. If the contamination is discovered to have spread and the plume may have intersected surface water, wetlands and/or ground water, a BIA would be necessary. If the project has the potential to have an adverse effect on the critical habitat of a species at risk (with endangered, threatened, or extirpated status) this BMP does NOT apply. The project will require a separate environmental impact analysis. If the project has the potential for **residual** adverse effects on the individuals or residence of a listed species at risk this BMP does NOT apply, the project will require a separate environmental impact analysis. **Note:** If there is any uncertainty regarding potential adverse effects to species at risk, consult a member of the National Office Species Conservation team.
Approved geographic area of application:	This BMP is intended for use in all Parks Canada administered protected heritage places.

Effects Assessment and Mitigation

Components of the environment	**Soil/Land Resources** • Soil compaction and rutting • Slope instability, due to increased soil exposure and improper excavation and storage

that may be affected:	• Soil contamination **Air quality** • Decreased ambient air quality (i.e. from dust, equipment emissions, etc.) • Increased ambient noise levels • Temporary increased levels of CO2 and other pollutants **Flora and Fauna** • Damage to and/or removal of vegetation in immediate or adjacent areas • Introduction of non-native species populations, or expansion of existing populations • Wildlife sensory disturbance causing displacement/preferred habitat avoidance • Wildlife habituation/attraction to artificial food sources • Damage to nests/disruption of nesting animals **Cultural Resources** • Adverse effects on the heritage value or character-defining elements of a cultural resource • Impacts to archaeological resources (known or potential)
Mitigation Measures:	**Regulatory requirements** • The system or component must be withdrawn by a person approved to do so by the province/territory in which the system or component is located. If no person has been approved in the province/territory where the storage tank system or component is located, the withdrawal must be supervised by a professional engineer. • A record must be kept that includes the date on which the system or component was withdrawn from service and that establishes that the storage tank system or component was withdrawn by an approved person or that the withdrawal was supervised by a professional engineer. • The Federal Identification Registry for Storage Tanks Systems (FIRSTS) database must be updated as to the status of system within 60 days of withdrawal date. • The following technical and environmental work must comply with applicable federal guidelines/regulations should there be no federal guidelines/regulations then, applicable provincial/territorial regulatory requirements must be followed. • For further guidance on regulatory requirements on petroleum storage tank systems, please consult existing parks Canada guidelines and tools from the Office of the Chief, Environmental Management or the Environment Canada Webpage **Use of Construction Equipment/Trucks** • Schedule activities during times that minimize noise effects to visitors, nesting birds and wildlife in the area. • Delineate the work zone; clearly mark the limits to active construction and the access and egress locations.

	• Ensure machinery arrives on site in a clean condition and is maintained free of fluid leaks, invasive species, noxious weeds and soils from off-site. • Equipment movements and workers' private vehicles shall be restricted to the 'footprint' of the construction area. • Minimize vegetation-clearing activities and ground disturbance by staging on existing hardened areas wherever possible. • Avoid or terminate activities on site that attract or disturb wildlife. Vacate the area and stay away from the immediate location if wildlife display aggressive behaviour or persistent intrusion. • Control materials that might attract wildlife (e.g. petroleum products, human food and garbage). **Excavating** • Where possible, schedule work to avoid wet, windy and rainy periods that may increase erosion and sedimentation. • Excavation plans must be compared to local archaeological resource inventories, if available. If no archaeological information is available for the work area, an Archaeological Overview Assessment (AOA) may be required to determine the archaeological potential of the work area. Based on the results from the AOA, an Archaeological Impact Assessment might be required. • If cultural resources (eg. archaeological resources) are discovered, immediately cease work, and alert appropriate Parks Canada staff. • Backfill and compact excavations as soon as possible. Optimize degree of compaction to minimize erosion and allow for re-vegetation. • Where possible, sweep up loose material or debris. Any material thought to pose a risk of contamination to soils, surface water or groundwater should be disposed of appropriately off-site. • Where appropriate, prevent the transport of sediment by installing appropriate erosion and sediment control. • Cover all stockpiled material with heavy-duty plastic or filter cloth to prevent erosion during precipitation events. **Removal of the tank and concrete foundation** • Remove and dispose of all liquids and sludge in the tank in compliance with with provincial/territorial guidelines and standards. • Purge the tank of vapours to less than 10% of the lower flammability limit and check for the presence of vapours with a combustible gas meter. • Following removal of the Underground Storage Tank, the floor and sidewalls of the excavation must be examined for visual and olfactory evidence of petroleum impacts and screened for the potential presence of volatile organic compounds (VOCs) using a real-time, organic vapor analyzer. • Dispose of tank through certified scrap dealer and landfill in compliance with provincial/territorial guidelines and standards. • Minimize dust spread during the removal of concrete or gravel base. • Dispose of concrete in an approved landfill. **Contaminated soil testing and removal**

	• Should the visual and olfactory evidence and the VOCs reading suggest soil contamination; conduct field testing to determine the extent of the contamination in compliance with provincial/territorial guidelines and standards. • If extra excavation is required beyond the storage tank footprint, there may be additional impacts to cultural or natural resources. Reevaluate the need for an AOA and/or consultation with an ecologist. • Excavate all contaminated soil in compliance with federal guidelines and supplement with provincial/territorial guidelines and standards should federal guidelines be unavailable. • Store, transport and dispose of contaminated soil in compliance with federal, provincial/territorial guidelines and standards. • Stockpiling of non-contaminated excavated soils and fill materials in a location that minimizes the potential for silt transport into water courses from storm water runoff.