



**Public Works and
Government Services Canada**

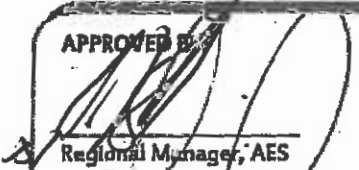
Requisition No. EZ899-180888

MERX I.D. No. _____

SPECIFICATIONS
for
**PORT HARDY AIRPORT
WATERMAIN REPLACEMENT – PHASE 1
PORT HARDY, B.C.**

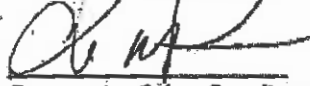
Project No. R.083359.001
June 2017

APPROVED BY



Regional Manager, AES


JUNE 28 / 2017
Date



Construction Safety Coordinator

JUNE 28
Date

TENDER:



Project Manager

29 JUN 17
Date

**Real Property Services Branch, Professional and Technical Services, Pacific Region
#219 800 Burrard Street, Vancouver, B.C. V6Z 2V8**

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JUN 20 2017

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1. CODES .1 Perform work to CURRENT Codes, Construction Standards and Bylaws, including Amendments up to the TENDER closing date
2. DESCRIPTION OF WORK .1 Work under this Contract comprises general construction for the supply and installation of new water distribution mains and abandonment of the existing main. The work also includes testing, commissioning, water service installation, tie-ins and complete site restoration to equal or better condition.
- .2 Work to be performed under this Contract includes, but is not limited to, the following items covered further in the Contract documents:
- 1 Construct work in stages to accommodate Transport Canada's continued use during construction.
 - .2 Prove existing utilities and advise Department Representative of any discrepancies 48 hours in advance of pipeline installation.
 - .3 Supply and Install water supply mains and services indicate as part of Phase 1 in a two phase project to replace the existing watermains.
 - .4 Complete daily temporary asphalt restoration
 - .5 Test all installed piping.
 - .6 Tie-ins and transfers
 - .7 Complete permanent site restorations to match existing or better conditions to the satisfaction of the Departmental Representative.
3. CONTRACT DOCUMENTS .1 The Contract documents, drawings and specifications are intended to complement each other, and to provide for and include everything necessary for the completion of the work.
- .2 Drawings are, in general, diagrammatic and are intended to indicate the scope and general arrangement of the work.
4. OTHER CONTRACTS .1 Cooperate with other Contractors in carrying out their respective works and carry out instructions from Departmental Representative.
- .2 Coordinate 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 this Work.

5. DIVISION OF SPECIFICATIONS

- .1 The specifications are subdivided in accordance with the current 6-digit National Master Specifications System.
- .2 A division may consist of the work of more than 1 subcontractor. Responsibility for determining which subcontractor provides the labour, material, equipment and services required to complete the work rests solely with the Contractor.
- .3 In the event of discrepancies or conflicts when interpreting the drawings and specifications, the specifications govern.

6. TIME OF COMPLETION

- .1 Total completion of the site work, including testing of the pipe line installation shall be no later than 12 weeks from contract award date.

7. HOURS OF WORK

- .1 No hours of work restrictions have been applied to this contract.

8. WORK SCHEDULE

- .1 Carry on work as follows:
 - .1 Within 10 working days after Contract award, provide a schedule showing anticipated progress stages and final completion of the work within the time period required by the Contract documents. Indicate the following:
 - .1 Submission of shop drawings, product data, MSDS sheets and samples.
 - .2 Commencement and completion of work of each section of the specifications or trade for each phase as outlined.
 - .3 Final completion date within the time period required by the Contract documents.
 - .2 Do not change approved Schedule without notifying Departmental Representative.
 - .3 Interim reviews of work progress based on work schedule will be conducted as decided by Departmental Representative and schedule updated by Contractor in conjunction with and to approval of Departmental Representative.

9. COST BREAKDOWN

- .1 Before submitting the first progress claim, submit a breakdown of the Contract lump sum prices in detail as directed by the Departmental Representative and aggregating Contract price.

10. CODES, BYLAWS,
STANDARDS

- .1 Perform work in accordance with the National Building Code of Canada, and other indicated Codes, Construction Standards and/or any other Code or Bylaw of local application.
- .2 Comply with applicable local bylaws, rules and regulations enforced at the location concerned.
- .3 Meet or exceed requirements of Contract documents, specified standards, codes and referenced documents.
- .4 In any case of conflict or discrepancy, the most stringent requirements shall apply.
- .5 All work shall be completed in accordance to the Geotechnical Investigation Report dated March 31, 2017 by Ryzuk Geotechnical. See Appendix A for a copy of the report.

11. DOCUMENTS REQUIRED

- .1 Maintain 1 copy each of the following at the job site:
 - .1 Contract drawings.
 - .2 Contract specifications.
 - .3 Addenda to Contract documents.
 - .4 Copy of approved work schedule.
 - .5 Reviewed/approved shop drawings.
 - .6 Change orders.
 - .7 Other modifications to Contract.
 - .8 Field test reports.
 - .9 Reviewed/approved samples.
 - .10 Manufacturers' installation and application instructions.
 - .11 One set of record drawings and specifications for "as-built" purposes.
 - .12 National Building Code of Canada.
 - .13 Current construction standards of workmanship listed in technical Sections.

12. REGULATORY
REQUIREMENTS

- .1 Obtain and pay for - Building Permit, Certificates, Licenses and other permits required by regulatory municipal, provincial or federal authorities to complete the work.
- .2 Provide inspection authorities with plans and information required for issue of acceptance certificates.
- .3 Furnish inspection certificates in evidence that the work installed conforms with the requirements of the authority having jurisdiction.

13. CONTRACTOR'S USE OF
SITE

- .1 Site located at Port Hardy Airport at the north end of Vancouver Island

- .2 Use of site:
 - .1 Assume responsibilities for work areas for performance of this work.
 - .2 Be responsible for coordination of all work activities on site, including the work of other contractors engaged by the Departmental Representative.
 - .3 Perform work in accordance with Contract documents. Ensure work is carried out in accordance with indicated phasing.
 - .4 Do not unreasonably encumber site with material or equipment
 - .5 Accept liability for damage, safety of equipment and overloading of existing equipment.
- .3 Port Hardy Airport will remain open during entire construction period for normal Airport operations.
- .5 Co-operate with Department Representative in scheduling operations to minimize conflict with Airport Operations.
- .6 Execute work with least possible interference or disturbance to the Airport operations and normal use of premises. Arrange with Departmental Representative to facilitate execution of work.
- .7 Repair or replace portions of existing work which have been altered during construction operations to match existing or adjoining work, as directed by Departmental Representative.
- .8 At completion of operations condition of existing work: equal to or better than that which existed before new work started.
- .9 Attend progress, safety and site security orientation meetings.

14. EXAMINATION

- .1 Examine site and be familiar and conversant with existing conditions likely to affect work.
- .2 Provide photographs of existing conditions, objects and structures prior to the start of the project.

15. EXISTING SERVICES

- .1 Notify, Departmental Representative and utility companies of intended interruption of services and obtain required permission.
- .2 Where Work involves breaking into or connecting to existing services, give the Departmental Representative 24 hours notice for necessary interruption throughout course of work. Minimize duration of interruptions. Carry out work at times

as directed by governing authorities with minimum disturbance to pedestrian, vehicular traffic and tenant operations.

- .3 Provide alternative routes for personnel and pedestrian and vehicular traffic as applicable.
- .4 Establish location and extent of service lines in area of work before starting Work. Notify Departmental Representative of findings.
- .5 Submit schedule to and obtain approval from Departmental Representative for any shut-down or closure of active service or facility including power and communications services. Adhere to approved schedule and provide notice to affected parties.
- .6 Provide temporary services when directed by Departmental Representative to maintain critical buildings and tenant systems.
- .7 Provide adequate bridging over trenches which traveled areas to permit normal traffic.
- .8 Where unknown services are encountered, immediately advise Departmental Representative and confirm findings in writing.
- .9 Protect, relocate or maintain existing active services. When inactive services are encountered, cap off in manner approved by authorities having jurisdiction.
- .10 Record locations of maintained, re-routed and abandoned service lines.

16. LOCATION OF
EQUIPMENT AND
FIXTURES

- .1 Location of equipment, fixtures and outlets indicated or specified are to be considered as approximate.
- .2 Locate equipment, fixtures and distribution systems to provide minimum interference and maximum usable space, and in accordance with manufacturer's recommendations for safety, access and maintenance.
- .3 Inform Departmental Representative of impending installation and obtain his approval for actual location.
- .4 Submit field drawings or shop drawings to indicate the relative position of various services and equipment when required by the Departmental Representative and/or as specified.

17. SETTING OUT OF WORK .1 Assume full responsibility for and execute complete layout of work to locations, lines and elevations indicated.
- .2 Provide devices needed to lay out and construct work.
- .3 Supply such devices as templates required to facilitate Departmental Representative's inspection of work.
18. QUALITY OF WORK .1 Ensure that quality workmanship is performed through use of skilled tradesmen, under supervision of qualified journeyman.
- .2 In cases of dispute, decisions as to standard or quality of work rest solely with the Departmental Representative, whose decision is final.
19. WORKS COORDINATION .1 Coordinate work of subtrades:
- .1 Designate one person to be responsible for review of contract documents and shop drawings and managing coordination of Work.
- .2 Convene meetings between subcontractors whose work interfaces and ensure awareness of areas and extent of interface required.
- .2 Provide each subcontractor with complete plans and specifications for Contract, to assist them in planning and carrying out their respective work.
- .3 Develop coordination drawings when required, illustrating potential interference between work of various trades and distribute to affected parties.
- .1 Pay particular close attention to overhead work above ceilings and within or near to building structural elements.
- .2 Identify on coordination drawings, building elements, services lines, rough-in points and indicate location services entrance to site.
- .3 Facilitate meeting and review coordination drawings. Ensure subcontractors agree and sign off on drawings.
- .4 Publish minutes of each meeting.
- .5 Plan and coordinate work in such a way to minimize quantity of service line offsets.
- .6 Submit copy of coordination drawings and meeting minutes to Departmental Representative for information purposes.
- .4 Submit shop drawings and order of prefabricated equipment or rebuilt components only after coordination meeting for such items has taken place.
- .5 Work cooperation:

.1 Ensure cooperation between trades in order to facilitate general progress of Work and avoid situations of spatial interference.

.2 Ensure that each trade provides all other trades reasonable opportunity for completion of Work and in such a way as to prevent unnecessary delays, cutting, patching and removal or replacement of completed work.

.3 Ensure disputes between subcontractors are resolved.

.6 Departmental Representative is not responsible for, or accountable for extra costs incurred as a result of Contractor's failure to coordinate Work.

.7 Maintain efficient and continuous supervision.

20. APPROVAL OF SHOP
DRAWINGS, PRODUCT DATA
AND SAMPLES

.1 In accordance with Section 013300, submit the requested shop drawings, product data, MSDS sheets and samples indicated in each of the technical Sections.

.2 Allow sufficient time for the following:

.1 Review of product data.

.2 Approval of shop drawings.

.3 Review of re-submission.

21. PROJECT MEETINGS

.1 Departmental Representative will arrange project meetings and assume responsibility for setting times and recording and distributing minutes.

22. TESTING AND
INSPECTIONS

.1 The Contractor will appoint and pay for the services of testing agency or testing laboratory as specified, and where required for the following:

.1 Inspection and testing required by laws, ordinances, rules, regulations or orders of public authorities.

.2 Inspection and testing performed exclusively for Contractor's convenience

.3 Certificates of compliance.

.4 Tests specified to be carried out by Contractor under the Departmental Representative's supervision.

.2 The contractor shall provide potable water for all flushing and testing of all sewage forcemains and watermains. The Department Representative does not have a sufficient water supply to complete the flushing and testing as required.

.3 Where tests or inspections by designated testing laboratory reveal work is not in accordance with the Contract requirements, Contractor shall pay

costs for additional tests or inspections as the Departmental Representative may require to verify acceptability of corrected work.

- .4 Contractor shall furnish labour and facilities to:
 - .1 Notify Departmental Representative in advance of planned testing.
- .5 Where materials are specified to be tested, deliver representative samples in required quantity to testing laboratory.
- .6 Pay costs for uncovering and making good work that is covered before required inspection or testing is completed and approved by Departmental Representative.
- .7 The Departmental Representative may require, and pay for, additional inspection and testing services
- .8 Provide Departmental Representative with copies of testing laboratory reports as soon as they are available.

23. AS-BUILT DOCUMENTS

- .1 The Departmental Representative will provide 2 sets of drawings, 2 sets of specifications, and 2 copies of the original AutoCAD files for "as-built" purposes.
- .2 As work progresses, maintain accurate records to show all deviations from the Contract documents. Note on as-built specifications, drawings and shop drawings as changes occur.
- .3 Closeout submittals in accordance with Section 01 78 00.

24. CLEANING

- .1 Daily conduct cleaning and disposal operations. Comply with local ordinances and anti-pollution laws.
- .2 Ensure cleanup of the work areas each day after completion of work.

25. ENVIRONMENTAL PROTECTION

- .1 Prepare an Erosion and Sediment Control Plan and provide monitoring and maintenance as per Section 01 35 43 - ENVIRONMENTAL PROCEDURES
- .2 Do not dispose of waste or volatile materials into water courses, storm or sanitary sewers.
- .3 Ensure proper disposal procedures in accordance with all applicable territorial regulations.

26. ADDITIONAL DRAWINGS .1 The Departmental Representative may furnish additional drawings for clarification. These additional drawings have the same meaning and intent as if they were included with plans referred to in the Contract documents.
- .2 Upon request, Departmental Representative may furnish up to a maximum of 10 sets of Contract documents for use by the Contractor at no additional cost. Should more than 10 sets of documents be required the Departmental Representative will provide them at additional cost.
27. SYSTEM OF MEASUREMENT .1 The metric system of measurement (SI) will be employed on this Contract.
28. SUBMISSION OF TENDER .1 Submission of a tender is deemed to be a confirmation of the fact that the Tenderer has analyzed the Contract documents and is fully conversant with all conditions.

-----END OF SECTION-----

PART 1 - GENERAL

1.1 ADMINISTRATIVE

- .1 Submit to Departmental Representative submittals listed for review. Submit promptly and in orderly sequence to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension by reason of such default will be allowed.
- .2 Do not proceed with Work affected by submittal until review is complete.
- .3 Present shop drawings, product data, samples and mock-ups in SI Metric units.
- .4 Where items or information is not produced in SI Metric units converted values are acceptable.
- .5 Review submittals prior to submission to Departmental Representative. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and co-ordinated with requirements of Work and Contract Documents. Submittals not stamped, signed, dated and identified as to specific project will be returned without being examined and considered rejected.
- .6 Notify Departmental Representative, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.
- .7 Verify field measurements and affected adjacent Work are co-ordinated.
- .8 Contractor's responsibility for errors and omissions in submission is not relieved by Departmental Representative's review of submittals.
- .9 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Departmental Representative review.
- .10 Keep one reviewed copy of each submission on site.

1.2 SHOP DRAWINGS
AND PRODUCT DATA

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

- .2 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.
- .3 Allow 5 working days for Departmental Representative's review of each submission.
- .4 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.
- .5 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.
- .6 Accompany submissions with transmittal letter, in duplicate, containing:
 - .1 Date.
 - .2 Project title and number.
 - .3 Contractor's name and address.
 - .4 Identification and quantity of each shop drawing, product data and sample.
 - .5 Other pertinent data.
- .7 Submissions include:
 - .1 Date and revision dates.
 - .2 Project title and number.
 - .3 Name and address of:
 - .1 Subcontractor.
 - .2 Supplier.
 - .3 Manufacturer.
 - .4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.
 - .5 Details of appropriate portions of Work as applicable:
 - .1 Fabrication.
 - .2 Layout, showing dimensions, including identified field dimensions, and clearances.
 - .3 Setting or erection details.
 - .4 Capacities.
 - .5 Performance characteristics.
 - .6 Standards.

- .7 Operating weight.
 - .8 Wiring diagrams.
 - .9 Single line and schematic diagrams.
 - .10 Relationship to adjacent work.
- .8 After Departmental Representative's review, distribute copies.
- .9 Submit one PDF of shop drawings for each requirement requested in specification sections and as Departmental Representative may reasonably request.
- .10 Delete information not applicable to project.
- .11 Supplement standard information to provide details applicable to project.
- .12 If upon review by Departmental Representative, no errors or omissions are discovered or if only minor corrections are made, transparency will be returned and fabrication and installation of Work may proceed. If shop drawings are rejected, noted copy will be returned and resubmission of corrected shop drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.
- .13 The review of shop drawings by Public Works and Government Services Canada (PWGSC) is for sole purpose of ascertaining conformance with general concept.
- .1 This review shall not mean that PWGSC approves detail design inherent in shop drawings, responsibility for which shall remain with Contractor submitting same, and such review shall not relieve Contractor of responsibility for errors or omissions in shop drawings or of responsibility for meeting requirements of construction and Contract Documents.
 - .2 Without restricting generality of foregoing, Contractor is responsible for dimensions to be confirmed and correlated at job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for co-ordination of Work of sub-trades.
- 1.3 CERTIFICATES AND TRANSCRIPTS .1 Immediately after award of Contract, submit Workers' Compensation Board status.
- 1.4 APPROVALS .1 Approval of shop drawings: refer to Section 01 11 55, clause 20.0.

PART 1 - GENERAL

1.1 RELATED
SECTIONS

- .1 Section 32 11 23-Aggregate Base Courses.
- .2 Section 32 11 16.01-Granular Sub-Base.

1.2 REFERENCES

- .1 Manual of Uniform Traffic Control Devices for Streets and Highways for Canada, Transportation Association of Canada.
- .2 Traffic Control Manual for Work on Roadways, BC Ministry of Transportation

1.3 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 Comply with most recent editions of the Traffic Control Manual for Work on Roadways published by the BC Ministry of Transportation and the Manual of Uniform Traffic Control Devices for Streets and Highways for Canada published by the Transportation Association of Canada.
- .3 During progress of the Work, make adequate provision to accommodate normal traffic along roads and highways immediately adjacent to or crossing the works so as to cause minimum inconvenience to the general public.
- .4 When working on travelled way:
 - .1 Place equipment in position to present minimum of interference and hazard to travelling public.
 - .2 Keep equipment units as close together as working conditions permit and preferably on same side of travelled way.
 - .3 Do not leave equipment on travelled way overnight.
- .5 Do not close any lanes of road without prior approval of Departmental Representative. Before re-routing traffic erect suitable signs and devices in accordance with instructions reference manuals.
- .6 Keep travelled way graded, free of pot holes and of sufficient width for required number of lanes of traffic.
 - .1 Provide minimum 7 m wide temporary roadway for traffic in two-way sections through Work and on

detours.

.2 Provide minimum 5 m wide temporary roadway for traffic in one-way sections through Work and on detours.

.7 As directed by Departmental Representative, provide gravelled detours or temporary roads to facilitate passage of traffic around restricted construction area:

.1 Place and compact granular sub-base in accordance with Section 32 11 16.01 - Granular Sub-base.

.2 Place and compact granular base in accordance with Section 32 11 23 - Aggregate Base Courses.

.8 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 meet approval of Departmental Representative.

1.4 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 reference manuals.

.3 Place signs and other devices in locations recommended in the reference manuals.

.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 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.

1.5 CONTROL OF PUBLIC TRAFFIC

.1 Provide competent flag persons, trained in accordance with, and properly equipped as specified in the reference manuals in following situations:

.1 When public traffic is required to pass working vehicles or equipment that block all or part of travelled roadway.

.2 When it is necessary to institute one-way traffic system through construction area or other

blockage where traffic volumes are heavy, approach speeds are high and traffic signal system is not in use.

.3 When workmen or equipment are employed on travelled way over brow of hills, around sharp curves or at other locations where oncoming traffic would not otherwise have adequate warning.

.4 Where temporary protection is required while other traffic control devices are being erected or taken down.

.5 For emergency protection when other traffic control devices are not readily available.

.6 In situations where complete protection for workers, working equipment and public traffic is not provided by other traffic control devices.

.7 At each end of restricted sections where pilot cars are required.

.8 Delays to public traffic due to contractor's operators: maximum 15 minutes.

.2 Where roadway, carrying two-way traffic, is restricted to one lane, for 24 hours each day, provide portable traffic signal system. Adjust, as necessary, and regularly maintain system during period of restriction. Signal system to meet requirements of the reference manuals.

1.6 OPERATIONAL
REQUIREMENTS

.1 Maintain existing conditions for traffic throughout period of contract except that, when required for construction under contract and when measures have been taken as specified and approved by Departmental Representative to protect and control public traffic.

.2 Maintain existing conditions for traffic crossing right-of-way.

-----END OF SECTION-----

PART 1 - GENERAL

1.1 REFERENCES

- .1 Government of Canada.
 - .1 Canada Labour Code - Part II
 - .2 Canada Occupational Health and Safety Regulations.
- .2 National Building Code of Canada (NBC 2005):
 - .1 Part 8, Safety Measures at Construction and Demolition Sites.
- .3 Canadian Standards Association (CSA):
 - .1 CSA Z797-2009 Code of Practice for Access Scaffold.
 - .2 CSA S269.1-1975 (R2003) Falsework for Construction Purposes
 - .3 CSA S350-M1980 (R2003) Code of Practice for Safety in Demolition of Structures
- .4 Fire Protection Engineering Services, HRSDC:
 - .1 FCC No. 301, Standard for Construction Operations.
 - .2 FCC No. 302, Standard for Welding and Cutting.
- .5 American National Standards Institute (ANSI):
 - .1 ANSI A10.3, Operations - Safety Requirements for Powder-Actuated Fastening Systems.
- .6 Province of British Columbia:
 - .1 Workers Compensation Act Part 3 Occupational Health and Safety.
 - .2 Occupational Health and Safety Regulation

1.2 RELATED SECTIONS

- .1 Refer to the following current NMS sections as required.
- .2 Section 01 33 00-Submittal Procedures.
- .3 Section 01 35 00.06-Special Procedures for Traffic Control.

1.3 WORKERS' COMPENSATION BOARD COVERAGE

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

1.4 COMPLIANCE WITH REGULATIONS

- .1 PWGSC may terminate the Contract without liability to PWGSC where the Contractor, in the opinion of PWGSC, refuses to comply with a requirement of the Workers' Compensation Act or the Occupational Health and Safety Regulations.
- .2 It is the Contractor's responsibility to ensure that all workers are qualified, competent and certified to perform the work as required by the Workers' Compensation Act or the Occupational Health and Safety Regulations.

1.5 SUBMITTALS

- .1 Submit to Department Representative submittal listed for review in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Work effected by submittal shall not proceed until review is complete
- .3 Submit the following:
 - .1 Health and Safety Plan.
 - .2 Copies of reports or directions issued by federal and provincial health and safety inspectors.
 - .3 Copies of incident and accident reports.
 - .4 Complete set of Material Safety Data Sheets (MSDS), and all other documentation required by Workplace Hazardous Materials Information System (WHMIS) requirements.
 - .5 Emergency procedures.
- .4 The Departmental Representative will review the Contractor's site-specific project Health and Safety Plan and emergency procedures, and provide comments to the Contractor within 7 days after receipt of the plan. Revise the plan as appropriate and resubmit to Departmental Representative for review upon request.
- .5 Medical surveillance: where prescribed by legislation, regulation or safety program, submit certification of medical surveillance for site personnel prior to commencement of work, and submit additional certifications for any new site personnel to Departmental Representative.
- .6 Submission of the Health and Safety Plan, and any revised version, to the Departmental Representative is for information and reference purposes only. It shall not:
 - .1 Be construed to imply approval by the Departmental Representative.
 - .2 Be interpreted as a warranty of being complete, accurate and legislatively compliant.
 - .3 Relieve the Contractor of his legal obligations for the provision of health and safety on the project.

- 1.6 RESPONSIBILITY
- .1 Assume responsibility as the Prime Contractor for work under this contract.
 - .2 Be responsible for health and safety of persons on site, safety of property on site and for protection of persons adjacent to site and environment to extent that they may be affected by conduct of Work.
 - .3 Comply with and enforce compliance by employees with safety requirements of Contract documents, applicable federal, provincial, territorial and local statutes, regulations, and ordinances, and with site-specific Health and Safety Plan.
- 1.7 GENERAL CONDITIONS
- .1 Provide safety barricades and lights around work site as required to provide a safe working environment for workers and protection for pedestrian and vehicular traffic.
 - .2 Ensure that non-authorized persons are not allowed to circulate in designated construction areas of the work site.
 - .1 Provide appropriate means by use of barricades, fences, warning signs, traffic control personnel, and temporary lighting as required.
 - .2 Secure site at night time as deemed necessary to protect site against entry.
- 1.8 REGULATORY REQUIREMENTS
- .1 Comply with specified codes, acts, bylaws, standards and regulations to ensure safe operations at site.
 - .2 In event of conflict between any provision of the above authorities, the most stringent provision will apply. Should a dispute arise in determining the most stringent requirement, the Departmental Representative will advise on the course of action to be followed.
- 1.9 FILING OF NOTICE
- .1 The General Contractor is to complete and submit a Notice of Project as required by provincial authorities.
 - .2 Provide copies of all notices to the Departmental Representative.
- 1.10 HEALTH AND SAFETY PLAN
- .1 Conduct a site-specific hazard assessment based on review of Contract documents, required work, and project site. Identify any known and potential health risks and safety hazards.
 - .2 Prepare and comply with a site-specific project Health and Safety Plan based on hazard assessment, including, but not limited to, the following:
 - .1 Primary requirements:
 - .1 Contractor's safety policy.

- .2 Identification of applicable compliance obligations.
- .3 Definition of responsibilities for project safety/organization chart for project.
- .4 General safety rules for project.
- .5 Job-specific safe work, procedures.
- .6 Inspection policy and procedures.
- .7 Incident reporting and investigation policy and procedures.
- .8 Occupational Health and Safety Committee/Representative procedures.
- .9 Occupational Health and Safety meetings.
- .10 Occupational Health and Safety communications and recordkeeping procedures.
- .2 Summary of health risks and safety hazards resulting from analysis of hazard assessment, with respect to site tasks and operations which must be performed as part of the work.
- .3 List hazardous materials to be brought on site as required by work.
- .4 Indicate engineering and administrative control measures to be implemented at the site for managing identified risks and hazards.
- .5 Identify personal protective equipment (PPE) to be used by workers.
- .6 Identify personnel and alternates responsible for site safety and health.
- .7 Identify personnel training requirements and training plan, including site orientation for new workers.
- .3 Develop the plan in collaboration with all subcontractors. Ensure that work/activities of subcontractors are included in the hazard assessment and are reflected in the plan.
- .4 Revise and update Health and Safety Plan as required, and re-submit to the Departmental Representative.
- .5 Departmental Representative's review: the review of Health and Safety Plan by Public Works and Government Services Canada (PWGSC) shall not relieve the Contractor of responsibility for errors or omissions in final Health and Safety Plan or of responsibility for meeting all requirements of construction and Contract documents.
- 1.11 EMERGENCY PROCEDURES
 - .1 List standard operating procedures and measures to be taken in emergency situations. Include an evacuation plan and emergency contacts (i.e. names/telephone numbers) of:
 - .1 Designated personnel from own company.
 - .2 Regulatory agencies applicable to work and as

- per legislated regulations.
- .3 Local emergency resources.
- .4 Departmental Representative.
- .2 Include the following provisions in the emergency procedures:
 - .1 Notify workers and the first-aid attendant, of the nature and location of the emergency.
 - .2 Evacuate all workers safely.
 - .3 Check and confirm the safe evacuation of all workers.
 - .4 Notify the fire department or other emergency responders.
 - .5 Notify adjacent workplaces or residences which may be affected if the risk extends beyond the workplace.
 - .6 Notify Departmental Representative.
- .3 Provide written rescue/evacuation procedures as required for, but not limited to:
 - .1 Work at high angles.
 - .2 Work in confined spaces or where there is a risk of entrapment.
 - .3 Work with hazardous substances.
 - .4 Underground work.
 - .5 Work on, over, under and adjacent to water.
 - .6 Workplaces where there are persons who require physical assistance to be moved.
- .4 Design and mark emergency exit routes to provide quick and unimpeded exit.
- .5 Revise and update emergency procedures as required, and re-submit to the Departmental Representative.
- 1.12 HEALTH & SAFETY COORDINATOR
 - .1 The Health and Safety Coordinator must:
 - .1 Be responsible for completing all health and safety training, and ensuring that personnel that do not successfully complete the required training are not permitted to enter the site to perform work.
 - .2 Be responsible for implementing, daily enforcing, and monitoring the Site Specific Health and Safety Plan
 - .3 Be on site during execution of work.
- 1.13 HAZARDOUS PRODUCTS
 - .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 (MSDS) acceptable to the Departmental Representative and in accordance with the Canada Labour Code.
 - .2 Where use of hazardous and toxic products cannot be avoided:
 - .1 Advise Departmental Representative beforehand

of the product(s) intended for use.

.2 In conjunction with Departmental Representative, schedule to carry out work during "off hours" when tenants have left the building.

.3 Provide adequate means of ventilation.

1.14 ELECTRICAL
SAFETY REQUIREMENTS

.1 Comply with authorities and ensure that, when installing new facilities or modifying existing facilities, all electrical personnel are completely familiar with existing and new electrical circuits and equipment and their operation.

.1 Before undertaking any work, coordinate required energizing and de-energizing of new and existing circuits with Departmental Representative.

.2 Maintain electrical safety procedures and take necessary precautions to ensure safety of all personnel working under this Contract, as well as safety of other personnel on site.

1.15 ELECTRICAL
LOCKOUT

.1 Develop, implement and enforce use of established procedures to provide electrical lockout and to ensure the health and safety of workers for every event where work must be done on any electrical circuit or facility.

.2 Prepare the lockout procedures in writing, listing step-by-step processes to be followed by workers, including how to prepare and issue the request/authorization form. Have procedures available for review upon request by the Departmental Representative.

.3 Keep the documents and lockout tags at the site and list in a log book for the full duration of the Contract. Upon request, make such data available for viewing by Departmental Representative or by any authorized safety representative.

1.16 OVERLOADING

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

1.17 FALSEWORK

.1 Design and construction falsework in accordance with CSA S269.1-1975 (R2003) Falsework for Construction Purposes.

1.18 CONFINED SPACES

.1 Carry out work in confined spaces in compliance with provincial regulations.

1.19 FIRE SAFETY
REQUIREMENTS

.1 Store oily/paint-soaked rags, waste products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed containers and remove from site on a daily basis.

.2 Handle, store, use and dispose of flammable and

combustible materials in accordance with the National Fire Code of Canada.

1.20 FIRE PROTECTION
AND ALARM SYSTEM

- .1 Fire protection and alarm systems shall not be:
 - .1 Obstructed.
 - .2 Shut off.
 - .3 Left inactive at the end of a working day or shift.
- .2 Do not use fire hydrants, standpipes and hose systems for purposes other than firefighting.
- .3 Be responsible/liable for costs incurred from the fire department, the building Department Representative and the tenants, resulting from false alarms.

1.21 UNFORESEEN
HAZARDS

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

1.22 POSTED DOCUMENTS

- .1 Post legible versions of the following documents on site:
 - .1 Health and Safety Plan.
 - .2 Sequence of work.
 - .3 Emergency procedures.
 - .4 Site drawing showing project layout, locations of the first-aid station, evacuation route and marshalling station, and the emergency transportation provisions.
 - .5 Notice of Project.
 - .6 Floor plans or site plans.
 - .7 Notice as to where a copy of the Workers' Compensation Act and Regulations are available on the work site for review by employees and workers.
 - .8 Workplace Hazardous Materials Information System (WHMIS) documents.
 - .9 Material Safety Data Sheets (MSDS).
 - .10 List of names of Joint Health and Safety Committee members, or Health and Safety Representative, as applicable.
- .2 Post all Material Safety Data Sheets (MSDS) on site, in a common area, visible to all workers and in locations accessible to tenants when work of this Contract includes construction activities adjacent to occupied areas.
- .3 Postings should be protected from the weather, and visible from the street or the exterior of the principal construction site shelter provided for workers and equipment, or as approved by the Departmental Representative.

- 1.23 MEETINGS .1 Attend health and safety pre-construction meeting and all subsequent meetings called by the Departmental Representative.
- 1.24 CORRECTION OF NON-COMPLIANCE .1 Immediately address health and safety non-compliance issues identified by the Departmental Representative.
- .2 Provide Departmental Representative with written report of action taken to correct non-compliance with health and safety issues identified.
- .3 The Departmental Representative may issue a "stop work order" if non-compliance of health and safety regulations is not corrected immediately or within posted time. The Contractor will be responsible for any costs arising from such a "stop work order".

-----END OF SECTION-----

PART 1 - GENERAL

- 1.1 RELATED SECTIONS .1 Section 01 33 00-Submittal Procedures
- 1.2 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. Control of environmental pollution and damage requires consideration of land, water, and air; biological and cultural resources; and includes management of visual aesthetics; noise; solid, chemical, gaseous, and liquid waste; radiant energy and radioactive material as well as other pollutants.
- 1.3 SUBMITTALS .1 The contractor shall prepare an Erosion and Sediment Control Plan.
- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- 1.4 FIRES .1 Fires and burning of rubbish on site not permitted.
- 1.5 DISPOSAL OF WASTES .1 Do not bury rubbish and waste materials on site unless approved by Departmental Representative.
- .2 Do not dispose of waste or volatile materials, such as mineral spirits, oil or paint thinner into waterways, storm or sanitary sewers.
- .3 Safely dispose of wet concrete and pipe grout off-site in accordance with Municipal, Provincial and Federal authorities' requirements.
- 1.6 EROSION AND SEDIMENT CONTROL / DRAINAGE .1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust that complies with the most stringent requirements of the authorities having jurisdiction.
- .2 The Erosion and Sediment control plan shall be prepared and submitted for the Department

Representative a minimum of 1 week prior to the start of construction and implemented during construction. The plan shall follow the recommendations of the *Land Development Guidelines for the Protection of Aquatic Habitat* (Fisheries and Ocean Canada and BC Ministry of Environment, Lands and Parks, 1992) and *A Users Guide to Working In and Around Water* (BC Ministry of Environment 2005). The plan shall include both structural and non-structural Best Management Practices.

- .3 The Erosion and Sediment Control plan shall consist of two key components:
 - .1 Effectiveness monitoring of the mitigation measures to ensure they are functioning as intended
 - .2 Water quality monitoring, which shall further confirm whether Erosion and Sediment control measures are function adequately as well as intended and ensuring that impacts to aquatic life/habitat are minimized. Water quality monitoring shall follow the parameters outlined in British Columbia's Ambient Water Quality Guideline (Criteria) for Turbidity, Suspended, and Benthic Sediments.
- .4 The Contractor shall retain an independent qualified Environmental Consultant to prepare an Erosion and Sediment Control (ESC) plan and completed the monitoring. The ESC supervisor shall provide weekly reports to the Department Representative until permanent vegetation has been established and the ESC Supervisor has signed off on removal of the works.
- .5 The contractor shall inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
- .6 The Erosion and Sediment Control Plan shall be signed and sealed by a Professional Engineer registered in the Province of British Columbia.
- .7 All work shall be undertaken and completed in such a manner as to prevent the release of sediment, silt, or sediment laden water, concrete or concrete leachate or any other deleterious substance into any ditch or water course.
- .8 Do not pump water containing suspended materials into waterways, sewer or drainage systems.
- .9 The contractor shall keep all portions of the work drained during construction until completion. Where necessary, catch water ditch shall be

constructed along the tops of excavations or fill slopes to prevent water flowing into or over the excavated or filled area. The contractor will be responsible for the repair for the damage, directly resulting for their operations and for the removal or dirt or debris from existing system, which may be caused by or which may result from water backing up or overflowing through, from, or along any part of the work or adjacent properties. The contractor shall bear all costs associated with these repairs until works are complete and accepted by the Department Representative.

- .10 The contractor shall modify and/or provide additional silt control measures as necessary to accommodate construction activities and satisfy the requirements or the governing agencies.
- .11 The contractor shall maintain all silt control facilities on an as-needed basis
- .12 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with local authority requirements.
- .13 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

1.7 SITE CLEARING AND PLANT PROTECTION

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

1.8 WORK ADJACENT TO WATERWAYS

- .1 Rip rap and headwall installation are to be done at low tides and in dry conditions.
- .2 Do not operate construction equipment in waterways.
- .3 Do not use waterway beds for borrow material without approval of Departmental Representative.

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

1.9 ENVIRONMENTALLY SENSITIVE HABITAT

- .1 The Contractor shall avoid all disruption to these areas.

1.10 POLLUTION CONTROL

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

1.11 SITE RESTORATION OF VEGETATED AREAS

- .1 All disrupted areas to be restored to match existing conditions
- .2 In vegetated areas, restoration shall include 100mm of topsoil and native vegetation to match existing.
- .2 Supply and plant native vegetation approved by Departmental Representative in all vegetated areas disrupted by the construction
- .3 Acceptable grass seeds mixtures shall be limited to the following native varieties: Creeping Red Fescue, Bromus sitchensis, Elymus Glaucus, and Agrostis exarata. Legumes shall be inoculated. The contractor shall provide the seed mixture to the Department Representative for acceptance prior to seeding.

1.12 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 of proposed corrective action and take such action for approval by Departmental Representative.
- .3 Departmental Representative will issue stop order of work until satisfactory corrective action has been taken.
- .4 No time extensions granted or equitable adjustments allowed to Contractor for such suspensions.

-----END OF SECTION-----

PART 1 - GENERAL

1.1 INSPECTION

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

Concrete	1 per 50 cu.m, one per day
Road Subbase and Granular Base (Densities)	1 per 500 sq. m
Trenches	1 per 100 lineal metres per 300mm lift
Asphalt - Marshall Test	1 test per asphalt type. Min 1 per day
Asphalt - Core	Every 200m per lane

1.2 INDEPENDENT INSPECTION AGENCIES

- .1 Independent Inspection/Testing Agencies shall be engaged by the Contractor for purpose of inspecting and/or testing portions of Work. Cost of such services will be borne by the Contractor.
- .2 Provide equipment required for executing inspection and testing by appointed agencies.
- .3 Employment of inspection/testing agencies does not relax responsibility to perform Work in accordance with Contract Documents.

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

1.3 ACCESS TO WORK

- .1 Allow inspection/testing agencies access to Work, off site manufacturing and fabrication plants.
- .2 Co-operate to provide reasonable facilities for such access.

1.4 PROCEDURES

- .1 Notify appropriate agency and Departmental Representative in advance of requirement for tests, in order that attendance arrangements can be made.
- .2 Submit samples and/or materials required for testing, as specifically requested in specifications. Submit with reasonable promptness and in orderly sequence to not cause delays in Work.
- .3 Provide labour and facilities to obtain and handle samples and materials on site. Provide sufficient space to store and cure test samples.

1.5 REJECTED WORK

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

1.6 REPORTS

- .1 Submit 4 copies of inspection and test reports to Departmental Representative. The inspection and certification report are to be submitted in PDF format during the construction stage with hard copies included in the Close Out documentation.

- 1.7 TESTS AND MIX DESIGNS .1 Furnish test results and mix designs as requested.
- DESIGNS .2 Cost of tests and mix designs beyond those called for in Contract Documents or beyond those required by law of Place of Work will be appraised by Departmental Representative and may be authorized as recoverable.
- 1.8 MILL TESTS .1 Submit mill test certificates as requested.

-----END OF SECTION-----

PART 1 - GENERAL

1.1 REFERENCES

- .1 Within text of each specifications section, reference may be made to reference standards.
- .2 Conform to these reference standards, in whole or in part as specifically requested in specifications.
- .3 If there is question as to whether 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.
- .4 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.

1.3 STORAGE,
HANDLING AND
PROTECTION

- .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 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 and 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.

1.4 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.

1.5 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.

1.6 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.

1.7 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.

1.8 REMEDIAL WORK

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

1.9 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 1 - GENERAL

1.1 PROJECT
CLEANLINESS

- .1 Maintain Work in tidy condition, free from accumulation of waste products and debris, other than that caused by Departmental Representative or other Contractors.
- .2 Remove waste materials from site at daily regularly scheduled times. Do not burn waste materials on site, unless approved by Departmental Representative.
- .3 Clear snow and ice from site to provide a safe working areas.
- .4 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .5 Provide on-site containers for collection of waste materials and debris.
- .6 Dispose of waste materials and debris off site.
- .7 Store volatile waste in covered metal containers, and remove from premises at end of each working day.

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.
- .2 Remove waste products and debris other than that caused by others, and leave Work clean and suitable for occupancy.
- .3 Prior to final review remove surplus products, tools, construction machinery and equipment.
- .4 Remove waste products and debris other than that caused by Departmental Representative or other Contractors.
- .5 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .6 Broom clean and wash exterior walks, steps and surfaces; rake clean other surfaces of grounds.
- .7 Remove dirt and other disfiguration from exterior surfaces.
- .8 Sweep and wash clean paved areas.

-----END OF SECTION-----

PART 1 - GENERAL

1.1 RELATED
SECTIONS

- .1 Section 01 33 00-Submittal Procedures.
- .2 Section 01 45 00-Quality Control

1.2 SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Copy will be returned after final inspection with Departmental Representative comments.
- .3 Revise content of documents as required prior to final submittal.
- .4 Furnish evidence, for type, source and quality of products provided.
- .5 Defective products will be rejected, regardless of previous inspections. Replace products at own expense.
- .6 Pay costs of transportation.
- .7 Submit to Department Representative, 4 final copies of all test reports completed for this project including compaction tests, granular material gradations, pipeline pressure tests, watermain certifications, a minimum 2 weeks prior to Substantial Performance of the Work.

1.3 FORMAT

- .1 Organize data as instructional manual.
- .2 Binders: vinyl, hard covered, 3 'D' ring, loose leaf 219 x 279mm with spine and face pockets.
- .3 When multiple binders are used correlate data into related consistent groupings. Identify contents of each binder on spine.
- .4 Cover: identify each binder with type or printed title 'Project Record Documents'; list title of project and identify subject matter of contents.
- .5 Arrange content by process flow, under Section numbers and sequence of Table of Contents.
- .6 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.
- .7 Text: manufacturer's printed data, or typewritten data.

- .8 Drawings: provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
- 1.4 CONTENTS - EACH VOLUME
- .1 Table of Contents: provide title of project;
 - .1 Date of submission; names.
 - .2 Addresses, and telephone numbers of Consultant 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. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in Section 01 45 00 - Quality Control.
- 1.5 AS-BUILTS
- .1 Maintain, in addition to requirements in General Conditions, 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 in field office apart from documents used for construction. Provide files, racks, and secure storage.
 - .3 Label record documents and file in accordance with Section number listings in List of Contents of this Project Manual. Label each document "PROJECT RECORD" in neat, large, printed letters.
 - .4 Maintain record documents in clean, dry and legible

1.6 RECORDING
ACTUAL SITE
CONDITIONS

- condition. Do not use record documents for construction purposes.
- .5 Keep record documents and samples available for inspection by Departmental Representative.
- .1 Record information on set of blue line, opaque drawings, and in copy of Project Manual, provided by Departmental Representative.
- .2 Provide felt tip marking pens, maintaining separate colours for each major system, for recording information.
- .3 Record information concurrently with construction progress. Do not conceal Work until required information is recorded.
- .4 Contract Drawings and shop drawings: mark each item to record actual construction, including:
.1 Measured depths of elements of foundation in relation to finish first floor datum.
.2 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
.3 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.
.4 Field changes of dimension and detail.
.5 Changes made by change orders.
.6 Details not on original Contract Drawings.
.7 References to related shop drawings and modifications.
- .5 Specifications: mark each item to record actual construction, including:
.1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items.
.2 Changes made by Addenda and change orders.
- .6 Other Documents: maintain manufacturer's certifications, inspection certifications, field test records, required by individual specifications sections to provide certification that all works have been completed as specified and that works are ready for tie-in.

-----END OF SECTION-----

PART 1 - GENERAL

1.1 SECTION INCLUDES .1 Methods for removal of existing asphalt pavement.

PART 2 - EXECUTION

2.1 PROTECTION .1 Protect existing pavement not designated for removal, light units and structures from damage. In event of damage, immediately replace or make repairs to approval of Department Representative at no additional cost.

2.2 REMOVAL .1 Remove existing asphalt pavement to lines and grades as established by in field.
.2 Use equipment and methods of removal and hauling which do not damage or disturb underlying pavement.
.3 Prevent contamination of removed asphalt pavement by topsoil, underlying gravel or other materials.
.4 Provide for suppression of dust generated by removal process.

2.3 SWEEPING .1 Sweep remaining asphalt pavement surfaces clean of debris resulting from removal operations using rotary power brooms and hand brooming as required.

PART 1 - GENERAL

- 1.1 RELATED SECTIONS .1 Section 01 33 00-Submittal Procedures.
- .2 Section 03 30 00-Cast-In-Place Concrete.
- .3 Section 33 05 13-Manholes Structures.
- 1.2 REFERENCES .1 American Concrete Institute (ACI)
- .1 SP-66, ACI Detailing Manual 2004.
- .1 ACI 315, Details and Detailing of Concrete Reinforcement.
- .2 ACI 315R, Manual of Engineering and Placing Drawings for Reinforced Concrete Structures.
- .2 American Society for Testing and Materials International (ASTM)
- .1 ASTM A 143/A 143M, Standard Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement.
- .2 ASTM A 185/A 185M, Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
- .3 ASTM A 497/A 497M, Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete.
- .4 ASTM A 775/A 775M, Standard Specification for Epoxy-Coated Reinforcing Steel Bars.
- .3 Canadian Standards Association (CSA International)
- .1 CSA-A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
- .2 CSA-A23.3, Design of Concrete Structures.
- .3 CAN/CSA-G30.18, Billet-Steel Bars for Concrete Reinforcement, A National Standard of Canada.
- .4 CSA-G40.20/G40.21, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
- .5 CAN/CSA-G164, Hot Dip Galvanizing of Irregularly Shaped Articles, A National Standard of Canada.
- .6 CSA W186, Welding of Reinforcing Bars in Reinforced Concrete Construction.
- .4 Reinforcing Steel Institute of Canada (RSIC)
- .1 RSIC, Reinforcing Steel Manual of Standard Practice.

1.3 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit shop drawings consisting of bar bending details, lists and placing drawings.
- .3 On placing drawings, indicate sizes, spacing, location and quantities of reinforcement and mechanical splices, with identifying code marks to permit correct placement with reference to structural drawings. Indicate sizes, spacing, and location of chairs, spacers and hangers. Drawings to be prepared in accordance with ACI315R, Manual of Contract Administrating and Place Drawing for Reinforced Concrete Structures.
- .4 Detail lap lengths and bar development length to CAN3-A23.3. Provide required tension lap splices.
- .5 Substitution of different size bars permitted only upon written approval of Department Representative.

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 as specified on contract drawings deformed bars to CAN/CSA-G30.12, unless indicated otherwise.
- .3 Reinforcing steel: weldable low alloy steel deformed bars to CSA-G30.16.
- .4 Cold-drawn annealed steel wire ties: to CSA G30.3.
- .5 Deformed steel wire for concrete reinforcement: to CSA G30.14.
- .6 Welded deformed steel wire fabric: to CSA G30.15. Provide in flat sheets only.
- .7 Epoxy Coating of non-prestressed reinforcement: to ASTM A775/A775M.
- .8 Galvanizing of non-prestressed reinforcement: to CAN/CSA-G164, minimum zinc coating 610 g/m².
- .9 Chairs, bolsters, bar supports, spacers: to CSA-A23.1.
- .10 Mechanical splices: subject to approval of Departmental Representative.

2.2 FABRICATION

- .1 Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and lists.
- .2 Fabricate reinforcing in accordance with with CAN/CSA-A23.1, ANSI/ACI 315, and ACI 315R Manual of Contract Administration and Placing Drawings for Reinforced Concrete Structures.
- .3 Upon Department Representative's approval for locations of reinforcement splices other than shown of placing drawings.
- .4 Obtain Department Representative's approval, weld reinforcement in accordance with CSA W186.

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/A23.2.
- .2 Prior to placing concrete, obtain Departmental Representative's approval of reinforcing material and placement.

3.3 FIELD TOUCH-UP

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

-----END OF SECTION-----

PART 1 - GENERAL

1.1 RELATED
SECTIONS

- .1 Section 03 20 00-Concrete Reinforcing.
- .2 Section 31 23 33.01-Excavating, Trenching and Backfilling.
- .3 Section 33 05 13-Manholes Structures.
- .4 Section 33 11 16- Watermains.
- .5 Section 33 31 13- Sanitary Sewer Gravity Mains.
- .6 Section 33 34 00-Sanitary Sewer Force Mains.

1.3 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM C 260, Standard Specification for Air-Entraining Admixtures for Concrete.
 - .2 ASTM C 309, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
 - .3 ASTM C 330, Standard Specification for Lightweight Aggregates for Structural Concrete.
 - .4 ASTM C 494/C 494M, Standard Specification for Chemical Admixtures for Concrete.
 - .5 ASTM C 1017/C 1017M, Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
 - .6 ASTM D 412, Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension.
 - .7 ASTM D 624, Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomer.
 - .8 ASTM D 1751, Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
 - .9 ASTM D 1752, Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-37.2, Emulsified Asphalt, Mineral Colloid-Type, Unfilled, for Dampproofing and Waterproofing and for Roof Coatings.
 - .2 CAN/CGSB-51.34, Vapour Barrier, Polyethylene Sheet for Use in Building Construction.
- .3 Canadian Standards Association (CSA International)
 - .1 CSA-A23.1/A23.2, Concrete Materials and

Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

.2 CSA A283, Qualification Code for Concrete Testing Laboratories.

.3 CAN/CSA-A3000, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).

.1 CSA-A3001, Cementitious Materials for Use in Concrete.

1.4 DESIGN
REQUIREMENTS

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

1.5 QUALITY
ASSURANCE

.1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.

.2 Contractor to pay for an independent testing agency to complete concrete tests.

.3 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 33 - Health and Safety Requirements.

1.6 DELIVERY,
STORAGE AND
HANDLING

.1 Concrete hauling time: maximum allowable time for concrete to be delivered to site of Work and discharged not to exceed 120 minutes after batching.

.1 Modifications to maximum time limit must be agreed to Departmental Representative and concrete producer as described in CSA A23.1/A23.2.

.2 Divert unused concrete materials from landfill to local facility as approved by Departmental Representative.

.3 Divert unused admixtures and additive materials (pigments, fibres) from landfill to official hazardous material collections site as approved by the Departmental Representative.

.4 Unused admixtures and additive materials must not be disposed of into sewer systems, into lakes, streams, onto ground or in other location where it will pose health or environmental hazard.

.5 Prevent admixtures and additive materials from entering drinking water supplies or streams. Using appropriate safety precautions, collect liquid or solidify liquid with inert, noncombustible material and remove for disposal. Dispose of waste in accordance with applicable local, Provincial and National regulations.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Cement: to CAN/CSA-A3001, Type GU.
- .2 Water: to CSA-A23.1.
- .3 Aggregates: to CAN/CSA-A23.1/A23.2.
- .4 Admixtures:
 - .1 Air entraining admixture: to ASTM C 260.
- .5 Grout:
 - .1 Cell-Crete™ or approved equivalent.

2.2 MIXES

- .1 Alternative 1 - Performance Method for specifying concrete: to meet Departmental Representative performance criteria in accordance with CAN/CSA-A23.1/A23.2.
 - .1 Ensure concrete supplier meets performance criteria as established below and provide verification of compliance as described in PART 3 - VERIFICATION.
 - .2 Provide concrete mix to meet following hard state requirements:
 - .1 Durability and class of exposure: C-1.
 - .2 Minimum compressive strength at 28 days age: 35 MPa.
 - .3 Surface texture: steel trowel finish.

PART 3 - EXECUTION

3.1 PREPARATION

- .1 Obtain Departmental Representative's approval before placing concrete.
 - .1 Provide 24 hours notice prior to placing of concrete.
- .2 Place concrete reinforcing in accordance with Section 03 20 00 - Concrete Reinforcing.
- .3 During concreting operations:
 - .1 Development of cold joints not allowed.
 - .2 Ensure concrete delivery and handling facilitates placing with minimum of re-handling, and without damage to existing structure or Work.
- .4 Prior to placing of concrete obtain Departmental Representative's approval of proposed method for protection of concrete during placing and curing in adverse weather.
- .5 Protect previous Work from staining.

- .6 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.

3.2 CONSTRUCTION

- .1 Do cast-in-place concrete work in accordance with CSA-A23.1/A23.2.

3.3 SURFACE TOLERANCE

- .1 Concrete tolerance in accordance with CSA-A23.1/A23.2 straightedge method.

3.4 FIELD QUALITY CONTROL

- .1 Site tests: conduct following test in accordance with Section 01 45 00 - Quality Control and submit report as described in PART 1 - SUBMITTALS.
 - .1 Slump tests.
- .2 Inspection and testing of concrete and concrete materials will be carried out by testing laboratory designated by Departmental Representative for review in accordance with CSA-A23.1/A23.2.
 - .1 Ensure testing laboratory is certified in accordance with CSA A283.
- .3 Non-Destructive Methods for Testing Concrete: in accordance with CSA-A23.1/A23.2.
- .4 Inspection or testing by Consultant will not augment or replace Contractor quality control nor relieve Contractor of his contractual responsibility.

3.5 VERIFICATION

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

-----END OF SECTION-----

PART 1 - GENERAL

- 1.1 GENERAL
- .1 This specification is NOT to be used for any structural facilities such as buildings, bridges, retaining wall, or similar structure requiring site specific structural engineering design.
 - .2 Except where specifically stated otherwise, all materials and methods in this Section conform to requirements of the latest version of CAN/CSA-A23.1.
- 1.2 REFERENCES
- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A 185/A 185M-[05a], Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
 - .2 ASTM A 775/A 775M-[04a], Standard Specification for Epoxy-Coated Reinforcing Steel Bars.
 - .3 ASTM C 260-[01], Standard Specification for Air-Entraining Admixtures for Concrete.
 - .4 ASTM D 412-[98a(2002)e1], Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension.
 - .5 ASTM D 2240-[05], Standard Test Method for Rubber Property - Durometer Hardness.
 - .2 Canadian Construction Documents Committee (CCDC)
 - .1 CCDC 2-[1994], Stipulated Price Contract.
 - .3 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.40-[97], Anticorrosive Structural Steel Alkyd Primer.
 - .2 CAN/CGSB-1.181-[99], Ready Mixed Organic Zinc-Rich Coating.
 - .4 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-A23.3-[04], Design of Concrete Structures.
 - .3 CSA-A23.4-[05], Precast Concrete - Materials and Construction.
 - .4 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.
 - .5 CAN/CSA-G30.18-[M92(R2002)], Billet-Steel Bars for Concrete Reinforcement.

- .6 CAN/CSA-G40.20/G40.21-[2004], General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
- .7 CAN/CSA-G164-[M92(R2003)], Hot Dip Galvanizing of Irregularly Shaped Articles.
- .8 CAN/CSA-S6-[2005], Canadian Highway Bridge Design Code.
- .9 CSA-W47.1-[03], Certification of Companies for Fusion Welding for Steel.
- .10 CAN/CSA W48-[01(R2006)], Filler Metals and Allied Materials for Metal Arc Welding (Developed in co-operation with the Canadian Welding Bureau).
- .11 CSA-W59-[03], Welded Steel Construction (Metal Arc Welding) (Metric version).
- .12 CSA-W186-[M1990(R2002)], Welding of Reinforcing Bars in Reinforced Concrete Construction.

- .5 The Master Painters Institute (MPI) - Architectural Painting Specification Manual (ASM) - [February 2004]

- .1 MPI # 18, Organic Zinc Rich Primer.
- .2 MPI # 23, Oil Alkyd Primer.

- .6 Underwriters' Laboratories of Canada (ULC)
 - .1 CAN/ULC-S701-[05], Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.

1.2 DESIGN REQUIREMENTS

- .1 Design precast elements to carry loads specified as indicated in accordance with applicable codes. All pre-cast elements to carry H20 traffic loading.

1.4 SUBMITTALS

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

1.5 QUALIFICATIONS

- .1 Fabricate and erect precast concrete elements by manufacturing plant certified in appropriate category according to CSA-A23.4
- .2 Precast concrete manufacturer to be certified in accordance with CSA's certification procedures for precast concrete plants prior to submitting bid and to specifically verify that plant is currently certified in appropriate category.
- .3 Only precast elements fabricated in such certified plants to be acceptable to Departmental Representative and plant certification to be

maintained for duration of fabrication, erection until warranty expires.

.4 Welding companies certified to CSA-W47.1.

1.6 DELIVERY,
STORAGE AND
HANDLING

.1 Deliver, handle and store precast/prestressed units according to manufacturer's instructions.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Precast concrete units to be constructed in accordance with CAN/CSA-A23.1 unless stated otherwise.

PART 3 - EXECUTION

3.1 GENERAL

.1 Install precast concrete unit, including surface tolerances, finishing and field quality control, in accordance with Contract Drawings.

.2 Protection, storage and handling of pre-cast concrete units to Manufacture's recommendation.

PART 1 - GENERAL

- 1.1 RELATED SECTIONS
- .1 Section 01 33 00-Submittal Procedures.
 - .2 Section 31 23 33.01-Excavating, Trenching and Backfilling.
 - .3 Section 32 11 16.01-Granular Sub-Base.
 - .4 Section 32 11 23-Aggregate Base Courses.
 - .5 Section 33 05 13-Manholes Structures.
 - .6 Section 33 11 16- Watermains.
- 1.2 REFERENCES
- .1 ASTM; AWWA; CAN - As specified in the contract document
- 1.3 SAMPLES
- .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Pay cost of sampling and testing of aggregates which fail to meet specified requirements.
- 1.4 WASTE MANAGEMENT AND DISPOSAL
- .1 Divert unused granular materials from landfill to local facility as approved by Departmental Representative.

PART 2 - PRODUCTS

- 2.1 MATERIALS
- .1 Aggregate quality: sound, hard, durable material free from soft, thin, elongated or laminated particles, organic material, clay lumps or minerals, or other substances that would act in deleterious manner for use intended.
 - .2 Flat and elongated particles of coarse aggregate: to ASTM D 4791.
 - .1 Greatest dimension to exceed five times least dimension.
 - .3 Fine aggregates satisfying requirements of applicable section to be one, or blend of following:
 - .1 Natural sand.
 - .2 Manufactured sand.

.3 Screenings produced in crushing of quarried rock, boulders, gravel or slag.

- .4 Coarse aggregates satisfying requirements of applicable section to be one of or blend of following:
- .1 Crushed rock.
 - .2 Gravel and crushed gravel composed of naturally formed particles of stone.
 - .3 Lightweight aggregate, including slag and expanded shale.

2.2 SOURCE QUALITY CONTROL

- .1 Inform Departmental Representative of proposed source of aggregates and provide access for sampling at least 4 weeks prior to commencing production.
- .2 If, in opinion of Departmental Representative, materials from proposed source do not meet, or cannot reasonably be processed to meet, specified requirements, locate an alternative source or demonstrate that material from source in question can be processed to meet specified requirements.
- .3 Advise Departmental Representative 4 weeks in advance of proposed change of material source.
- .4 Acceptance of material at source does not preclude future rejection if it fails to conform to requirements specified, lacks uniformity, or if its field performance is found to be unsatisfactory.

PART 3 - EXECUTION

3.1 PREPARATION

- .1 Topsoil stripping
- .1 Do not handle topsoil while in wet or frozen condition or in any manner in which soil structure is adversely affected.
 - .2 Begin topsoil stripping of areas as directed by Departmental Representative after area has been cleared of brush and grasses and removed from site.
 - .3 Strip topsoil to depths as indicated. Avoid mixing topsoil with subsoil.
 - .4 Dispose of topsoil to location as indicated off site.
- .2 Aggregate source preparation
- .1 Prior to excavating materials for aggregate production, clear and grub area to be worked, and strip unsuitable surface materials. Dispose of cleared, grubbed and unsuitable materials as

approved by authority having jurisdiction.

.2 When excavation is completed dress sides of excavation to nominal 1.5:1 slope, and provide drains or ditches as required to prevent surface standing water.

.3 Trim off and dress slopes of waste material piles and leave site in neat condition.

.3 Processing

.1 Process aggregate uniformly using methods that prevent contamination, segregation and degradation.

.2 Blend aggregates, if required, to obtain gradation requirements, percentage of crushed particles, or particle shapes, as specified. Use methods and equipment approved by Departmental Representative.

.3 Wash aggregates, if required to meet specifications. Use only equipment approved by Departmental Representative.

.4 When operating in stratified deposits use excavation equipment and methods that produce uniform, homogeneous aggregate.

.4 Handling

.1 Handle and transport aggregates to avoid segregation, contamination and degradation.

.5 Stockpiling

.1 Stockpile aggregates on site in locations as indicated unless directed otherwise by Departmental Representative. Do not stockpile on completed pavement surfaces.

3.2 CLEANING

.1 Leave aggregate stockpile site in tidy, well drained condition, free of standing surface water.

.2 Leave any unused aggregates in neat compact stockpiles as directed by Departmental Representative.

-----END OF SECTION-----

PART 1 - GENERAL

1.1 RELATED SECTIONS

- .1 Section 01 35 43-Environmental Procedures.
- .2 Section 31 05 16-Aggregate Materials.
- .3 Section 31 23 16.26-Rock Removal.
- .4 Section 33 05 13-Manholes and Catch Basin Structures.

1.2 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM C 117, Standard Test Method for Material Finer than 0.075 mm (No.200) Sieve in Mineral Aggregates by Washing.
 - .2 ASTM C 136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .3 ASTM D 422-63, Standard Test Method for Particle-Size Analysis of Soils.
 - .4 ASTM D 698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³) (600 kN-m/m³).
 - .5 ASTM D 1557, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³) (2,700 kN-m/m³).
 - .6 ASTM D 4318, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-8.1, Sieves, Testing, Woven Wire, Inch Series.
 - .2 CAN/CGSB-8.2, Sieves, Testing, Woven Wire, Metric.
- .3 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-A3000, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
 - .1 CSA-A3001, Cementitious Materials for Use in Concrete.
 - .2 CSA-A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

1.3 DEFINITIONS

- .1 Excavation classes: one class of excavation will be recognized; common excavation.
 - .1 Rock : solid material in excess of 1.00m³ and which cannot be removed by means of heavy duty mechanical excavating equipment with 1.0m³ bucket.

Frozen material not classified as rock.

.2 Common excavation: excavation of materials of whatever nature, which are not included under definitions of rock excavation.

.2 Topsoil:

.1 Material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping and seeding.

.2 Material reasonably free from subsoil, clay lumps, brush, objectionable weeds, and other litter, and free from cobbles, stumps, roots, and other objectionable material.

.3 Waste material: excavated material unsuitable for use in Work or surplus to requirements.

.4 Borrow material: material obtained from locations outside area to be graded, and required for construction of fill areas or for other portions of Work.

.5 Recycled fill material: material, considered inert, obtained from alternate sources and engineered to meet requirements of fill areas.

.6 Unsuitable materials:

.1 Weak, chemically unstable, and compressible materials.

.2 Frost susceptible materials:

.1 Fine grained soils with plasticity index less than 10 when tested to ASTM D 4318, and gradation within limits specified when tested to ASTM D 422 and ASTM C 136: Sieve sizes to CAN/CGSB-8.1.

.2 Coarse grained soils containing more than 10 % by mass passing 0.075 mm sieve.

.7 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.

1.4 QUALITY ASSURANCE

.1 Qualification Statement: submit proof of insurance coverage for professional liability.

.2 Design and supporting data submitted to bear stamp and signature of qualified professional engineer registered or licensed in Province of BC, Canada.

.3 Keep design and supporting data on site.

.4 Engage services of qualified professional Engineer who is registered or licensed in Province of C, Canada in which Work is to be carried out to design

and inspect cofferdams, shoring, bracing and underpinning required for Work.

- .5 Health and Safety Requirements:
 - .1 Do construction occupational health and safety in accordance with Section 01 35 33 - Health and Safety Requirements.

1.5 WASTE
MANAGEMENT AND
DISPOSAL

- .1 Divert excess materials from landfill to local facility for reuse.

1.6 EXISTING
CONDITIONS

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

.3 Where required for excavation, cut roots or branches as directed by Departmental Representative.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Type 1 and Type 2 fill: properties to Section 31 05 16 - Aggregate Materials and the following requirements:
- .1 Crushed, pit run or screened stone, gravel or sand.
 - .2 Gradations to be within limits specified when tested to ASTM C 136 and ASTM C 117. Sieve sizes to CAN/CGSB-8.2.

- .2 Table

<u>Sieve</u> <u>Designation</u>	<u>Percent Passing</u>
75mm	100
50mm	70-100
25mm	50-100
4.75mm	22-100
2.36mm	10-85
0.075mm	0-5

- .3 Type 3 fill: selected material from excavation or other sources, approved by Departmental Representative for use intended, unfrozen and free from rocks larger than 75mm, cinders, ashes, sods, refuse or other deleterious materials.

PART 3 - EXECUTION

3.1 TEMPORARY EROSION AND SEDIMENT CONTROL

- .1 All Erosion and Sediment Control to be completed as per Section 01 35 43 ENVIRONMENTAL PROCEDURES 1.6

3.2 SITE PREPARATION

- .1 Remove obstructions, ice and snow, from surfaces to be excavated within limits indicated.
- .2 Cut pavement or sidewalk neatly along limits of proposed excavation in order that surface may break evenly and cleanly.

3.3 PREPARATION/ PROTECTION

- .1 Protect existing features.
- .2 Keep excavations clean, free of standing water, and loose soil.

- .3 Where soil is subject to significant volume change due to change in moisture content, cover and protect to Departmental Representative approval.
- .4 Protect natural and man-made features required to remain undisturbed. Unless otherwise indicated or located in an area to be occupied by new construction, protect existing trees from damage.
- .5 Protect buried services that are required to remain undisturbed.

3.4 STRIPPING OF TOPSOIL

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

3.5 STOCKPILING

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

3.6 COFFERDAMS, SHORING, BRACING AND UNDERPINNING

- .1 Maintain sides and slopes of excavations in safe condition by appropriate methods and in accordance with Section 01 35 33 - Health and Safety Requirements.
- .2 During backfill operation:
 - .1 Unless otherwise indicated or directed by Departmental Representative, remove sheeting and shoring from excavations.
 - .2 Do not remove bracing until backfilling has reached respective levels of such bracing.
 - .3 Pull sheeting in increments that will ensure compacted backfill is maintained at elevation at

least 500mm above toe of sheeting.

3.7 DEWATERING AND HEAVE PREVENTION

- .1 Riprap and headwall installation are to be done at low tides and in dry conditions.
- .2 Keep excavations free of water while Work is in progress.
- .3 Provide for Departmental Representative's review details of proposed dewatering or heave prevention methods, including dikes, well points, and sheet pile cut-offs.
- .4 Avoid excavation below groundwater table if quick condition or heave is likely to occur.
 - .1 Prevent piping or bottom heave of excavations by groundwater lowering, sheet pile cut-offs, or other means.
- .5 Protect open excavations against flooding and damage due to surface run-off.
- .6 Dispose of water in a manner not detrimental to public and private property, or portion of Work completed or under construction.
 - .1 Provide and maintain temporary drainage ditches and other diversions outside of excavation limits.
- .7 Provide flocculation tanks, settling basins, or other treatment facilities to remove suspended solids or other materials before discharging to storm sewers, watercourses or drainage areas.

3.8 EXCAVATION

- .1 Excavate to lines, grades, elevations and dimensions as indicated.
- .2 Remove concrete, masonry, paving, walks demolished foundations and rubble and other obstructions encountered during excavation.
- .3 Excavation must not interfere with bearing capacity of adjacent foundations.
- .4 Do not disturb soil within branch spread of trees or shrubs that are to remain.
 - .1 If excavating through roots, excavate by hand and cut roots with sharp axe or saw.
- .5 For trench excavation, unless otherwise authorized by Departmental Representative in writing, do not excavate more than 30 m of trench in advance of installation operations and do not leave open more than 15 m at end of day's operation.

- .6 Keep excavated and stockpiled materials safe distance away from edge of trench as directed by Departmental Representative.
- .7 Restrict vehicle operations directly adjacent to open trenches.
- .8 Dispose of surplus and unsuitable excavated material off site.
- .9 Do not obstruct flow of surface drainage or natural watercourses.
- .10 Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft or organic matter.
- .11 Remove unsuitable material from trench bottom including those that extend below required elevations to extent and depth as directed by Departmental Representative.
- .12 Correct unauthorized over-excavation as follows:
 - .1 Fill under bearing surfaces and footings with Type 2 fill compacted to not less than 100% of corrected Standard Proctor maximum dry density.
 - .2 Fill under other areas with Type 2 fill compacted to not less than 95% of corrected Standard Proctor maximum dry density.
- .13 Hand trim, make firm and remove loose material and debris from excavations.
 - .1 Where material at bottom of excavation is disturbed, compact foundation soil to density at least equal to undisturbed soil.
 - .2 Clean out rock seams and fill with concrete mortar or grout to approval of Departmental Representative.

3.9 BEDDING AND SURROUND OF UNDERGROUND SERVICES

- .1 Place and compact granular material for bedding and surround of underground services as indicated.
- .2 Place bedding and surround material in unfrozen condition.

3.10 BACKFILLING

- .1 Do not proceed with backfilling operations until completion of following:
 - .1 Departmental Representative has inspected and approved installations.
 - .2 Departmental Representative has inspected and approved of construction below finish grade.
 - .3 Inspection, testing, approval, and recording location of underground utilities.

- .4 Removal of concrete formwork.
- .5 Removal of shoring and bracing; backfilling of voids with satisfactory soil material.
- .2 Areas to be backfilled to be free from debris, snow, ice, water and frozen ground.
- .3 Do not use backfill material which is frozen or contains ice, snow or debris.
- .4 Place backfill material in uniform layers not exceeding 300mm compacted thickness up to grades indicated. Compact each layer before placing succeeding layer.
- .5 Backfilling around installations:
 - .1 Do not backfill around or over cast-in-place concrete within 24 hours after placing of concrete.
 - .2 Place layers simultaneously on both sides of installed Work to equalize loading. Difference not to exceed 0.30 m.

3.11 RESTORATION

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

-----END OF SECTION-----

PART 1 - GENERAL

- 1.1 RELATED SECTIONS
- .1 Section 01 35 00.06-Special Procedures for Traffic Control.
 - .2 Section 31 05 16-Aggregate Materials.
- 1.2 REFERENCES
- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM C 117, Standard Test Methods for Material Finer Than 0.075 mm Sieve in Mineral Aggregates by Washing.
 - .2 ASTM C 131, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
 - .3 ASTM C 136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .4 ASTM D 422, Standard Test Method for Particle-Size Analysis of Soils.
 - .5 ASTM D 698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft-lbf/ft³) (600kN-m/m³).
 - .6 ASTM D 1557, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000ft-lbf/ft³) (2,700kN-m/m³).
 - .7 ASTM D 1883, Standard Test Method for CBR (California Bearing Ratio) of Laboratory Compacted Soils.
 - .8 ASTM D 4318, Standard Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils.
 - .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-8.1, Sieves, Testing, Woven Wire, Inch Series.
 - .2 CAN/CGSB-8.2, Sieves, Testing, Woven Wire, Metric.
- 1.3 WASTE MANAGEMENT AND DISPOSAL
- .1 Divert unused granular material from landfill to local facility.

PART 2 - PRODUCTS

- 2.1 MATERIALS
- .1 Granular sub-base material: in accordance with Section 31 05 16 - Aggregate Materials and following requirements:
 - .1 Crushed, pit run or screened stone, gravel or sand.

.2 Gradations to be within limits specified when tested to ASTM C 136 and ASTM C 117. Sieve sizes to CAN/CGSB-8.2.

.3 Table

<u>Sieve Designation</u>	<u>% Passing</u>
75 mm	100
38 mm	60-100
25 mm	-
19 mm	35-80
12.5 mm	-
9.5 mm	26-60
4.75 mm	20-40
2.36 mm	15-30
1.18 mm	10-20
0.6 mm	5-15
0.3 mm	3-10
0.180 mm	-
<u>0.075 mm</u>	<u>0-5</u>

.4 Other Properties as follows:

.1 Liquid Limit: to ASTM D 4318, Maximum 25.

.2 Plasticity Index: to ASTM D 4318, Maximum 6.

.3 Los Angeles degradation: to ASTM C 131. Max% Loss by mass: 40.

PART 3 - EXECUTION

3.1 PLACING

- .1 Place granular sub-base after subgrade is inspected and approved by Departmental Representative.
- .2 Construct granular sub-base to depth and grade in areas indicated.
- .3 Ensure no frozen material is placed.
- .4 Place material only on clean unfrozen surface, free from snow or ice.
- .5 Begin spreading sub-base material on crown line or high side of one-way slope.
- .6 Place granular sub-base materials using methods which do not lead to segregation or degradation.
- .7 Place material to full width in uniform layers not exceeding 300mm compacted thickness. Departmental Representative may authorize thicker lifts (layers) if specified compaction can be achieved.
- .8 Shape each layer to smooth contour and compact to

specified density before succeeding layer is placed.

- .9 Remove and replace portion of layer in which material has become segregated during spreading.

3.2 COMPACTION

- .1 Compaction equipment to be capable of obtaining required material densities.
- .2 Compact to density of not less than 100% Standard Proctor Density.
- .3 Shape and roll alternately to obtain smooth, even and uniformly compacted sub-base.
- .4 Apply water as necessary during compaction to obtain specified density.
- .5 Compaction of each lift of backfill material shall be verified through in-place density testing by the nuclear densometer method.
- .6 Contractor to provide test reports from an independent testing agency to Department Representative indicating specified compaction has been achieved.
- .7 In areas not accessible to rolling equipment, compact to specified density with mechanical tampers approved by Departmental Representative.
- .8 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.

3.3 SITE TOLERANCES

- .1 Finished sub-base surface to be within 15mm of elevation as indicated but not uniformly high or low.

3.4 PROTECTION

- .1 Maintain finished sub-base in condition conforming to this section until succeeding base is constructed, or until granular sub-base is accepted by Departmental Representative.

-----END OF SECTION-----

PART 1 - GENERAL

- 1.1 RELATED SECTIONS
- .1 Section 01 35 00.06-Special Procedures for Traffic Control.
 - .2 Section 32 11 16.01-Granular Sub-Base.
 - .3 Section 31 05 16-Aggregate Materials.
- 1.2 REFERENCES
- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM C 117, Standard Test Methods for Material Finer Than 0.075 mm Sieve in Mineral Aggregates by Washing.
 - .2 ASTM C 131, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
 - .3 ASTM C 136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .4 ASTM D 698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft-lbf/ft³) (600kN-m/m³).
 - .5 ASTM D 1557-[00], Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000ft-lbf/ft³) (2,700kN-m/m³).
 - .6 ASTM D 1883, Standard Test Method for CBR (California Bearing Ratio) of Laboratory Compacted Soils.
 - .7 ASTM D 4318, Standard Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils.
 - .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-8.1, Sieves, Testing, Woven Wire, Inch Series.
 - .2 CAN/CGSB-8.2, Sieves, Testing, Woven Wire, Metric.
- 1.3 WASTE MANAGEMENT AND DISPOSAL
- .1 Divert unused granular material from landfill to local facility.

PART 2 - PRODUCTS

- 2.1 MATERIALS
- .1 Granular base: material in accordance with Section 31 05 16 - Aggregate Materials and following requirements:
 - .1 Crushed stone or gravel.

.2 Gradations to be within limits specified when tested to ASTM C 136 and ASTM C 117. Sieve sizes to CAN/CGSB-8.2.

.1 Gradation Method # 1 to:

<u>Sieve Designation</u>	<u>% Passing</u>
19 mm	100
12.5 mm	75-100
9.5 mm	60-90
4.75 mm	40-70
2.36 mm	27-55
1.18 mm	16-42
0.600 mm	8-30
0.300 mm	5-20
0.075 mm	2-8

PART 3 - EXECUTION

3.1 SEQUENCE OF OPERATION

- .1 Place granular base after sub-base surface is inspected and approved by Departmental Representative.
- .2 Placing
 - .1 Construct granular base to depth and grade in areas indicated.
 - .2 Ensure no frozen material is placed.
 - .3 Place material only on clean unfrozen surface, free from snow and ice.
 - .4 Begin spreading base material on crown line or on high side of one-way slope.
 - .5 Place material using methods which do not lead to segregation or degradation of aggregate.
 - .6 For spreading and shaping material, use spreader boxes having adjustable templates or screeds which will place material in uniform layers of required thickness.
 - .7 Place material to full width in uniform layers not exceeding 150mm compacted thickness. Departmental Representative may authorize thicker lifts (layers) if specified compaction can be achieved.
 - .8 Shape each layer to smooth contour and compact to specified density before succeeding layer is placed.
 - .9 Remove and replace that portion of layer in which material becomes segregated during spreading.
- .3 Compaction Equipment
 - .1 Compaction equipment to be capable of obtaining required material densities.
- .4 Compacting

- .1 Compact to density not less than 100% Standard Proctor Density.
- .2 Shape and roll alternately to obtain smooth, even and uniformly compacted base.
- .3 Apply water as necessary during compacting to obtain specified density.
- .4 In areas not accessible to rolling equipment, compact to specified density with mechanical tampers approved by Departmental Representative.
- .5 Contractor to provide test reports from an independent testing agency to Department Representative indicating specified compaction has been achieved.
- .6 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.

- .5 Where compaction tests reveal areas of defective subgrade:
 - .1 Remove base, sub-base and subgrade material to depth and extent as directed by Departmental Representative.
 - .2 Backfill excavated subgrade with sub-base material and compact in accordance with Section 32 11 16.01 - Granular Sub-Base.
 - .3 Replace sub-base material and compact in accordance with Section 32 11 16.01 - Granular Sub-base.
 - .4 Replace base material and compact in accordance with this Section.
- .6 Where compaction tests reveals defective base or sub-base, remove defective materials to depth and extent as required and replace with new materials in accordance with Section 32 11 16.01 - Granular Sub-base and this section at no extra cost.

3.2 SITE TOLERANCES

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

3.3 PROTECTION

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

-----END OF SECTION-----

PART 1 - GENERAL

- 1.1 SECTION INCLUDES .1 Materials and application of asphalt prime to granular base surface prior to asphalt paving.
- 1.2 RELATED SECTIONS .1 Section 01 33 00-Submittal Procedures.
.2 Section 01 35 00.06-Special Procedures for Traffic Control.
.3 Section 32 12 16-Asphalt Paving.
- 1.3 REFERENCES .1 American Society for Testing and Materials International, (ASTM)
.1 ASTM D 140, Standard Practice for Sampling Bituminous Materials.
.2 Canadian General Standards Board (CGSB)
.1 CAN/CGSB-16.1, Cutback Asphalts for Road Purposes.
.2 CAN/CGSB-16.2, Emulsified Asphalts, Anionic Type, for Road Purposes.
- 1.4 QUALITY ASSURANCE .1 Upon request from Departmental Representative, submit manufacturer's test data and certification that asphalt prime material meets requirements of this Section.
- 1.5 DELIVERY, STORAGE AND HANDLING .1 Deliver, store and handle materials to ASTM D 140.
.2 Provide, maintain and restore asphalt storage area.
- 1.6 WASTE MANAGEMENT AND DISPOSAL .1 Divert unused asphalt materials from landfill to local facility approved by Departmental Representative.
.2 Divert unused aggregate materials from landfill to local facility approved by Departmental Representative.
- PART 2 - PRODUCTS
- 2.1 MATERIAL .1 Asphalt material: to CAN/CGSB-16.1 grade: RM-20 or CAN/CGSB-16.2 grade: SS-1.
.2 Sand blotter: clean granular material passing 4.75mm sieve and free from organic matter or other deleterious materials.

- .3 Water: clean, potable, free from foreign matter.

2.2 EQUIPMENT

- .1 Pressure distributor to be :
 - .1 Designed, equipped, maintained and operated so that asphalt material can be:
 - .1 Maintained at even temperature.
 - .2 Applied uniformly on variable widths of surface up to 5 m.
 - .3 Applied at controlled rates from 0.2 to 5.4 L/m² with uniform pressure, and allowable variation from any specified rate not exceeding 0.1 L/m².
 - .4 Distributed in uniform spray without atomization at temperature required.
 - .2 Equipped with meter registering metres of travel per minute, visibly located to enable truck driver to maintain constant speed required for application at specified rate.
 - .3 Equipped with pump having flow meter graduated in units of 5 L or less per minute passing through nozzles and readily visible to operator. Pump power unit to be independent of truck power unit.
 - .4 Equipped with easily read, accurate and sensitive device which registers temperature of liquid in reservoir.
 - .5 Equipped with accurate volume measuring device or calibrated tank.
 - .6 Equipped with nozzles of same make and dimensions, adjustable for fan width and orientation.
 - .7 Equipped with nozzle spray bar, with operational height adjustment.
 - .8 Cleaned if previously used with incompatible asphalt material.

PART 3 - EXECUTION

3.1 APPLICATION

- .1 Obtain Departmental Representative's approval of granular base surface before applying asphalt prime.
- .2 Cutback asphalt:
 - .1 Heat asphalt prime to [between 60 and 70 degrees C for pumping and spraying.
 - .2 Apply asphalt prime to granular base at rate as directed by Departmental Representative, but not to exceed 2 L/m².
 - .3 Apply on dry surface unless otherwise directed by Departmental Representative.
- .3 Anionic emulsified asphalt:

- .1 Dilute asphalt emulsion with clean water at 1:1 ratio for application.
- .2 Mix thoroughly by pumping or other method approved by Departmental Representative.
- .3 Apply diluted asphalt emulsion at rate directed by Departmental Representative, but do not exceed 5 L/m².
- .4 Apply diluted asphalt emulsion on damp surface unless otherwise directed by Departmental Representative.
- .4 Apply asphalt prime only on unfrozen surface.
- .5 Do not apply prime when air temperature is less than 5 degrees C or when rain is forecast within 2 hours.
- .6 Paint contact surfaces of curbs, gutters, headers, manholes and like structures with thin, uniform coat of asphalt prime material.
- .7 Where traffic is to be maintained, treat no more than one-half width of surface in one application.
- .8 Prevent overlap at junction of applications.
- .9 Do not prime surfaces that will be visible when paving is complete.
- .10 Apply additional material to areas not sufficiently covered as directed by Departmental Representative.
- .11 Keep traffic off primed areas until asphalt prime has cured.
- .12 Permit prime to cure before placing asphalt paving.

3.2 USE OF SAND
BLOTTER

- .1 If asphalt prime fails to penetrate within 24 hours, spread sand blotter material in amounts required to absorb excess material.
- .2 Allow sufficient time for excess prime to be absorbed as directed by Departmental Representative.
- .3 Apply second application of sand blotter as required.
- .4 Sweep and remove excess blotter material.

-----END OF SECTION-----

PART 1 - GENERAL

- 1.1 SECTION INCLUDES .1 Materials and application of asphalt tack coat to an existing asphalt or concrete surface prior to asphalt paving.
- 1.2 RELATED SECTIONS .1 Section 01 33 00-Submittal Procedures.
.2 Section 01 35 00.06-Special Procedures for Traffic Control.
.3 Section 32 12 16-Asphalt Paving.
- 1.3 MEASUREMENT PROCEDURES .1 All work included in this section shall be included in the lump sum bid for all materials, equipment and labour for the scope of work shown on the plans and specifications.
- 1.4 REFERENCES .1 American Society for Testing and Materials International, (ASTM)
.1 ASTM D 140, Standard Practice for Sampling Bituminous Materials.
.2 Canadian General Standards Board (CGSB)
.1 CAN/CGSB-16.2, Emulsified Asphalts, Anionic Type, for Road Purposes.
- 1.5 QUALITY ASSURANCE .1 Upon request by Departmental Representative, submit manufacturer's test data and certification that asphalt tack coat material meets requirements of this section.
- 1.6 DELIVERY, STORAGE AND HANDLING .1 Deliver, store and handle materials in accordance with ASTM D 140.
.2 Provide, maintain and restore asphalt storage area.
- 1.7 WASTE MANAGEMENT AND DISPOSAL .1 Divert unused asphalt from landfill to facility capable of recycling materials.

PART 2 - PRODUCTS

- 2.1 MATERIALS .1 Anionic emulsified asphalt: to CAN/CGSB-16.2, grade: SS-1.

- .2 Water: clean, potable, free from foreign matter.

2.2 EQUIPMENT

- .1 Pressure distributor to be:
 - .1 Designed, equipped, maintained and operated so that asphalt material can be:
 - .1 Maintained at even temperature.
 - .2 Applied uniformly on variable widths of surface up to 5 m.
 - .3 Applied at readily determined and controlled rates from 0.2 to 5.4 L/m² with uniform pressure, and with an allowable variation from any specified rate not exceeding 0.1 L/m².
 - .4 Distributed in uniform spray without atomization at temperature required.
 - .2 Equipped with meter, registering metres of travel per minute, visibly located to enable truck driver to maintain constant speed required for application at specified rate.
 - .3 Equipped with pump having flow meter graduated in units of 5 L or less per minute passing through nozzles and readily visible to operator. Pump power unit to be independent of truck power unit.
 - .4 Equipped with an easily read, accurate and sensitive device which registers temperature of liquid in reservoir.
 - .5 Equipped with accurate volume measuring device or calibrated tank.
 - .6 Equipped with nozzles of same make and dimensions, adjustable for fan width and orientation.
 - .7 Equipped with nozzle spray bar, with operational height adjustment.
 - .8 Cleaned if previously used with incompatible asphalt material.

PART 3 - EXECUTION

3.1 APPLICATION

- .1 Obtain Departmental Representative's approval of surface before applying asphalt tack coat.
- .2 Apply asphalt tack coat only on clean and dry surface.
- .3 Dilute asphalt emulsion with water at 1:1 ratio for application.
 - .1 Mix thoroughly by pumping or other method approved by Departmental Representative.
- .4 Apply asphalt tack coat evenly to pavement surface

at rate as directed by Departmental Representative, but not to exceed 5 L/m².

- .5 Paint contact surfaces of curbs, gutters, headers, manholes and like structures with thin, uniform coat of asphalt tack coat material.
- .6 Do not apply asphalt tack coat when air temperature is less than 5 degrees C or when rain is forecast within 2 hours of application.
- .7 Apply asphalt tack coat only on unfrozen surface.
- .8 Evenly distribute localized excessive deposits of tack coat by brooming as directed by Departmental Representative.
- .9 Where traffic is to be maintained, treat no more than one half of width of surface in one application.
- .10 Keep traffic off tacked areas until asphalt tack coat has set.
- .11 Re-tack contaminated or disturbed areas as directed by Departmental Representative.
- .12 Permit asphalt tack coat to set before placing asphalt pavement.

-----END OF SECTION-----

PART 1 - GENERAL

- 1.1 SECTION INCLUDES
- .1 Materials and installation for asphalt concrete paving for roads and airport runways.
- 1.2 RELATED SECTIONS
- .1 Section 01 33 00-Submittal Procedures.
- .2 Section 01 35 00.06-Special Procedures for Traffic Control.
- .3 Section 31 05 16-Aggregate Materials.
- .4 Section 32 12 15-Asphalt Tack Coats.
- .5 Section 32 12 14-Asphalt Prime Coats.
- 1.3 MEASUREMENT PROCEDURES
- .1 All work included in this section shall be included in the lump sum bid for all materials, equipment and labour for the scope of work shown on the plans and specifications.
- 1.4 REFERENCES
- .1 American Association of State Highway and Transportation Officials (AASHTO)
- .1 AASHTO M320, Standard Specification for Performance Graded Asphalt Binder.
- .2 AASHTO R29, Standard Specification for Grading or Verifying the Performance Graded of an Asphalt Binder.
- .3 AASHTO T245, Resistance to Plastic flow of Bituminous Mixtures Using Marshall Apparatus.
- .2 Asphalt Institute (AI)
- .1 AI MS2 Sixth Edition, Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types.
- .3 American Society for Testing and Materials International, (ASTM)
- .1 ASTM C 88, Standard Test Method for Soundness of Aggregates by Use of Sodium Sulphate or Magnesium Sulphate.
- .2 ASTM C 117, Standard Test Method for Material Finer Than 0.075mm (No.200) Sieve in Mineral Aggregates by Washing.
- .3 ASTM C 123, Standard Test Method for Lightweight Particles in Aggregate.
- .4 ASTM C 127, Standard Test Method for Specific Gravity and Absorption of Coarse Aggregate.
- .5 ASTM C 128, Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Fine Aggregate.
- .6 ASTM C 131, Standard Test Method for

Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

.7 ASTM C 136, Standard Method for Sieve Analysis of Fine and Coarse Aggregates.

.8 ASTM C 207, Standard Specification for Hydrated Lime for Masonry Purposes.

.9 ASTM D 995, Standard Specification for Mixing Plants for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures.

.10 ASTM D 2419, Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate.

.11 ASTM D 3203, Standard Test Method for Percent Air Voids in Compacted Dense and Open Bituminous Paving Mixtures.

.12 ASTM D 4791, Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate.

.4 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-8.1, Sieves Testing, Woven Wire, Inch Series.

.2 CAN/CGSB-8.2, Sieves Testing, Woven Wire, Metric.

.3 CAN/CGSB-16.3, Asphalt Cements for Road Purposes.

1.5 PRODUCT DATA

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

.2 Submit manufacturer's test data and certification that asphalt cement meets requirements of this Section.

.3 Submit asphalt concrete mix design and trial mix test results to Departmental Representative for review at least 4 weeks prior to beginning Work.

1.6 SAMPLES

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

1.7 DELIVERY, STORAGE AND HANDLING

.1 Deliver and stockpile aggregates in accordance with Section 31 05 16 - Aggregate Materials.

1.8 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse and recycling.

.2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

.3 Divert unused aggregate materials from landfill to facility for reuse.

- .4 Divert unused asphalt from landfill to facility capable of recycling materials.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Asphalt cement: to CAN/CGSB-16.3, grade: 80-100.
- .2 Reclaimed asphalt pavement:
 - .1 Crushed and screened so that 100% of RAP material passes 50 mm screen before mixing.
- .3 Aggregates: in accordance with Section 31 05 16 - Aggregate Materials: General following requirements:
 - .1 Crushed stone or gravel.
 - .2 Gradations: within limits specified when tested to ASTM C 136 and ASTM C 117.
 - .3 Table

Sieve Designation	Percent Passing			
	Lower Course #1	Lower Course #2	Upper Course #1	Upper Course #1
25.0mm	100	--	--	--
19.0mm	--	100	100	--
12.5mm	70 - 85	84 - 99	84 - 99	100
9.5mm	--	73 - 88	73 - 88	--
4.75mm	40 - 65	50 - 68	50 - 68	55 - 75
2.36mm	32 - 53	35 - 55	35 - 55	38 - 58
1.18mm	26 - 44	27 - 46	27 - 46	28 - 47
0.600mm	18 - 36	18 - 36	18 - 36	20 - 36
0.300mm	10 - 26	10 - 26	10 - 26	10 - 26
0.150mm	4 - 17	4 - 17	4 - 17	4 - 17
0.075mm	3 - 8	3 - 8	3 - 8	3 - 8

Lower Course #1 - Highway 4, lower course only
 Lower Course #2 - Local Roadways, lower course only
 Upper Course #1 - Highway 4, upper course only
 Upper Course #2 - Local Roadways, surface course only

.4 Coarse aggregate: aggregate retained on 4.75mm sieve and fine aggregate is aggregate passing 4.75mm sieve when tested to ASTM C 136.

.5 When dryer drum plant or plant without hot screening is used, process fine aggregate through 4.75mm sieve and stockpile separately from coarse aggregate.

.6 Do not use aggregates having known polishing characteristics in mixes for surface courses.

.7 Sand equivalent: ASTM D 2419 Min: 40.

.8 Magnesium Sulphate soundness: to ASTM C 88

- Max% loss by mass:
- .1 Coarse aggregate surface course: 15%.
 - .2 Coarse aggregate lower course: 15%.
 - .3 Fine aggregate, surface course: 18%.
 - .4 Fine aggregate, lower course: 18%.
- .9 Los Angeles degradation: Grading B, to ASTM C 131 Max % loss by mass:
- .1 Coarse aggregate, surface course: 25%
 - .2 Coarse aggregate, lower course: 35%.
- .10 Absorption: to ASTM C 127 Max % by mass:
- .1 Coarse aggregate, surface course: 1.75%.
 - .2 Coarse aggregate, lower course: 2.00%.
- .11 Loss by washing: to ASTM C 117 Max % passing 0.075 mm sieve:
- .1 Coarse aggregate, surface course: 1.5
 - .2 Coarse aggregate, lower course: 2.0
- .12 Flat and elongated particles: to ASTM D 4791, (with length to thickness ratio greater than 5):
- Max% by mass:
- .1 Coarse aggregate, surface course: 10%.
 - .2 Coarse aggregate, lower course: 10%.
- .13 Crushed fragments: at least 60% of particles by mass within each of following sieve designation ranges, to have at least 2 freshly fractured face. Material to be divided into ranges, using methods of ASTM C 136.

Passing		Retained on
[25] mm	to	12.5mm
[12.5] mm	to	4.75mm

- .14 Regardless of compliance with specified physical requirements, fine aggregates may be accepted or rejected on basis of past field performance.
- .4 Mineral filler:
- .1 Finely ground particles of limestone, hydrated lime, Portland cement or other approved non-plastic mineral matter, thoroughly dry and free from lumps.
 - .2 Add mineral filler when necessary to meet job mix aggregate gradation or as directed to improve mix properties.
 - .3 Mineral filler to be dry and free flowing when added to aggregate.
- .5 Water: to approval of Departmental Representative.

2.2 EQUIPMENT

- .1 Pavers: mechanical grade controlled self-powered pavers capable of spreading mix within specified tolerances, true to line, grade and crown indicated.

- .2 Rollers: sufficient number of type and weight to obtain specified density of compacted mix.
- .3 Vibratory rollers:
 - .1 Minimum drum diameter: 1200mm.
 - .2 Maximum amplitude of vibration (machine setting): 0.5mm for lifts less than 40 mm thick.
- .4 Haul trucks: sufficient number and of adequate size, speed and condition to ensure orderly and continuous operation and as follows:
 - .1 Boxes with tight metal bottoms.
 - .2 Covers of sufficient size and weight to completely cover and protect asphalt mix when truck fully loaded.
 - .3 In cool weather or for long hauls, insulate entire contact area of each truck box.
 - .4 Use only trucks which can be weighed in single operation on scales supplied.
- .5 Hand tools:
 - .1 Lutes or rakes with covered teeth for spreading and finishing operations.
 - .2 Tamping irons having mass not less than 12 kg and bearing area not exceeding 310 cm² for compacting material along curbs, gutters and other structures inaccessible to roller. Mechanical compaction equipment, when approved by Departmental Representative may be used instead of tamping irons.
 - .3 Straight edges, 3.0m in length, to test finished surface.

2.3 MIX DESIGN

- .1 Mix design to be developed by testing laboratory approved by Departmental Representative.
- .2 Mix to contain maximum 20% by mass of RAP. Departmental Representative may approve higher proportion of RAP if Contractor demonstrates ability to produce mix meeting requirements of specification.

- .3 Design of mix: by Marshall method to requirements below.
 - .1 Compaction blows on each face of test specimens: 75.
 - .2 Mix physical requirements:

Property		Pavement Course	
Marshall Stability at 60°C	kN min	6.4	Lower course
		5.5	Upper Course
Flow Value	mm	2-4	
Air Voids in Mixture	%	3-6	Lower course
		3-5	Upper course
Voids in Mineral Aggregate	% min	13	Lower course 1
		14	Lower course 2
		14	Upper course 1
		15	Upper course 2
Index of Retained Stability	% min	75	

- .3 Measure physical requirements as follows:
 - .1 Marshall load and flow value: to ASTM D1559.
 - .4 Do not change job-mix without prior approval of Departmental Representative. When change in material source proposed, new job-mix formula to be reviewed by Departmental Representative.

PART 3 - EXECUTION

3.1 PLANT AND MIXING REQUIREMENTS

- .1 Batch and continuous mixing plants:
 - .1 To ASTM D 995.
 - .2 Feed aggregates from individual stockpiles through separate bins to cold elevator feeders. Do not load frozen materials into bins.
 - .3 Feed cold aggregates to plant in proportions to ensure continuous operations.
 - .4 Calibrate bin gate openings and conveyor speeds to ensure mix proportions are achieved.
 - .5 Before mixing, dry aggregates to moisture content not greater than 1% by mass or to lesser moisture content if required to meet mix design requirements.
 - .6 Immediately after drying, screen aggregates into hot storage bins in sizes to permit recombining into gradation meeting job-mix requirements.
 - .7 Store hot screened aggregates in manner to minimize segregation and temperature loss.
 - .8 Heat asphalt cement and aggregate to mixing

temperature directed by Departmental Representative. Do not heat asphalt cement above 160 degrees C.

.9 Maintain temperature of materials within 5 degrees C of specified mix temperature during mixing.

.10 Mixing time:

.1 In batch plants, both dry and wet mixing times as directed by Departmental Representative. Continue wet mixing as long as necessary to obtain thoroughly blended mix but not less than 30s or more than 75s.

.2 In continuous mixing plants, mixing time as directed by Departmental Representative but not less than 45s.

.3 Do not alter mixing time unless directed by Departmental Representative.

.11 Where RAP is to be incorporated into mix:

.1 Feed from separate cold feed bin specially designed to minimize consolidation of material. Provide 37.5mm scalping screen on cold feed to remove oversized pieces of RAP.

.2 Ensure positive and accurate control of RAP cold feed by use of hydraulic motor or electric clutch and equip with anti rollback device to prevent material from sliding backward on feed belt.

.3 Combine RAP and new aggregates in proportions as directed by Departmental Representative. Dry mix thoroughly, until uniform temperature within plus or minus 5 degrees C of mix temperature, as directed by Departmental Representative Consultant is achieved prior to adding new asphalt cement. Do not add new asphalt cement where temperature of dried mix material is above 160 degrees C.

.2 Dryer drum mixing plant:

.1 To ASTM D 995.

.2 Load aggregates from individual stockpiles to separate cold feed bins. Do not load frozen materials into bins.

.3 Feed aggregates to burner end of dryer drum by means of multi-bin cold feed unit and blend to meet job-mix requirements by adjustments of variable speed feed belts and gates on each bin.

.4 Where RAP is to be incorporated into mix, dryer drum mixer is to be designed to prevent direct contact of RAP with burner flame or with exhaust gases hotter than 180 degrees C.

.5 Feed RAP from separate cold feed bin designed to minimize reconsolidation of material.

.6 Meter total flow of aggregate and RAP by an electronic weigh belt system with indicator that

can be monitored by plant operator and which is interlocked with asphalt pump so that proportions of aggregate RAP and asphalt entering mixer remain constant.

.7 Provide for easy calibration of weighing systems for aggregates and RAP without having material enter mixer.

.8 Calibrate bin gate openings and conveyor speeds to ensure mix proportions are achieved. Calibrate weigh bridge on charging conveyor by weighing amount of aggregate passing over weigh bridge in set amount of time. Difference between this value and amount shown by plant computer system to differ by not more than plus or minus 2%.

.9 Make provision for conveniently sampling full flow of materials from cold feed.

.10 Provide screens or other suitable devices to reject oversize particles or lumps of aggregate and RAP from cold feed prior to entering drum.

.11 Provide system interlock stop on feed components if either asphalt or aggregate from bin stops flowing.

.12 Accomplish heating and mixing of asphalt mix in approved parallel flow dryer-mixer in which aggregate enters drum at burner end and travels parallel to flame and exhaust gas stream. Control heating to prevent fracture of aggregate or excessive oxidation of asphalt. Equip system with automatic burner controls and provide for continuous temperature sensing of asphalt mixture at discharge, with printing recorder that can be monitored by plant operator. Submit printed record of mix temperatures at end of each [week] [day].

.13 Mixing period and temperature to produce uniform mixture in which particles are thoroughly coated, and moisture content of material as it leaves mixer to be less than 0.5%.

.3 Temporary storage of hot mix:

.1 Provide mix storage of sufficient capacity to permit continuous operation and designed to prevent segregation.

.2 Do not store asphalt mix in storage bins in excess of 12 hour.

.4 Mixing tolerances:

.1 Permissible variation in aggregate gradation from job mix (percent of total mass).

4.75 mm sieve and	
larger	5.5
2.00 mm sieve	4.5
0.425 mm sieve	3.5
0.180 mm sieve	2.5
0.075 mm sieve	1.5

- .2 Permissible variation of asphalt cement from job mix: 0.3%.
- .3 Permissible variation of mix temperature at discharge from plant: 5 degrees C.

- .5 Addition of anti-stripping agent:
 - .1 Plant to be equipped with pug mill to thoroughly mix aggregates and lime prior to entering the plant.
 - .2 Plant to be equipped with suitable conveyor systems capable of supplying aggregates and lime at constant rate.
 - .3 Plant and equipment used for addition of lime to be equipped with covers to control loss of lime.
 - .4 Plant to be equipped to control rate of lime incorporation to within 1/4%.
 - .5 Add water to aggregate prior to entering pug mill.
 - .6 Add water to lime sufficiently in advance to permit time to slake prior to entering pug mill.

3.2 TRANSPORTATION OF MIX

- .1 Transport mix to job site in vehicles cleaned of foreign material.
- .2 Paint or spray truck beds with limewater, soap or detergent solution, or non petroleum based commercial product, at least daily or as required. Elevate truck bed and thoroughly drain. No excess solution to remain in truck bed.
- .3 Schedule delivery of material for placing in daylight, unless Departmental Representative approves artificial light.
- .4 Deposit mix from surge or storage silo to trucks in multiple drops to reduce segregation. Do not dribble mix into trucks.
- .5 Deliver material to paver at uniform rate and in an amount within capacity of paving and compacting equipment.
- .6 Deliver loads continuously in covered vehicles and immediately spread and compact. Deliver and place mixes at temperature within range as directed by Departmental Representative, but not less than 125 degrees C.

3.3 PLACING

- .1 Obtain Departmental Representative's approval of base and existing surface and tack coat and prime coat prior to placing asphalt.
- .2 Place asphalt concrete to thicknesses, grades and

lines as directed by Departmental Representative.

- .3 Placing conditions:
 - .1 Place asphalt mixtures only when air temperature is above 5 degrees C.
 - .2 When temperature of surface on which material is to be placed falls below 10 degrees C, provide extra rollers as necessary to obtain required compaction before cooling.
 - .3 Do not place hot-mix asphalt when pools of standing water exist on surface to be paved, during rain, or when surface is damp.
- .4 Place asphalt concrete in compacted lifts of thickness as follows:
 - .1 Levelling courses to thicknesses required but not exceeding 100mm.
 - .2 Lower course in layers of 50mm each.
 - .3 Surface course in layers of maximum 50mm each.
- .5 Where possible do tapering and levelling where required in lower lifts. Overlap joints by not less than 300 mm.
- .6 Spread and strike off mixture with self propelled mechanical finisher.
 - .1 Construct longitudinal joints and edges true to line markings. Departmental Representative to establish lines for paver to follow parallel to centerline of proposed pavement. Position and operate paver to follow established line closely.
 - .2 When using pavers in echelon, have first paver follow marks or lines, and second paver follow edge of material placed by first paver. Work pavers as close together as possible and in no case permit them to be more than 30 m apart.
 - .3 Maintain constant head of mix in auger chamber of paver during placing.
 - .4 If segregation occurs, immediately suspend spreading operation until cause is determined and corrected.
 - .5 Correct irregularities in alignment left by paver by trimming directly behind machine.
 - .6 Correct irregularities in surface of pavement course directly behind paver. Remove by shovel or lute excess material forming high spots. Fill and smooth indented areas with hot mix. Do not broadcast material over such areas.
 - .7 Do not throw surplus material on freshly screeded surfaces.
- .7 When hand spreading is used:
 - .1 Use approved wood or steel forms, rigidly supported to assure correct grade and cross section. Use measuring blocks and intermediate

strips to aid in obtaining required cross-section.

.2 Distribute material uniformly. Do not broadcast material.

.3 During spreading operation, thoroughly loosen and uniformly distribute material by lutes or covered rakes. Reject material that has formed into lumps and does not break down readily.

.4 After placing and before rolling, check surface with templates and straightedges and correct irregularities.

.5 Provide heating equipment to keep hand tools free from asphalt. Control temperature to avoid burning material. Do not use tools at higher temperature than temperature of mix being placed.

3.4 COMPACTING

.1 Roll asphalt continuously to density not less than 97% of 75 blow Marshall density to ASTM D1559 with no individual test less than 95%. Contractor to provide test reports from an independent testing agency to Department Representative indicating acceptable densities have been achieved.

.2 General:

.1 Provide at least two rollers and as many additional rollers as necessary to achieve specified pavement density. When more than two rollers are required, one roller must be pneumatic tired type.

.2 Start rolling operations as soon as placed mix can bear weight of roller without excess displacement of material or cracking of surface.

.3 Operate roller slowly initially to avoid displacement of material. Do not exceed 5 km/h for breakdown and intermediate rolling for static steel-wheeled and pneumatic tired rollers. Do not exceed 8 km/h for finish rolling.

.4 Use static compaction for levelling coarse less than 25 mm thick.

.5 For lifts 50 mm thick and greater, adjust speed and vibration frequency of vibratory rollers to produce minimum of 20 impacts per metre of travel. For lifts less than 50 mm thick, impact spacing not to exceed compacted lift thickness.

.6 Overlap successive passes of roller by minimum of 200mm and vary pass lengths.

.7 Keep wheels of roller slightly moistened with water to prevent pick-up of material but do not over-water.

.8 Do not stop vibratory rollers on pavement that is being compacted with vibratory mechanism operating.

.9 Do not permit heavy equipment or rollers to stand on finished surface before it has been compacted and has thoroughly cooled.

.10 After traverse and longitudinal joints and outside edge have been compacted, start rolling

longitudinally at low side and progress to high side. Ensure that all points across width of pavement receive essentially equal numbers of passes of compactors.

.11 When paving in echelon, leave unrolled 50 to 75 mm of edge which second paver is following and roll when joint between lanes is rolled.

.12 Where rolling causes displacement of material, loosen affected areas at once with lutes or shovels and restore to original grade of loose material before re-rolling.

3.5 JOINTS

- .1 General:
 - .1 Remove surplus material from surface of previously laid strip. Do not deposit on surface of freshly laid strip.
 - .2 Construct joints between asphalt concrete pavement and Portland cement concrete pavement as indicated.
 - .3 Paint contact surfaces of existing structures such as manholes, curbs or gutters with bituminous material prior to placing adjacent pavement.
- .2 Transverse joints:
 - .1 Offset transverse joint in succeeding lifts by at least 600mm.
 - .2 Cut back to full depth vertical face and tack face with thin coat of hot asphalt prior to continuing paving.
 - .3 Compact transverse joints to provide smooth riding surface. Use methods to prevent rounding of compacted surface at joints.
- .3 Longitudinal joints:
 - .1 Offset longitudinal joints in succeeding lifts by at least 150mm.
 - .2 Cold joint is defined as joint where asphalt mix is placed, compacted and left to cool below 100 degrees C prior to paving of adjacent lane.
 - .1 For airfield runway paving, avoid cold joint construction in mid 30 m of runway.
 - .2 If cold joint can not be avoided, cut back by saw cutting previously laid lane, by at least 150 mm, to full depth vertical face, and tack face with thin coat of hot asphalt of adjacent lane.
 - .3 Overlap previously laid strip with spreader by 100mm.
 - .4 Before rolling, carefully remove and discard coarse aggregate in material overlapping joint with lute or rake.
 - .5 Roll longitudinal joints directly behind paving operation.
 - .6 When rolling with static or vibratory rollers, have most of drum width ride on newly

placed lane with remaining 150 mm extending onto previously placed and compacted lane.

- .4 Construct feather joints so that thinner portion of joint contains fine graded material obtained by changed mix design or by raking out coarse aggregate in mix. Place and compact joint so that joint is smooth and without visible breaks in grade. Location of feather joints as indicated.
- .5 Construct butt joints as indicated.

3.6 FINISH
TOLERANCES

- .1 Finished asphalt surface to be within 6mm of design elevation but not uniformly high or low.
- .2 Finished asphalt surface not to have irregularities exceeding 6mm when checked with 3 m straight edge placed in any direction.

3.7 DEFECTIVE WORK

- .1 Correct irregularities which develop before completion of rolling by loosening surface mix and removing or adding material as required. If irregularities or defects remain after final compaction, remove surface course promptly and lay new material to form true and even surface and compact immediately to specified density.
- .2 Repair areas showing checking, rippling, or segregation.
- .3 Adjust roller operation and screed settings on paver to prevent further defects such as rippling and checking of pavement.

-----END OF SECTION-----

PART 1 - GENERAL

1.1 RELATED
SECTIONS

- .1 Section 01 33 00-Submittal Procedures.
- .2 Section 03 20 00-Concrete Reinforcing.
- .3 Section 03 30 00-Cast-In-Place Concrete.
- .4 Section 31 23 33.01-Excavating, Trenching and Backfilling.

1.2 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A 48/A 48M, Standard Specification for Gray Iron Castings.
 - .2 ASTM C 117, Standard Test Method for Materials Finer than 75- μ m (No. 200) Sieve in Mineral Aggregates by Washing.
 - .3 ASTM C 136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .4 ASTM C 139, Standard Specification for Concrete Masonry Units for Construction of Catch Basins and Manholes.
 - .5 ASTM C 478M, Standard Specification for Precast Reinforced Concrete Manhole Sections [Metric].
 - .6 ASTM D 698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-8.1, Sieves, Testing, Woven Wire, Inch Series.
 - .2 CAN/CGSB-8.2, Sieves, Testing, Woven Wire, Metric.
- .3 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-A23.1/A23.2-[04], Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 - .2 CAN/CSA-A3000, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
 - .1 CSA-A3001, Cementitious Materials for Use in Concrete.
 - .2 CSA-A3002, Masonry and Mortar Cement.
 - .3 CAN/CSA-A165 Series, CSA Standards on Concrete Masonry Units (Consists of A165.1,

A165.2 and A165.3).

.4 CAN/CSA-G30.18, Billet Steel Bars for Concrete Reinforcement.

.5 CAN/CSA-G164, Hot Dip Galvanizing of Irregularly Shaped Articles.

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

.1 Material Safety Data Sheets (MSDS).

1.3 SUBMITTALS

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

1.4 DELIVERY, STORAGE AND HANDLING

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

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Cast-in-place concrete:
- .1 In accordance with Section 03 30 00 - Cast-in-Place Concrete.
 - .2 Cement: to CAN/CSA-A3001, Type GU 50.
 - .3 Concrete mix design to produce 30 MPa minimum compressive strength at 28 days and containing 25mm maximum size coarse aggregate, with water/cement ratio to CAN/CSA-A23.1.
 - .1 Air entrainment to CAN/CSA-A23.1.
 - .4 Concrete reinforcement: in accordance with Section 03 20 00 - Concrete Reinforcing.
- .2 Precast manhole units: to ASTM C 478M, circular or oval.
- .1 Top sections eccentric cone or flat slab top type with opening offset for vertical ladder installation.
- .3 Joints: made watertight using rubber rings to ASTM C443 or cement mortar.
- .4 Mortar:
- .1 Aggregate: to CSA A82.56.
 - .2 Masonry Cement: to CAN/CSA-A8.
- .5 Ladder rungs: to CAN/CSA-G30.18, No.25M billet steel deformed bars, hot dipped galvanized to CAN/CSA-G164.
- .1 Rungs to be safety pattern (drop step type).

- .6 Adjusting rings: to ASTM C 478.
- .7 Concrete Brick: to CAN3-A165 Series.
- .8 Drop manhole pipe: same as sewer pipe.
- .9 Galvanized iron sheet: approximately 2 mm thick.
- .10 Steel gratings, I-beams and fasteners: as indicated.
- .11 Frames, gratings, covers to dimensions as indicated and following requirements:
 - .1 Metal gratings and covers to bear evenly on frames.
 - .1 Frame with grating or cover to constitute one unit.
 - .2 Assemble and mark unit components before shipment.
 - .2 Cast iron manhole & catchbasin frames and covers must conform to ASTM A48 and be designed to withstand H2O loading.
 - .1 Must bear manufacturer identification on castings.
- .12 Granular bedding and backfill: in accordance with Section 31 05 16 - Aggregate Materials.
 - .1 Concrete mixes and materials: in accordance with Section 03 30 00 - Cast-in-Place Concrete.
- .13 Unshrinkable fill: in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 EXCAVATION AND BACKFILL

- .1 Excavate and backfill in accordance with Section 31 23 33.01 - Excavating Trenching and Backfilling and as indicated.

3.3 CONCRETE WORK

- .1 Do concrete work in accordance with Section 03 30 00 - Cast-in-Place Concrete.
- .2 Place concrete reinforcement in accordance with Section 03 20 00 - Concrete Reinforcing.
- .3 Position metal inserts in accordance with dimensions and details as indicated.

3.4 INSTALLATION

- .1 Construct units in accordance with details indicated, plumb and true to alignment and grade.
- .2 Dewater excavation to approval of Departmental Representative and remove soft and foreign material before placing concrete base.
- .3 Set precast concrete base on 100 mm minimum of granular bedding compacted to 95%. Modified proctor density in compliance with ASTM D1557.
- .4 Precast units:
 - .1 Set bottom section of precast unit in bed of cement mortar and bond to concrete slab or base.
 - .2 Make each successive joint watertight with Departmental Representative's approval rubber ring gaskets, bituminous compound, cement mortar, epoxy resin cement, or combination of these materials.
 - .3 Clean surplus mortar and joint compounds from interior surface of unit as work progresses.
 - .4 Plug lifting holes with concrete plugs set in cement mortar or mastic compound.
- .5 For sewers:
 - .1 Place stub outlets and bulkheads at elevations and in positions indicated.
 - .2 Bench to provide smooth U-shaped channel.
 - .1 Side height of channel to be 0.75 times diameter of sewer.
 - .2 Slope adjacent floor at 1 in 20.
 - .3 Curve channels smoothly.
 - .4 Slope invert to establish sewer grade.
- .6 Compact granular backfill to 95% Modified Proctor Density.
- .7 Place unshrinkable backfill in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.
- .8 Installing units in existing systems:
 - .1 Where new unit is installed in existing run of pipe, ensure full support of existing pipe during installation, and carefully remove that portion of existing pipe to dimensions required and install new unit as specified.
 - .2 Make joints watertight between new unit and existing pipe.
 - .3 Where deemed expedient to maintain service around existing pipes and when systems constructed under this project are ready for

operation, complete installation with appropriate break-outs, removals, redirection of flows, blocking unused pipes or other necessary work.

- .9 Set frame and cover to required elevation on no more than three courses of brick.
 - .1 Make brick joints and join brick to frame with cement mortar.
 - .2 Parge and make smooth and watertight.
- .10 Clean units of debris and foreign materials.
 - .1 Remove fins and sharp projections.
 - .2 Prevent debris from entering system.
- .11 Install safety platforms in manholes having depth of 6 m or greater, as indicated.

3.5 ADJUSTING TOPS OF EXISTING UNITS

- .1 Remove existing gratings, frames and store for re-use at locations designated by Departmental Representative.
- .2 Sectional units:
 - .1 Raise or lower straight walled sectional units by adding or removing precast sections as required.
 - .2 Raise or lower tapered units by removing cone section, adding, removing, or substituting riser sections to obtain required elevation, then replace cone section.
 - .1 When amount of raise is less than 300mm use standard manhole brick, moduloc or grade rings.
- .3 Monolithic units:
 - .1 Raise monolithic units by roughening existing top to ensure proper bond and extend to required elevation with mortared brick course for 150 mm or less alteration.
 - .2 Lower monolithic units with straight wall by removing concrete to elevation indicated for rebuilding.
 - .3 When monolithic units with tapered upper section are lowered more than 150 mm, remove concrete for entire depth of taper plus as much straight wall as necessary, then rebuild upper section to required elevation with cast-in-place concrete.
 - .4 Install additional manhole ladder rungs in adjusted portion of units as required.
 - .5 Re-use existing gratings, frames and I-beams.

3.6 SEALING OVER EXISTING UNITS

- .1 Fill with material approved by Departmental Representative.

-----END OF SECTION-----

PART 1 - GENERAL

- 1.1 SECTION INCLUDES
- .1 Materials and installation for water mains, hydrants, valves, valve boxes, and valve chambers, including service connections.
- 1.2 RELATED SECTIONS
- .1 Section 01 33 00 - Submittal Procedures].
 - .2 Section 01 78 00 - Closeout Submittals.
 - .3 Section 31 23 33.01 - Excavating, Trenching and Backfilling.
 - .4 Section 03 20 00 - Concrete Reinforcing.
 - .5 Section 03 30 00 - Cast-in-Place Concrete.
- 1.3 REFERENCES
- .1 American National Standards Institute/American Water Works Association (ANSI/AWWA)
 - .1 ANSI/AWWA B300-[99], Hypochlorites.
 - .2 ANSI/AWWA C153/A21.53-11, Ductile-Iron Compact Fittings for Water Service.
 - .3 ANSI/AWWA C500-09, Metal-Seated Gate Valves for Water Supply Service
 - .4 ANSI/AWWA C651-14, Disinfecting Water Mains.
 - .5 ANSI/AWWA C800-12, Underground Service Line Valves and Fittings
 - .6 ANSI/AWWA C900-16, Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings, 4 Inch through 60 Inch (100 mm - 1200 mm)
 - .2 American Society for Testing and Materials International, (ASTM)
 - .3 American Water Works Association (AWWA)/Manual of Practice
 - .1 AWWA M17-2006, Installation, Field Testing, and Maintenance of Fire Hydrants.
 - .4 Canadian General Standards Board (CGSB)
 - .5 Canadian Standards Association (CSA International)
- 1.4 SUBMITTALS
- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Submit complete construction schedule for water mains. Include method for installation of water main.

- .3 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
- .4 Contractor to provide to the Department Representative for approval 1 week prior to start of laying pipe the results of a sieve analysis of the proposed bedding materials.
- .5 Submit manufacturer's pipe certification
- .6 Pipe certification to be on pipe.

1.5 CLOSEOUT
SUBMITTALS

- .1 Provide record drawings, including directions for operating valves, list of equipment required to operate valves, details of pipe material, location of air and vacuum release valves, hydrant details, maintenance and operating instructions in accordance with Section 01 78 00 - Closeout Submittals.
 - .1 Include top of pipe, horizontal location of fittings and type, valves, valve boxes, valve chambers and hydrants.

1.6 WASTE
MANAGEMENT AND
DISPOSAL

- .1 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .2 Place materials defined as hazardous or toxic in designated containers.
- .3 Handle and dispose of hazardous materials in accordance with the Canadian Environmental Protection Act (CEPA), Transportation of Dangerous Good Act (TDGA), Regional and Municipal regulations.
- .4 Ensure emptied containers are sealed and stored safely.
- .5 Divert unused materials from landfill to metal recycling facility.
- .6 Divert unused concrete materials from landfill to local facility.
- .7 Divert unused aggregate materials from landfill to facility for reuse.
- .8 Dispose of unused disinfection material at official hazardous material collections site.
- .9 Do not dispose of unused disinfection material into sewer system, into streams, lakes, onto ground or

in other location where they will pose health or environmental hazard.

- .10 Fold up metal banding, flatten and place in designated area for recycling.

1.7 SCHEDULING OF WORK

- .1 Schedule Work to minimize interruptions to existing services.
- .2 Submit schedule of expected interruptions to Department Representative for approval and adhere to interruption schedule as approved by Department Representative.
- .3 Notify Department Representative a minimum of 48 h in advance of interruption in service.
- .4 Do not interrupt water service for more than 3 hours and confine this period between 10:00 and 16:00 h local time unless otherwise authorized.
- .5 Notify fire department of any planned or accidental interruption of water supply to hydrants.
- .6 Provide "Out of Service" sign on hydrant not in use.
- .7 Advise local police department of anticipated interference with movement of traffic.

PART 2 - PRODUCTS

2.1 PIPE, JOINTS AND FITTINGS

- .1 Polyvinyl chloride pressure pipe: to ANSI/AWWA C900, pressure class 150, DR 18, 1 MPa gasket bell end
 - .1 CSA-B137.3, PVC series 160, 1.1 MPa elastomeric gasket [coupling].
 - .2 Ductile Iron fittings: to ANSI/AWWA C153/A21.53-06.

2.2 VALVES AND VALVE BOXES

- .1 Valves to open counter clockwise.
- .2 Gate valves: to ANSI/AWWA C500, standard iron body, bronze mounted valves with non-rising stems, suitable for 1 Pa with mechanical, flanged, push-on, grooved type joints.
- .3 Air and vacuum release valves: heavy duty combination air release valves employing direct acting kinetic principle.

- .1 Fabricate valves of cast iron body and cover, with bronze trim, stainless steel floats with shock-proof synthetic seat suitable for [2] MPa working pressure.
- .2 Valves to expel air at high rate during filling, at low rate during operation, and to admit air while line is being drained.
- .3 Valve complete with surge check unit.
- .4 Ends to be flanged to ANSI/AWWA.

2.3 TRACER WIRE

- .1 Direct Burial #12 AWG Solid (.0808" diameter), steel core hard drawn extra high strength tracer wire, 1150# average tensile break load, 45 mil high molecular weight-high density polyethylene jacket complying with ASTM-D-1248, 30 volt rating.
- .2 Tracer Box shall include:
 - .1 Tube material shall be of high grade ABS, or equivalent rigid plastic that meets or exceeds ASTM D-1788, Type 1 requirements.
 - .2 Lid material shall be of cast iron or ductile iron. Tensile strength or ductility of such material shall be equal or superior to hi-tensile cast iron ASTM A126-B requirements.
 - .3 Lid-locking bolt material shall be made of aluminum material equal or superior to ASTM B253.
 - .4 Lid-locking mechanism material shall be made of plastic to meet or exceed ASTM A126-B requirements.
 - .5 Box shall be designed to be easily detected by magnetic and electronic locators even when box is covered by a minimum of 100mm of soil, sod and / or paving material.
 - .6 A magnet shall be securely attached at the top of the upper tube of the box for locating purposes.

2.4 VALVE CHAMBERS

- .1 Concrete and reinforcing steel to Section 03 30 00 - Cast-in-Place Concrete and Section 03 20 00 - Concrete Reinforcing.
- .2 Precast concrete sections to ASTM C478M. Cast ladder rungs integral with unit; field installation not permitted.
- .3 Valve chamber frames and covers:
 - .1 Design and dimensions as indicated.
 - .2 Cover to be marked "WATER"/"EAU" .
- .5 Ladder rungs for valve chambers: 20 mm diameter deformed rail steel bars to CAN/CSA-G30.18, hot-dipped galvanized after fabrication to CAN/CSA-G164. Rungs to be safety pattern.

2.5 SERVICE CONNECTIONS

- .1 Copper tubing: to ASTM B 88M type K, annealed.
- .2 Polyethylene pressure pipe:
 - .1 To CSA-B137.1, type PE, series 160, ASTM F714, Type PE, series DR 11.
 - .2 90 mm to 1600 mm: to CGSB 41-GP-25M, type PE, series 250.
- .3 Copper tubing joints: compression type suitable for 1 MPa working pressure.
- .4 Polyethylene pipe joints: thermal butt fusion welded
- .5 Brass corporation stops: compression type having threads to ANSI/AWWA C800.
- .6 Brass inverted key-type curb stops: compression type with drains.
 - .1 Curb stops to have adjustable bituminous coated cast iron service box with stem to suit depth of bury.
 - .2 Top of cast iron box marked "WATER"/"EAU".
- .7 Polyethylene tapping tees or multi-saddle tees: for Polyethylene pipe. Tees to be socket fused to pipe.
- .8 Service connections for PVC pipe:
 - .1 Service connections less than 100 mm: Corporation stop, tapped to main using AWWA threads, complete with stainless service saddle. Service saddle to consist of circumferential band type complete with side bars and fingers, keeper bar, stud bolts, nuts, washers and gaskets.
 - .2 Service connections 100 mm and over: Use tee fitting or tapping valve and sleeve.
- .9 Bronze type service clamps: for PVC pipe service connections.
 - .1 Service clamps to be of strap-type, with confined "O" ring seal cemented in place.
 - .2 Clamps to be tapped with threads to ANSI/AWWA C800.
- .10 Tee connections: for services above NPS 1. Tee connections to be fabricated of same material and to same standards as specified pipe fittings and to have ends matching pipe to which they are joined.

2.6 YARD HYDRANTS

- .1 Yard Hydrants: Terminal City self-draining stand pipe, factory assembled unit:
 - .1 Hydrants to open threads to local standard, Provide metal caps and chains.
 - .2 Yard Hydrant to be manufactured with bronze

operating and draining components.

.3 The stuffing box and draining mechanism to have "O" ring rubber gaskets for sealing purposes.

.4 Polyurethane anti-score seating material is used for the valve disc facing.

.5 Provide key operated gate valve located 1m from hydrant.

.6 Depth of bury 1.2 m.

.2 Hydrant paint: exterior enamel to CAN/CGSB-1.88,MPI #96.

2.6 PIPE BEDDING
 AND SURROUND
 MATERIAL

.1 Granular material to: Section 31 05 16 - Aggregate Materials and following requirements:

.1 Crushed or screened stone, gravel or sand.

.2 Table

<u>Sieve Designation</u>	<u>Percent Passing</u>	
	<u>Type 1*</u>	<u>Type 2*</u>
25.0mm	100	100
19.0mm	90-100	90-100
12.5mm	65-85	70-100
9.5mm	50-75	-
4.75mm	25-50	40-70
2.36mm	10-35	25-52
1.18mm	6-26	15-38
0.600mm	3-17	6-27
0.300mm	-	3-20
0.075mm	0-5	0-8

*Type 1: Standard Gradation

*Type 2: To be used only in dry trench conditions and with prior approval of Department Representative.

2.7 BACKFILL
 MATERIAL

.1 In accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

2.8 PIPE
 DISINFECTION

.1 Sodium hypochlorite to ANSI/AWWA B300 to disinfect water mains.

.2 Undertake disinfection of water mains in accordance with ANSI/AWWA C651.

PART 3 - EXECUTION

3.1 PREPARATION

.1 Clean pipes, fittings, valves, hydrants, and appurtenances of accumulated debris and water

before installation.

.1 Inspect materials for defects to approval of the Department Representative.

.2 Remove defective materials from site as directed by Department Representative.

3.2 TRENCHING

.1 Do trenching work in accordance with Section 31 23 33.01 - Excavating Trenching and Backfilling.

.2 Trench depth to provide cover over pipe of not less than 1.0 m from finished grade or as indicated.

.3 Trench alignment and depth require Department Representative approval prior to placing bedding material and pipe.

3.3 CONCRETE BEDDING AND ENCASEMENT

.1 Do concrete work in accordance with Section 03 30 00 - Cast-in-Place Concrete.

.2 Place concrete to details as indicated.

.3 Do not backfill over concrete within 24 hours after placing.

3.4 GRANULAR BEDDING

.1 Place granular bedding material in uniform layers not exceeding 150 mm compacted thickness to depth of 150mm below bottom of pipe.

.2 Do not place material in frozen condition.

.3 Shape bed true to grade to provide continuous uniform bearing surface for pipe.

.4 Shape transverse depressions in bedding as required to suit joints.

.5 Compact each layer full width of bed to at least 95% maximum density to ASTM D 698.

.6 Fill authorized or unauthorized excavation below design elevation of bottom of specified bedding in accordance with Section 31 23 33.01 - Excavating Trenching and Backfilling.

3.5 PIPE INSTALLATION

.1 Lay pipes to manufacturer's standard instructions and specifications. Do not use blocks except as specified.

.2 Join pipes in accordance with manufacturer's recommendations.

.3 Bevel or taper ends of PVC pipe to match fittings.

- .4 Handle pipe by methods recommended by pipe manufacturer. Do not use chains or cables passed through pipe bore so that weight of pipe bears on pipe ends.
- .5 Lay pipes on prepared bed, true to line and grade.
 - .1 Ensure barrel of each pipe is in contact with shaped bed throughout its full length.
 - .2 Take up and replace defective pipe.
 - .3 Correct pipe which is not in true alignment or grade or pipe which shows differential settlement after installation greater than 10 mm in 3 m.
- .6 Face socket ends of pipe in direction of laying. For mains on grade of 2% or greater, face socket ends up-grade.
- .7 Do not exceed one half of permissible deflection at joints as recommended by pipe manufacturer.
- .8 Keep jointing materials and installed pipe free of dirt and water and other foreign materials.
 - .1 Whenever work is stopped, install a removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.
- .9 Position and join pipes with equipment and methods approved by Department Representative.
- .10 Cut pipes in approved manner as recommended by pipe manufacturer, without damaging pipe or its coating and to leave smooth end at right angles to axis of pipe.
- .11 Align pipes before jointing.
- .12 Install gaskets to manufacturer's recommendations. Support pipes with hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.
- .13 Avoid displacing gasket or contaminating with dirt or other foreign material.
 - .1 Remove disturbed or contaminated gaskets.
 - .2 Clean, lubricate and replace before jointing is attempted again.
- .14 Complete each joint before laying next length of pipe.
- .15 Minimize deflection after joint has been made.
- .16 Apply sufficient pressure in making joints to ensure that joint is completed to manufacturer's

recommendations.

- .17 Ensure completed joints are restrained by compacting bedding material alongside and over installed pipes or as otherwise approved by the Department Representative.
- .18 When stoppage of work occurs, block pipes in an approved manner to prevent creep during down time.
- .19 Recheck plastic pipe joints assembled above ground after placing in trench to ensure that no movement of joint has taken place.
- .20 Install tracer wire along entire length of watermain with Test boxes located at maximum 1000m separation.
- .21 Do not lay pipe on frozen bedding.
- .22 Do hydrostatic and leakage test and have results approved by the Department Representative before surrounding and covering joints and fittings with granular material.
- .23 Backfill remainder of trench.

3.6 VALVE INSTALLATION

- .1 Install valves to manufacturer's recommendations at locations as indicated.

3.7 VALVE CHAMBERS

- .1 Use precast units as approved by the Department Representative.
- .2 Construct units as indicated, plumb and centered over valve nut, true to alignment and grade, and not resting on pipe.
- .3 Clean surplus mortar and joint compounds from interior surface of valve chamber as work progresses.
- .4 Plug lifting holes with precast concrete plugs set in cement mortar.
- .5 Place frame and cover on top section to elevation indicated. If adjustment is required use concrete ring.
- .6 Clean valve chambers of debris and foreign materials; remove fins and sharp projections.

3.8 SERVICE CONNECTIONS

- .1 Terminate building water service 1 m outside building wall or as indicated opposite point of connection to main. Locate point of connection in advance and advise Department Representative.
 - .2 Cap or seal end of pipe and place temporary marker to locate pipe end.
- .2 Do not install service connections until satisfactory completion of hydrostatic and leakage tests of water main.
- .3 Construct service connections at right angles to water main unless otherwise directed.
- .4 Tappings on ductile iron, or PVC-C900 pipe, may be threaded without service clamps.
 - .1 Double strap service connections with galvanized malleable iron body and neoprene gasket cemented in place may be used.
 - .2 Tappings PVC-C900 pipe to conform to following:

Pipe Diameter (mm)	Maximum Tap Without Clamp (mm)	Maximum Tap With Clamp (mm)
100	20	25
150	20	40
200	25	50
250	25	50
300	40	75

- .5 Tappings on PVC pipe to be either PVC valve tees or bronze type service clamps, strap type with "O" ring seal cemented in place.
- .6 Tappings for PE pipe: PE tapping tees or multi-saddle tees.
- .7 Employ only competent workmen equipped with suitable tools to carry out tapping of mains, cutting and flaring of pipes.
- .8 Install single and multiple tap service connections on top half of main, between 45 degrees and 90 degrees measured from apex of pipe.
- .9 Install multiple corporation stops, [30 degrees] apart around circumference of pipe and minimum of [300] mm apart along pipe.
- .10 Tap main at 2:00 o'clock or 10:00 o'clock position only; not closer to joint nor closer to adjacent

service connections than recommended by manufacturer, or 1 m, whichever is greater.

- .11 Leave corporation stop valves fully open.
- .12 In order to relieve strain on connections, install service pipe in "Goose Neck" form "laid over" into horizontal position.
- .13 Install rigid stainless steel liners in small diameter plastic pipes with compression fittings.
- .14 Install curb stop with corporation box on services NPS 2 or less in diameter.
 - .1 Equip larger services with gate valve and cast iron box.
 - .2 Set box plumb over stop and adjust top flush with final grade elevation.
 - .3 Leave curb stop valves fully closed.
- .15 Place temporary location marker at ends of plugged or capped unconnected water lines.
 - .1 Each marker to consist of 38 x 89 mm stake extending from pipe end at pipe level to 600 mm above grade.
 - .2 Paint exposed portion of stake red with designation "WATER SERVICE LINE" in black.

3.9 YARD HYDRANTS

- .1 Install yard hydrants at locations as indicated.
- .2 Set hydrants plumb, with hose outlets parallel with edge of pavement with outlet facing roadway.
- .3 Place concrete thrust blocks as indicated and specified ensuring that drain holes are unobstructed.
- .3 To provide proper draining for each hydrant, excavate pit measuring not less than 1 x 1 x 0.5 m deep and backfill with coarse gravel or crushed stone to level 150 mm above drain holes.
- .4 Place appropriate sign on installed hydrants indicating whether or not they are in service during construction.

3.10 THRUST BLOCKS AND RESTRAINED JOINTS

- .1 For thrust blocks: do concrete Work in accordance with Section 03 30 00 - Cast-in-Place Concrete.
- .2 Place concrete thrust blocks between valves, tees, plugs, caps, bends, changes in pipe diameter, reducers, hydrants and fittings and undisturbed ground as indicated or as directed by Department Representative.

- .3 Keep joints and couplings free of concrete.
- .4 Do not backfill over concrete within 24 hours after placing.
- .5 For restrained joints: only use restrained joints approved by Department Representative

3.11 HYDROSTATIC AND LEAKAGE TESTING

- .1 Do tests in accordance with ANSI/AWWA C600.
- .2 Provide labour, equipment and materials required to perform hydrostatic and leakage tests hereinafter described.
- .3 Notify Department Representative at least 24 hours in advance of proposed tests.
 - .1 Perform tests in presence of Department Representative.
- .4 Where section of system is provided with concrete thrust blocks, conduct tests at least [5] days after placing concrete or [2] days if high early strength concrete is used.
- .5 Test pipeline in sections not exceeding 365 m in length, unless otherwise authorized by the Department Representative.
- .6 Upon completion of pipe laying and after Department Representative has inspected Work in place, surround and cover pipes between joints with approved granular material placed as directed by Department Representative.
- .7 Leave hydrants, valves, joints and fittings exposed.
- .8 When testing is done during freezing weather, protect hydrants, valves, joints and fittings from freezing.
- .9 Strut and brace caps, bends, tees, and valves, to prevent movement when test pressure is applied.
- .10 Open valves.
- .11 Expel air from main by slowly filling main with potable water.
 - .1 Install corporation stops at high points in main where no air-vacuum release valves are installed.
 - .2 Remove stops after satisfactory completion of test and seal holes with plugs.

- .12 Thoroughly examine exposed parts and correct for leakage as necessary.
- .13 Apply hydrostatic test pressure of 1035 kPa based on elevation of lowest point in main and corrected to elevation of test gauge, for period of 1 hours.
- .14 Examine exposed pipe, joints, fittings and appurtenances while system is under pressure.
- .15 Remove joints, fittings and appurtenances found defective and replace with new sound material and make watertight.
- .16 Repeat hydrostatic test until defects have been corrected.
- .17 Define leakage as amount of water supplied in order to maintain test pressure for 2 hours.
- .18 Locate and repair defects if leakage is greater than amount specified.
- .19 Repeat test until leakage is within specified allowance for full length of water main.

3.12 PIPE SURROUND

- .1 Upon completion of pipe laying and after Department Representative has inspected Work in place, surround and cover pipes as indicated.
- .2 Hand place surround material in uniform layers not exceeding 150 mm compacted thickness as indicated.
- .3 Place layers uniformly and simultaneously on each side of pipe.
- .4 Do not place material in frozen condition.
- .5 Compact each layer from pipe invert to mid height of pipe to at least 95% maximum density to ASTM D 698.
- .6 Compact each layer from mid height of pipe to underside of backfill to at least 95% maximum density to ASTM D 698.

3.13 BACKFILL

- .1 Place backfill material, above pipe surround, in uniform layers not exceeding 150 mm compacted thickness up to grades as indicated.
- .2 Do not place backfill in frozen condition.
- .3 Under roadways and pathways, compact backfill to at

least 95% maximum density to ASTM D 698.

3.14 PAINTING OF
HYDRANTS

- .1 After installation, paint hydrants red.
- .2 After hydrant flow tests, paint caps and ports to meet colour selections approved by authority having jurisdiction.

3.15 FLUSHING AND
DISINFECTING

- .1 Flushing and disinfecting operations: witnessed by Department Representative.
 - .1 Notify Department Representative at least 4 days in advance of proposed date when disinfecting operations will begin.
- .2 Flush water mains through available outlets with a sufficient flow of potable water to produce velocity of 1.5 m/s, within pipe for minimum 10 minutes, or until foreign materials have been removed and flushed water is clear. The contractor shall supply all water for flushing and testing.
- .3 Flushing flows as follows:

Pipe Size NPS	Flow (L/s) Minimum
6 and below	38
8	75
10	115
12	150

- .4 Provide connections and pumps for flushing as required.
- .5 Open and close valves, hydrants and service connections to ensure thorough flushing.
- .6 When flushing has been completed to Department Representative approval, introduce strong solution of chlorine as approved by Department Representative into water main and ensure that it is distributed throughout entire system.
- .8 Rate of chlorine application to be proportional to rate of water entering pipe.
- .9 Chlorine application to be close to point of filling water main and to occur at same time.
- .10 Operate valves, hydrants and appurtenances while main contains chlorine solution.
- .11 Flush line to remove chlorine solution after 24 hours.

- .12 Measure chlorine residuals at extreme end of pipe-line being tested.
 - .13 Perform bacteriological tests on water main, after chlorine solution has been flushed out.
 - .1 Take samples daily for minimum of two days.
 - .2 Should contamination remain or recur during this period, repeat disinfecting procedure.
 - .3 Specialist contractor to submit certified copy of test results.
 - .14 Take water samples at hydrants and service connections, in suitable sequence, to test for chlorine residual.
 - .15 After adequate chlorine residual not less than 50 ppm has been obtained leave system charged with chlorine solution for 24 hours.
 - .1 After 24 hours, take further samples to ensure that there is still not less than 10 ppm of chlorine residual remaining throughout system.
- 3.16 SURFACE
RESTORATION
- .1 After installing and backfilling over water mains, restore surface to original condition as approved by the Department Representative.

-----END OF SECTION-----

APPENDIX A
Geotechnical Report

Port Hardy Airport - Watermain Replacement Package
Port Hardy, BC

March 31, 2017
Ryzuk Geotechnical

RYZUK GEOTECHNICAL

Engineering & Materials Testing

28 Crease Avenue, Victoria, BC, V8Z 1S3 Tel: 250-475-3131 Fax: 250-475-3611 www.ryzuk.com

March 31, 2017
File No: 8-7930-2

ISL Engineering and Land Services Ltd.
#201-8506 200th Street
Langley, BC
V2Y 0M1

Attention: Steve Verkaik, P.Eng.
(by email: sverkaik@islengineering.com)

Re: Port Hardy Airport – Watermain Replacement Package
Port Hardy, BC

As requested, and in accordance with our proposal dated November 17, 2016, we have completed a geotechnical investigation of the subsurface soil conditions at the referenced site as such relate to the proposed development. Our observations and recommendations are summarized below.

PROPOSED DEVELOPMENT

Based on the ISL Engineering and Land Services Ltd. (ISL) drawings, *Port Hardy Airport – Watermain Replacement Package*, dated October 13, 2016, we understand that approximately 1,500 m of watermain is to be installed along Byng Road, Metchosin Street, Yew Street and Newport Avenue at the Port Hardy Airport. All watermains will be installed between approximately 1.0 and 2.5 m below the finished grades. Furthermore, the existing asbestos cement (AC) watermain in the area is to be capped and abandoned.

To place the new watermain and to cap and abandon the existing watermain, it is anticipated that trenching through the above-noted asphalt paved roads and/or road shoulders will be required. It is expected that all excavation and trenching is to be backfilled and compacted to MMCD standards.

INVESTIGATION PROCEDURE

Our work consisted of a combination of a desktop study, a site reconnaissance, and a subsurface investigation. The desktop study included a review of our previously completed work in the surrounding area, as well as the review of soil maps and aerial photography.

On March 1, 2017, we visited the subject site to complete the site reconnaissance and subsurface investigation. The site reconnaissance consisted of traversing the site by foot and documenting features of engineering, geological, and topographical significance. The subsurface investigation

included the excavation of 16 test pits (TP17-01 to TP17-16) to depths down to 2.3 m below the existing ground surface. The test pits were completed using a subcontracted track-mounted mini excavator.

Grab-bag soil samples were collected for subsequent laboratory testing which was limited to a sieve analysis and confirmation of field identification. Where applicable, on-site soil testing was conducted using a handheld pocket penetrometer. Test pit locations are indicated on the Test Pit Location Plan (dwg. 8-7930-2-1), included with this report. Detailed test pit logs and results of the sieve analysis are also attached.

Finally, a visual site review of the pavement surfaces associated with the project extents was completed. The roads associated with the watermain replacement were traversed by foot and the existing pavement conditions were documented. To supplement the pavement assessment, three of the test pits (TP17-14 to TP17-16) were excavated immediately adjacent to existing roads in order to determine the underlying road structure.

INVESTIGATION RESULTS

Results and interpretations of the site reconnaissance, subsurface investigation, and pavement assessment follow.

Surface conditions

From the southern edge of the proposed works, along Newport Avenue, the site slopes down gently to the north at a slope gradient of about 2 to 3%, with an overall vertical relief of about 8 m over a horizontal distance of about 350 m. The eastern portion of the site, east of Pine Street includes the airport terminal, maintenance buildings, and associated parking areas. West of Pine Street, the site consists of a series of interconnected roads and undeveloped grasslands. We understand that this area had been previously occupied by army barracks that included a number timber framed buildings with concrete foundations. However, at the time of the site visit, within the project extents, no buildings were present west of Pine Street.

Subsurface Conditions

Based on available published geological information and our local experience in the area, it is interpreted that the area is generally underlain by glaciofluvial silty sands and gravels. The test pits excavated throughout the site confirmed these interpretations. In all test pits excavated, between 0.2 and 1.2 m of fill material was found to overlie the native very dense silty sand or very stiff to hard silt. The dense sand was generally encountered in the test pits excavated east of Yew Street, and the very stiff to hard silt noted in those excavated west of Yew Street. The overlying fills consisted of a variable mix of silt, clay, sand, and gravel often with minor inclusions of organics, wood, and concrete debris.

During the investigation, the static groundwater table was not encountered; however, seepage through the overlying fills was noted in a number of the test pits.

Pavement Condition

As noted above, a visual assessment of the existing pavement condition and a subsurface investigation of the underlying road structure was completed. Within the project extents, Byng Road appears to have been recently reconstructed and in very good condition. No signs of cracking or patching were noted. In a test pit excavated adjacent to the road (TP17-14), the road structure was found to consist of 150 mm of asphalt pavement underlain by 250 mm of 19 mm minus crushed sand and gravel road base, over a 500 mm thick road subbase of 75 mm minus pit-run sand and gravel. The road structure was founded on the native, dense silty sand.

The remaining roads, Newport Avenue, Pine Street, Yew Street, and Metchosin Street were found to be in poor condition. Severe longitudinal, transverse, and alligator cracking were noted throughout all portions of the roads. In test pits excavated adjacent to Yew Street (TP17-15) and Metchosin Street (TP17-16), 60 mm of asphalt was underlain by roughly 1.0 m of gravelly sand with some silt over the native subgrade.

GEOTECHNICAL ASSESSMENT AND RECOMMENDATIONS

Based on our observations described above, the following conclusions and recommendations are provided.

Excavation and Trenching

It is our opinion that conventional open trenching is the most feasible and practical construction option for inground infrastructure. Based on our review of the proposed watermain alignment, we expect that trenching will generate cutslopes to depths up to about 2.5 m. We expect that temporary excavation cutslopes within the observed subsurface materials will be stable at the following configurations:

- Topsoil/Fill materials – between 0.75H:1V and 1H:1V (Horizontal : Vertical)
- Dense grey silty sand – 0.5H:1V
- Hard grey silt - 0.5H:1V

Depending on the actual soil conditions and seepage encountered during excavation, the above slope configurations are subject to change and may be flattened; or, in some cases unsupported vertical cuts may be viable. All excavation cutslopes deeper than 1.2 m and steeper than 0.75H:1V must be assessed by a geotechnical professional in accordance with WorkSafeBC guidelines.

Alternatively, open excavation methods may be combined with conventional shoring cages and trench boxes to achieve required excavation depths.

Temporary Dewatering

We do not expect that a static groundwater level will be of concern throughout the project extents. However, groundwater levels do fluctuate seasonally and it should be anticipated that groundwater

seepage and/or surface water runoff may occur during or after periods of intense rainfall or rapid snowmelt. Temporary dewatering, if required, will most likely be achieved through conventional methods such as sumps and pumps.

Existing Service Crossings

Where other services cross the alignment of any excavations, existing services should be reviewed and inspected by a qualified professional to ensure that recommendations for temporary support can be made, if required. Typical methods of support include the installation of steel beams across the trench, with straps suspended from the beams and wrapped around the services for support. This temporary support is required to minimize potential or excessive stresses and strains on these utilities.

Site Preparation

Excavated areas beneath the new watermain alignment should be kept as dry as possible and any loose, saturated, and/or deleterious material should be removed from its footprint to expose the undisturbed native very stiff to hard silt or very dense silty sand.

It is important to note that, while very stiff, the native silt subgrade soils at the site are fine grained and thus moisture sensitive and prone to excessive disturbance. If construction activities occur during periods of wet weather, a thin bedding layer of 19 mm minus gravel should be placed to protect the subgrade surface from disturbance.

Backfill and Reuse of On-Site Materials

All backfill should meet the appropriate MMCD specifications. Based on the ISL drawings provided, it appears that much of the new watermain alignment will be contained below existing roads. In these areas, an imported granular backfill should be placed in lifts no thicker than 300 mm and compacted to at least 95% of the materials Modified Proctor Maximum Dry Density (MPMDD).

In the areas outside of Byng Road, sieve analysis of granular fill materials sampled during the test pit investigation indicate that the materials do not meet MMCD specifications and thus may not be used as either granular pipe bedding or as trench backfill above the pipe in trenched road areas. However, provided that they are free of any organic and/or other deleterious material, and that they can be compacted to at least 90% of their MPMDD, the fill materials may be used as trench backfill in easements or boulevards.

As previously noted, the pavement structure of Byng Road has been recently reconstructed. During the watermain installation, the road base and subbase may be stockpiled and reused in the replacement road structure.

Road Structure

For the watermain alignment below Byng Road, to match the existing road conditions, the following minimum road structure is recommended:

Table 1: Road Structure – Byng Road

Thickness	Material Type
150 mm	Asphalt
250 mm	Base – 19 mm minus crushed sand and gravel
300 mm	Subbase – 75 mm minus pit-run sand and gravel
-	Approved Trench Backfill

Trenching is also anticipated through Newport Avenue and select sections of Metchosin Street. Currently the condition of these roads is poor. The following trench patch is provided as a temporary, practical, and economical solution with the anticipation that a full road reconstruction will be completed in the future.

Table 2: Temporary Trench Patch – Newport Avenue, Metchosin Street

Thickness	Material Type
50 mm	Asphalt
100 mm	Base – 19 mm minus crushed sand and gravel
200 mm	Subbase – 75 mm minus pit-run sand and gravel
-	Approved Trench Backfill

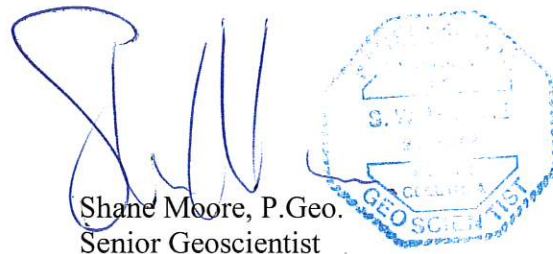
CLOSURE

We trust the preceding is suitable for your purposes at present. Please do not hesitate to contact our office if we can be of further assistance.

Kind regards,
Ryzuk Geotechnical



Jeff Ferraby, EIT
Project Engineer




Shane Moore, P. Geo.
Senior Geoscientist


- Attachments
- Test Pit Location Plan, dwg. 8-7930-2-1
 - Test Pit Logs TP17-01 to TP17-16
 - Sieve Analysis Results



NOTES:

1. Base image taken from Google Earth, 2017

 Proposed new watermain alignment (approx.)

 Existing watermain alignment (approx.)

 Test Pit Location (approx.)



ISL Engineering and Land Services Ltd.

Port Hardy Airport Watermain Replacement Package

Test Pit Location Plan

Port Hardy Airport

Port Hardy, BC

RYZUK GEOTECHNICAL

Engineering & Materials Testing

DRAWN JAF

DATE March 31, 2017

APPROVED 

SCALE NTS

DRAWING No. 8-7930-2-1



28 Crease Avenue
 Victoria, BC
 V8Z 1S3
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 mail@ryzuk.com www.ryzuk.com

TEST PIT LOG

TP17-01

Project: Port Hardy Airport Watermain Replacement Package

Client: ISL Engineering and Land Services Job #: 8-7930-2

Location: Port Hardy Airport Method: Mini-Excavator

See Location Plan dwg. 8-7930-2-1 Excavator: T. Nicholson

Test Date: March 1, 2017 Inspector: JAF

Depth (m)	Stratigraphy	Stratigraphic Description	Cpen (kPa)	Cvane (kPa)	Sample	Moisture %									
						0	20	40	60	80	100				
0.0	*****	Topsoil - loose, brown, sand, silty, roots, damp, grass-cover													
	▨	Fill - grey, clay, silty, some sand, some gravel, moist													
0.5	▨	Fill - brown-grey, sand, gravelly, some silt, some cobbles, organics, moist													
1.0	▨	SAND (till-like), very dense, grey, gravelly, some silt, trace cobbles, moist													
1.5		End of Test-Pit at 1.4 m Desired Depth													
2.0															
2.5															

LEGEND

- ▼ Groundwater table
- ▨ Grab Sample
- ▲ Moisture Content
- Cpen: Su from pocked penetrometer
- Cvane: Su from pocket vane



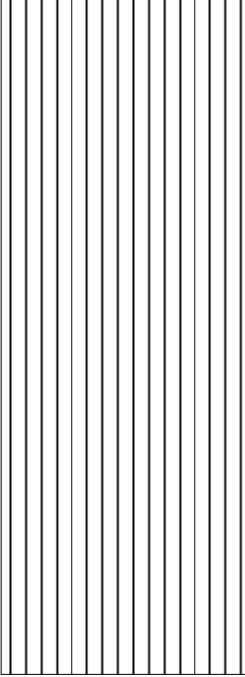
COMMENTS: - Seepage at 1.0 m



TEST PIT LOG

28 Crease Avenue
 Victoria, BC
 V8Z 1S3
 Tel. 250-475-3131 Fax. 250-475-3611
 mail@ryzuk.com www.ryzuk.com

Project: Port Hardy Airport Watermain Replacement Package
 Client: ISL Engineering and Land Services Job #: 8-7930-2
 Location: Port Hardy Airport Method: Mini-Excavator
 See Location Plan dwg. 8-7930-2-1 Excavator: T. Nicholson
 Test Date: March 1, 2017 Inspector: JAF

Depth (m)	Stratigraphy	Stratigraphic Description	Cpen (kPa)	Cvane (kPa)	Sample	Moisture %						
						0	20	40	60	80	100	
0.0	  	Topsoil - loose, brown, sand, silty, roots, damp, grass-cover Fill - grey, clay, silty, some sand, moist SILT, very stiff to hard, grey, clayey, trace sand, trace gravel, damp	220									
0.5												
1.0												
1.5		End of Test-Pit at 1.4 m Desired Depth										
2.0												
2.5												

LEGEND

- ▼ Groundwater table
- Grab Sample
- ▲ Moisture Content
- Cpen: Su from pocked penetrometer
- Cvane: Su from pocket vane

COMMENTS: - No groundwater or seepage encountered



28 Crease Avenue
 Victoria, BC
 V8Z 1S3
 Tel. 250-475-3131 Fax. 250-475-3611
 mail@ryzuk.com www.ryzuk.com

TEST PIT LOG

TP17-08

Project: Port Hardy Airport Watermain Replacement Package

Client: ISL Engineering and Land Services Job #: 8-7930-2

Location: Port Hardy Airport Method: Mini-Excavator

See Location Plan dwg. 8-7930-2-1 Excavator: T. Nicholson

Test Date: March 1, 2017 Inspector: JAF

Depth (m)	Stratigraphy	Stratigraphic Description	Cpen (kPa)	Cvane (kPa)	Sample	Moisture %							
						0	20	40	60	80	100		
0.0	***** ***** *****	Topsoil - loose, brown, sand, silty, roots, damp, grass-cover	220		[Sample]								
	[Cross-hatched pattern]	Fill - grey, sand, gravelly, moist											
0.5	[Vertical line pattern]	SILT, very stiff to hard, grey, clayey, trace sand, trace gravel, damp											
1.0													
1.5													
		End of Test-Pit at 1.6 m Desired Depth											
2.0													
2.5													

LEGEND

- ▼ Groundwater table
- Grab Sample
- ▲ Moisture Content
- Cpen: Su from pocked penetrometer
- Cvane: Su from pocket vane

COMMENTS: - No groundwater or seepage encountered



TEST PIT LOG

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Project: Port Hardy Airport Watermain Replacement Package

Client: ISL Engineering and Land Services Job #: 8-7930-2

Location: Port Hardy Airport Method: Mini-Excavator

See Location Plan dwg. 8-7930-2-1 Excavator: T. Nicholson

Test Date: March 1, 2017 Inspector: JAF

Depth (m)	Stratigraphy	Stratigraphic Description	Cpen (kPa)	Cvane (kPa)	Sample	Moisture %									
						0	20	40	60	80	100				
0.0		Topsoil - loose, brown, sand, silty, roots, damp, grass-cover													
		Fill - grey, sand, gravelly, some silt, moist													
		Fill - brown, organics, some gravel, some silt, moist													
0.5		Fill - brown, sand, some gravel, some cobbles, moist													
		SILT, very stiff to hard, grey, clayey, trace sand, trace gravel, damp													
1.0															
1.5															
		End of Test-Pit at 1.7 m Desired Depth													
2.0															
2.5															

LEGEND

- ▼ Groundwater table
- Grab Sample
- ▲ Moisture Content
- Cpen: Su from pocked penetrometer
- Cvane: Su from pocket vane

COMMENTS: - No groundwater or seepage encountered



TEST PIT LOG

Project: Port Hardy Airport Watermain Replacement Package

Client: ISL Engineering and Land Services Job #: 8-7930-2

Location: Port Hardy Airport Method: Mini-Excavator

See Location Plan dwg. 8-7930-2-1 Excavator: T. Nicholson

Test Date: March 1, 2017 Inspector: JAF

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Depth (m)	Stratigraphy	Stratigraphic Description	Cpen (kPa)	Cvane (kPa)	Sample	Moisture %							
						0	20	40	60	80	100		
0.0		Fill - brown, sand, some silt, trace gravel, trace cobbles, moist	220										
0.5													
1.0		SILT, very stiff to hard, grey, clayey, trace sand, trace gravel, damp											
1.5		End of Test-Pit at 1.4 m Desired Depth											
2.0													
2.5													

LEGEND

- ▼ Groundwater table
- Grab Sample
- ▲ Moisture Content
- Cpen: Su from pocked penetrometer
- Cvane: Su from pocket vane

COMMENTS: - No groundwater or seepage encountered



TEST PIT LOG

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Project: Port Hardy Airport Watermain Replacement Package

Client: ISL Engineering and Land Services Job #: 8-7930-2

Location: Port Hardy Airport Method: Mini-Excavator

See Location Plan dwg. 8-7930-2-1 Excavator: T. Nicholson

Test Date: March 1, 2017 Inspector: JAF

Depth (m)	Stratigraphy	Stratigraphic Description	Cpen (kPa)	Cvane (kPa)	Sample	Moisture %									
						0	20	40	60	80	100				
0.0	***** *****	Topsoil - loose, brown, sand, silty, roots, damp, grass-cover													
	▣	Fill - brown-grey, sand, gravelly, organics, roots, moist													
0.5															
1.0															
1.5	▤	SILT, very stiff to hard, grey, clayey, trace sand, trace gravel, damp													
2.0															
2.2		End of Test-Pit at 2.2 m Desired Depth													
2.5															

LEGEND

- ▼ Groundwater table
- ▣ Grab Sample
- ▲ Moisture Content

Cpen: Su from pocked penetrometer
 Cvane: Su from pocket vane

COMMENTS: - Seepage at 0.4 m



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TEST PIT LOG

TP17-12

Project: Port Hardy Airport Watermain Replacement Package

Client: ISL Engineering and Land Services Job #: 8-7930-2

Location: Port Hardy Airport Method: Mini-Excavator

See Location Plan dwg. 8-7930-2-1 Excavator: T. Nicholson

Test Date: March 1, 2017 Inspector: JAF

Depth (m)	Stratigraphy	Stratigraphic Description	Cpen (kPa)	Cvane (kPa)	Sample	Moisture %									
						0	20	40	60	80	100				
0.0	*****	Topsoil - loose, brown, sand, silty, roots, damp, grass-cover													
	▣	Fill - brown, sand, gravelly, some silt, some cobbles, trace boulders, organics, concrete, moist													
0.5															
1.0															
1.5	▤	SILT, very stiff to hard, grey, clayey, trace sand, trace gravel, damp													
		End of Test-Pit at 1.7 m Desired Depth													
2.0															
2.5															

LEGEND

- ▼ Groundwater table
- ▣ Grab Sample
- ▤ Moisture Content
- Cpen: Su from pocked penetrometer
- Cvane: Su from pocket vane

COMMENTS: - No groundwater or seepage encountered



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TEST PIT LOG

TP17-13

Project: Port Hardy Airport Watermain Replacement Package

Client: ISL Engineering and Land Services Job #: 8-7930-2

Location: Port Hardy Airport Method: Mini-Excavator

See Location Plan dwg. 8-7930-2-1 Excavator: T. Nicholson

Test Date: March 1, 2017 Inspector: JAF

Depth (m)	Stratigraphy	Stratigraphic Description	Cpen (kPa)	Cvane (kPa)	Sample	Moisture %					
						0	20	40	60	80	100
0.0		Fill - gravel, grey, trace sand, damp									
		Fill - brown, sand, gravelly, some silt, trace cobbles, damp									
0.5											
1.0		SILT, very stiff to hard, grey, clayey, trace sand, trace gravel, damp									
1.5											
2.0		End of Test-Pit at 2.0 m Desired Depth	220								
2.5											

LEGEND

- ▼ Groundwater table
- Grab Sample
- ▲ Moisture Content
- Cpen: Su from pocked penetrometer
- Cvane: Su from pocket vane

COMMENTS: - No groundwater or seepage encountered



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TEST PIT LOG

TP17-14

Project: Port Hardy Airport Watermain Replacement Package

Client: ISL Engineering and Land Services Job #: 8-7930-2

Location: Port Hardy Airport Method: Mini-Excavator

See Location Plan dwg. 8-7930-2-1 Excavator: T. Nicholson

Test Date: March 1, 2017 Inspector: JAF

Depth (m)	Stratigraphy	Stratigraphic Description	Cpen (kPa)	Cvane (kPa)	Sample	Moisture %									
						0	20	40	60	80	100				
0.0		Asphalt (150 mm)													
		Fill (road base) - brown, sand, gravelly, trace silt, moist													
0.5		Fill (75 mm minus pit-run) - brown, sand, gravelly, trace silt, trace cobbles, moist													
1.0		SILT, very stiff to hard, grey, clayey, trace sand, trace gravel, damp													
		End of Test-Pit at 1.0 m Desired Depth													
1.5															
2.0															
2.5															

LEGEND

- ▼ Groundwater table
- Grab Sample
- ▲ Moisture Content
- Cpen: Su from pocked penetrometer
- Cvane: Su from pocket vane

COMMENTS: - No groundwater or seepage encountered



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TEST PIT LOG

TP17-15

Project: Port Hardy Airport Watermain Replacement Package

Client: ISL Engineering and Land Services Job #: 8-7930-2

Location: Port Hardy Airport Method: Mini-Excavator

See Location Plan dwg. 8-7930-2-1 Excavator: T. Nicholson

Test Date: March 1, 2017 Inspector: JAF

Depth (m)	Stratigraphy	Stratigraphic Description	Cpen (kPa)	Cvane (kPa)	Sample	Moisture %									
						0	20	40	60	80	100				
0.0		Asphalt (60 mm)													
		Fill - brown-grey, sand, gravelly, some silt, some cobbles, trace organics, moist													
0.5															
1.0		SAND (till-like), very dense, grey, gravelly, some silt, trace cobbles, moist													
		End of Test-Pit at 1.2 m Desired Depth													
1.5															
2.0															
2.5															

LEGEND

- ▼ Groundwater table
- Grab Sample
- ▲ Moisture Content
- Cpen: Su from pocked penetrometer
- Cvane: Su from pocket vane

COMMENTS: - Seepage at 1.0 m



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TEST PIT LOG

TP17-16

Project: Port Hardy Airport Watermain Replacement Package

Client: ISL Engineering and Land Services Job #: 8-7930-2

Location: Port Hardy Airport Method: Mini-Excavator

See Location Plan dwg. 8-7930-2-1 Excavator: T. Nicholson

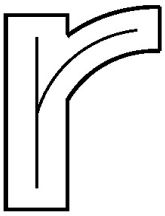
Test Date: March 1, 2017 Inspector: JAF

Depth (m)	Stratigraphy	Stratigraphic Description	Cpen (kPa)	Cvane (kPa)	Sample	Moisture %									
						0	20	40	60	80	100				
0.0		Asphalt (60 mm)													
		Fill - brown-grey, sand, gravelly, some silt, some cobbles, trace organics, moist													
0.5															
1.0															
1.5		SILT, very stiff to hard, grey, clayey, trace sand, trace gravel, damp													
		End of Test-Pit at 1.5 m Desired Depth													
2.0															
2.5															

LEGEND

- ▼ Groundwater table
- Grab Sample
- ▲ Moisture Content
- Cpen: Su from pocked penetrometer
- Cvane: Su from pocket vane

COMMENTS: - No groundwater or seepage encountered



RYZUK GEOTECHNICAL
ENGINEERING & MATERIALS TESTING

Aggregate Gradation Analysis

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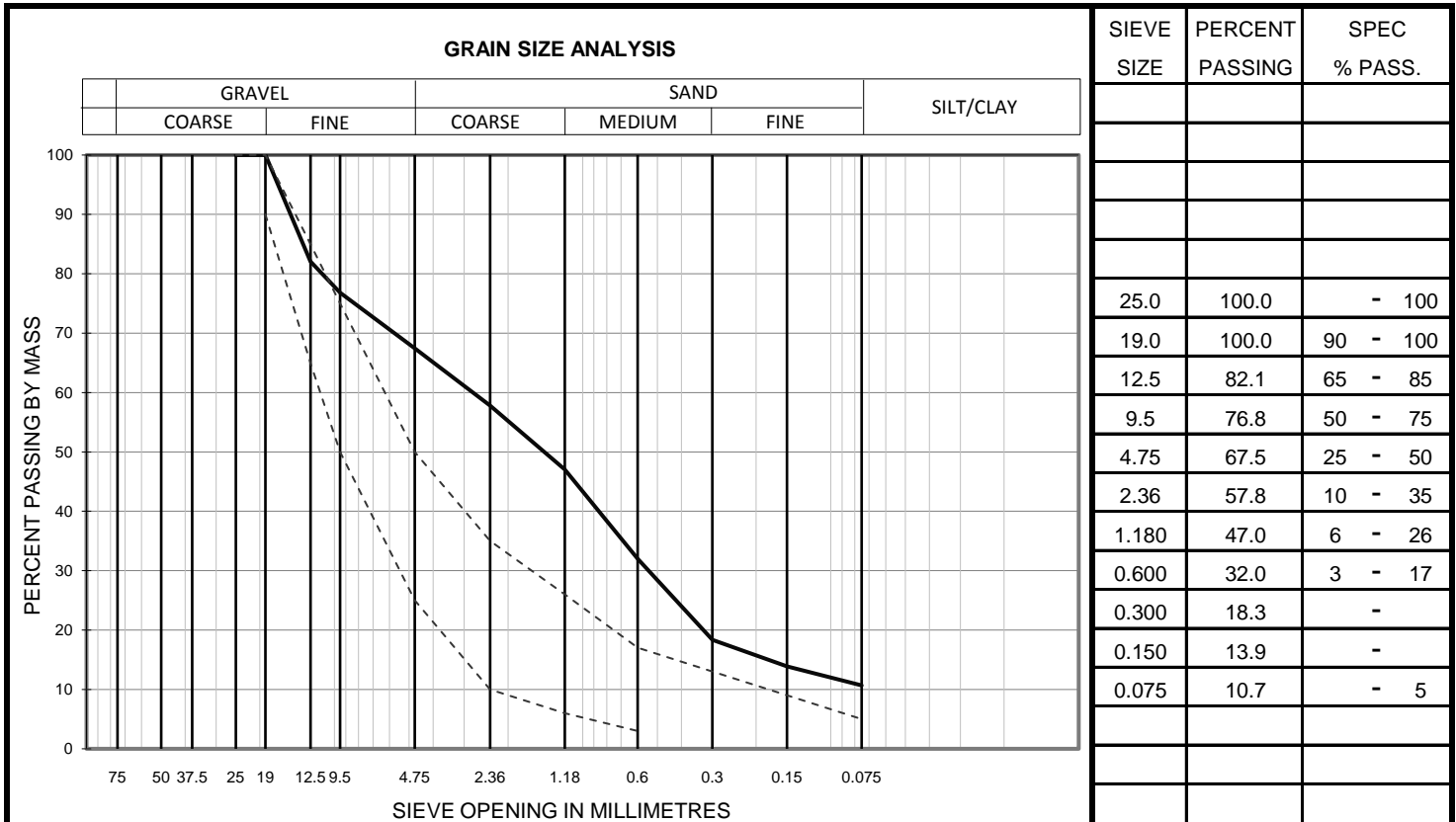
Project No.: 8-7930-2
Project: Port Hardy Airport Watermain Replacement Package

Client: ISL Engineering and Land Services Ltd.

Contact: Steve Verkaik
Email/Fax No. sverkaik@islengineering.com

Copy to: _____ Email/Fax: _____

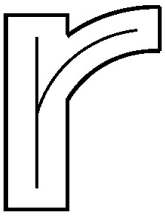
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DATE SAMPLED: 01-Mar-17 DATE RECEIVED: 02-Mar-17 DATE TESTED: 09-Mar-17
TEST METHOD: ASTM C136, D1140 SOURCE: Test Pit



SAMPLE DESCRIPTION: 0

COMMENTS: - Washed sieve
- Dashed boundares for MMCD Type 1 Granular Pipe Bedding and Surround Material

Per: _____



RYZUK GEOTECHNICAL
ENGINEERING & MATERIALS TESTING

Aggregate Gradation Analysis

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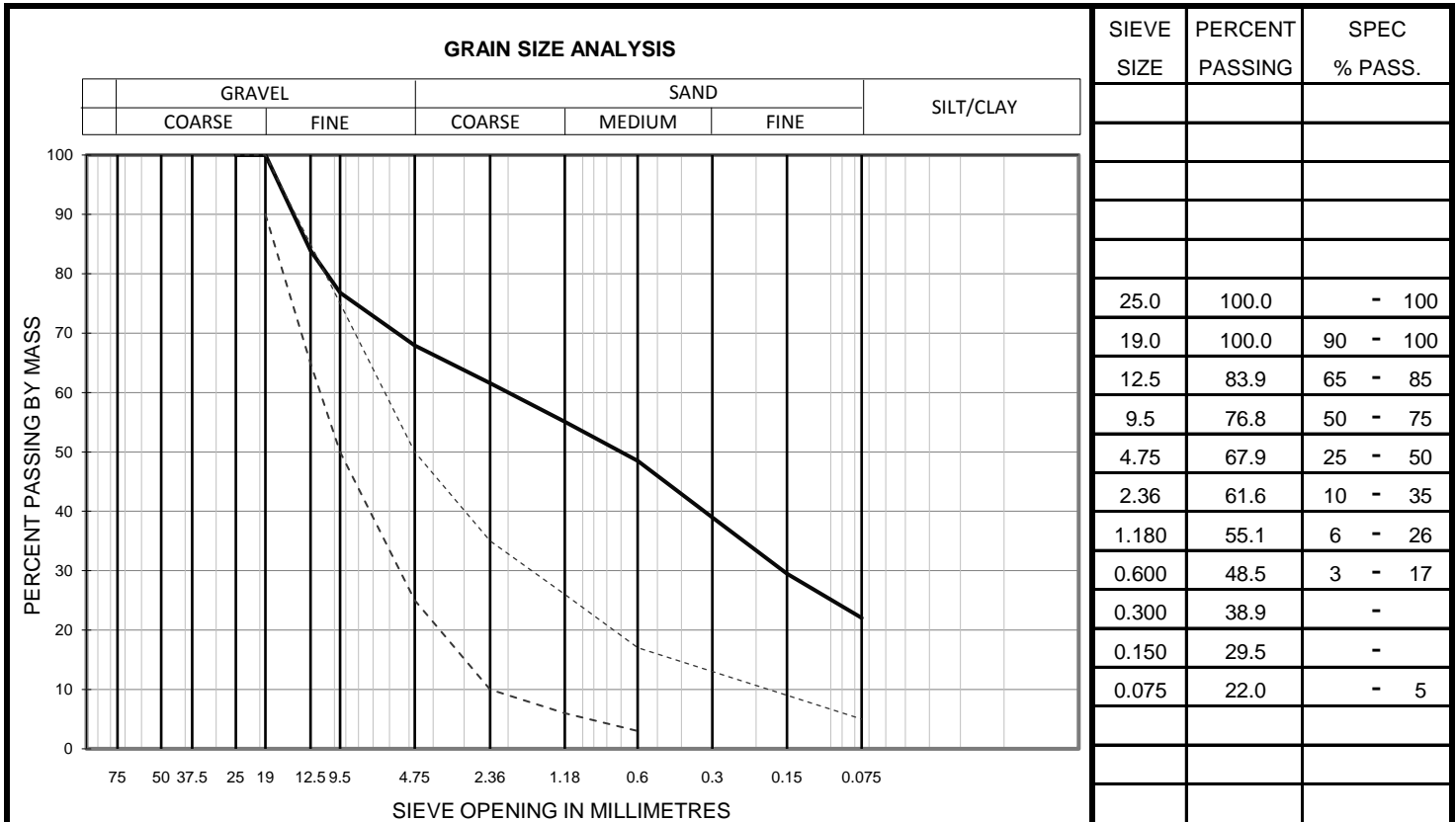
Project No.: 8-7930-2
Project: Port Hardy Airport Watermain Replacement Package

Client: ISL Engineering and Land Services Ltd.

Contact: Steve Verkaik
Email/Fax No. sverkaik@islengineering.com

Copy to: _____ Email/Fax: _____

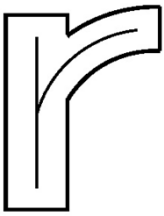
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DATE SAMPLED: 01-Mar-17 DATE RECEIVED: 02-Mar-17 DATE TESTED: 09-Mar-17
TEST METHOD: ASTM C136, D1140 SOURCE: Test Pit



SAMPLE DESCRIPTION: 0

COMMENTS: - Washed sieve
- Dashed boundaries for MMCD Type 1 Granular Pipe Bedding and Surround Material

Per: _____



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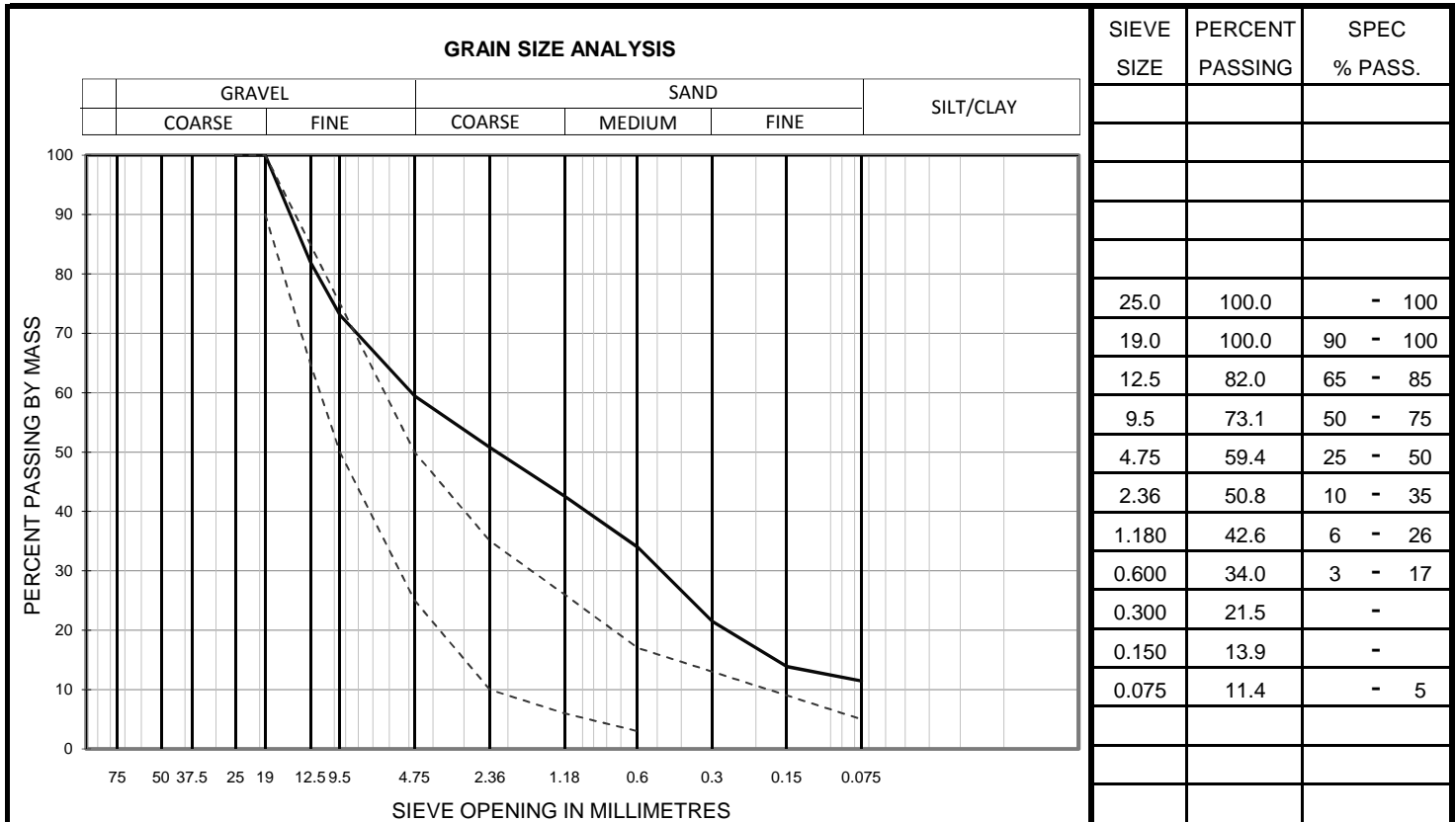
Project No.: 8-7930-2
Project: Port Hardy Airport Watermain Replacement Package

Client: ISL Engineering and Land Services Ltd.

Contact: Steve Verkaik
Email/Fax No. sverkaik@islengineering.com

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SAMPLE I.D.: TP17-08 1.6 m SAMPLE TYPE: Grab SAMPLED BY: JAF
DATE SAMPLED: 01-Mar-17 DATE RECEIVED: 02-Mar-17 DATE TESTED: 09-Mar-17
TEST METHOD: ASTM C136, D1140 SOURCE: Test Pit



SAMPLE DESCRIPTION: 0

COMMENTS: - Washed sieve
- Dashed boundaries for MMCD Type 1 Granular Pipe Bedding and Surround Material

Per: _____