

SPECIFICATIONS

for

Fisheries and Oceans Canada

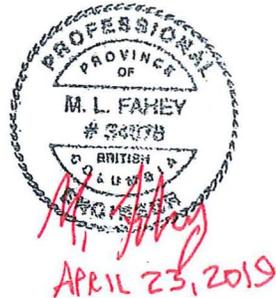
Kitimat River Hatchery – Valve Replacement

April 2019

Civil Specifications

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Civil

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Kitimat River Hatchery - Record Drawings

22-35-5	Updated Site Plan
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22-35-420	Hatchery Site Paving Pavement Layout Plan
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Civil Specifications

Division 01 - General Requirements

1) Introduction

Fisheries and Oceans Canada (DFO) is looking for experienced contractors to replace 47 variously sized valves and 14 curb stops with associated drains at the Kitimat River Hatchery. The existing hatchery was constructed in the early 1980's along with the installation of the water piping and valves. Many of the existing valves are currently not operational and are freezing underground, resulting in damage to the above ground operation.

The valves are used to service the raceways where the hatchery rear Chinook, Steelhead, Chum, and Coho. Each raceway was designed for a specific type of salmon and can hold adults and juvenile salmon during various phases of the salmon's life cycle.

2) Project Details

a. Scope of Work

The scope of work for this project consists of the removal and replacement of forty-six (46) butterfly valves ranging in size from 75mm to 500mm, one (1) 19mm corporation stop and fourteen (14) 19mm curb stop drains with service boxes. Details of the existing valves along with the proposed materials for replacement are included in the contract drawings and in the quantities table below. The scope of work includes all of the associated valve operators, riser and floor boxes/stands. The valves are all located at significant depths between two (2) to four (4) meters below the existing asphalt and adjacent to the existing hatchery building and concrete rearing ponds. Special attention should be paid to the location of the existing valves when evaluation this tender and to the requirements set out for trenching and excavation support outlined by the Geotechnical Engineering package.

b. Schedule of Work

Construction work for this project is dependent on the hatchery's operational requirements. Strict schedule timelines are to be adhered to and are as follows:

Raceways / Ponds	Valves	Start Date	Deadline
13-14	34-45	3 rd week of May	June 28th
7-12	13-33	3 rd week of May	July 19th
1-6	1-12, 46-47	1 st week of June	August 2nd

Valves 13 and 15 must be complete prior to the start of work for raceways 1-6.

The contractor is required to submit with their tender documents a proposed schedule for completion of the works and this schedule is to be updated on a weekly basis during construction. This project is being tendered as a single contract and the potential contractors will be evaluated based on the total price for all project works.

The contractor must strictly adhere to the schedule outlined above, and if at any time it is evident that the contractor is not or will not adhere to this schedule, DFO reserves the right to place a stop work order.

If delays in the work necessitate the need for additional water supply to the concrete rearing ponds, the contractor will be required to coordinate, install, and maintain the required water supply at their own cost.

Paving restoration works are to be started no earlier than September 5th and completed no later than October 11th. Prior to this window, paving can be scheduled based on the approval of the Hatchery Manager and coordinated based on the operational requirements for vehicular access. Please note in August the Hatchery will require vehicular access to the raceways on a daily basis. The selected contractor will be required to maintain the unpaved areas to the satisfaction of the Departmental Representative for hatchery equipment to move freely around the site. The contractor will be required to perform water and compaction as necessary and monitor dust on site. The proposed paving schedule is to be coordinated and approved by both the Departmental Representative and Hatchery Manager.

c. Quantities

The table below outlines the quantities for this project.

Item	Description	Quantity
1.1	75mm Butterfly Valve for Pond Inlet with Above Ground Operation (Type 2 – DWG C9)	4
1.2	100mm Butterfly Valve for Pond Inlet with Above Ground Operation (Type 2 – DWG C9)	9
1.3	150mm Butterfly Valve for Pond Inlet with Above Ground Operation (Type 2 – DWG C9)	11
1.4	250mm Butterfly Valve for Pond Inlet with Above Ground Operation (Type 2 – DWG C9)	4
2.1	150mm Butterfly Valve with In Ground Floor Box Operation (Type 1 – DWG C9)	1
2.2	350mm Butterfly Valve with In Ground Floor Box Operation (Type 1 – DWG C9)	10
2.3	450mm Butterfly Valve with In Ground Floor Box Operation (Type 1 – DWG C9)	1
2.4	500mm Butterfly Valve with In Ground Floor Box Operation (Type 1 – DWG C9)	6
3.1	25mm Corporation Stop Air Relief Valve with Riser Pipe and Floor Box	1
4.1	19mm Curb Stop Valve with Service Box and Stationary Rod	14

d. Measurement and Payment

- .1 Payment for the quantities outlined above will include the supply, delivery, and installation of all valves, risers, and gear operators and any other fittings required to complete the works shown in the contract drawings and specifications.
- .2 Payment for the quantities outlined above will include all excavation, shoring supports and trenching work in accordance with the geotechnical specifications to expose and remove the existing valves and associated equipment and stockpile at a location directed by the departmental representative or remove from site when directed to do so.
- .3 Payment for the quantities outline above will include all supply, delivery, placement and compaction of pipe bedding material, engineered fill, sub-base material, base material and asphalt pavement as shown on the contract drawings and specifications.
- .4 Payment for the quantities outlined above will include all site restoration work necessary to remediate and return any damaged: equipment, concrete, landscaped areas, pipe, electrical conduit and cable or any other materials affected to a condition that is equivalent to or better than the condition prior to construction.
- .5 Payment for the quantities outlined above will include all other work shown in the contract documents and specifications including but not limited to: survey layout, environmental protection, quality control and testing, watermain pressure testing, trench de-watering, as-built drawings and maintenance manuals.

e. Available Materials

In advance of this project works, several materials have been purchased by the Department of Fisheries and Oceans Canada. These materials are available for purchase by the selected contractor from the department of Fisheries and Oceans Canada. The list of available materials is as follows:

Description	Qty
150mm (6'') Bray Series Butterfly Valve with 2'' op. nut for Buried Service	2
250mm (10'') Bray Series Butterfly Valve with 2'' op. nut for Buried Service	2
500mm (20'') Bray Series Butterfly Valve with 2'' op. nut for Buried Service	1
250mm (10'') Crispin 504 Butterfly Valve with 2'' op. nut for Buried Service	1
350mm (14'') Crispin 504 Butterfly Valve with 2'' op. nut for Buried Service	4
150mm (6'') Crispin 504 Butterfly Valve with 2'' op. nut for Buried Service	2
19mm (3/4'') CMB CJ x CJ Curb Stop Ball Valve	1
4m lengths of 150mm (6'') SDR 35 PVC Pipe	7
Valve Risers with Floor boxes or Floor stands	7

Contact the departmental representative for any additional details of the materials listed above.

f. Quality Control

The contractor will carry out field density testing of the pipe bedding, trench backfill, sub-base, and base course as outlined in the geotechnical specifications. The contractor will employ the use of a qualified testing agency to perform field density testing and will submit all testing results to the departmental representative for review.

The contractor will submit a sieve sample and proctor results for all materials to be imported or re-used on this project to the departmental representative.

3) Contractors Equipment

All work that will require the use of vehicles, equipment such as hydraulic excavators, or machinery should be in condition suitable to the operation within or in the vicinity of the spawning channels without risks of contamination with fuel, oil, grease, hydraulic fluid or any other pollutants. If, in the opinion of the departmental representative, any of the contractor's equipment is in such condition as to present undue risk of oil, fuel or hydraulic leaks or spills, the contractor will need to repair it or replace it immediately.

4) Erosion and Sedimentation Control

The contract drawings and specifications detail typical erosion and sedimentation control measures that the contractor shall use for the project. The contractor shall follow these measures and ensure no sediment laden water enter any creeks or ditches. The specifications section 01 57 01 "Environmental Protection" provides additional details on spill prevention, site restoration, dust control, fire prevention, etc.

5) Trenching and Excavation

The selected contractor will be required to supply for review the details of their proposed trench support methods and excavation procedures to meet the requirements of the geotechnical engineering package. The trench support methods and excavation procedures will be reviewed by the consulting geotechnical engineer prior to any excavation work taking place. The contractor will be required to monitor and report on the condition of the excavation slopes and trench support to the geotechnical engineer.

6) Valve Operational Equipment

The selected contractor is required to supply and transfer to the owner at the end of construction a minimum of one (1) each of the equipment required to operate the newly installed valves. The contractor should submit to the departmental representative for review any shop drawings related to the equipment operations.

7) Contract Close Out Documents

The selected contractor is required to submit to the departmental representative at the end of construction all as-built mark up drawings where deviations from the original design occurred. If during construction, the contractor notices differences between the existing as-built drawings and the in-situ conditions the contractor should notify the departmental representative and note on the drawings the location and information of these differences.

The selected contractor is required to submit to the departmental representative at the end of construction all maintenance and warranty information related to the newly installed equipment.

The following "General Notes" shall apply to the work:

- 1.** The "Owner" of the project is defined as the Department of Fisheries and Oceans Canada. The "Departmental Representative" is defined as the designated representative of the "Owner."
- 2.** Work carried out in accordance with the latest British Columbia's occupational health & safety regulations.
- 3.** Location, extent and detail of existing underground utilities as per DFO reference record drawings under separate cover. Contractor to verify location and elevation of all underground utilities prior to commencing the work.
- 4.** Contractor to ensure integrity of buried underground electrical lines as indicated on reference drawing 22-35-298. Contractor to verify location and elevation of buried electrical lines prior to commencing the work.
- 5.** Contractor to ensure trenching and excavation work meets workers compensation board health and safety requirements.
- 6.** Contractor to ensure trenching and excavation work is in accordance with all drawings, details and specifications contained within the geotechnical drawings and specifications package prepared by horizon engineering.
- 7.** Contractor to ensure integrity of pond concrete structure and is responsible for any remediation required as a by-product of the work,
- 8.** Contractor to schedule work in accordance with hatchery requirements and at the discretion of the departmental representative. Refer to specifications section "01 01 00 - Project Description" for details of the hatchery schedule.
- 9.** Contractor to give prior notice to departmental representative of all works planned in order to schedule inspection of the works.
- 10.** Contractor to provide shop drawings to departmental representative for review prior to purchase.
- 11.** All existing materials removed as part of the works to remain on site or be disposed of at the discretion of the departmental representative.
- 12.** Contractor to store equipment and materials in accordance with manufacturers recommendations and departmental representative direction.
- 13.** Contractor to ensure pipe and fittings installed as part of the works are clean and free from debris prior to installation.

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- 14.** Contractor to ensure installation of pipe and fittings meets manufacturers guidelines and specifications. Departmental representative to inspect installation of all underground works prior to backfilling. Pipe and fittings to pass pressure and leakage test in accordance with the technical specifications.
 - 15.** No chlorine disinfection to be performed prior to or after installation.
 - 16.** Contractor to remove thrust blocks and concrete as necessary to complete the work and re-instate as indicated on the drawings and at the direction of the departmental representative. Thrust block re-instatement to match details on drawing C9.
 - 17.** Contractor to expose and replace valves as indicated on the drawings and schedule of valve replacements. Contractor to replace associated pipe and fittings as necessary to replace the valves at the direction of the departmental representative.
 - 18.** Contractor to remove and replace riser stem and valve boxes with replacement risers and operators as indicated on the schedule of valve replacements and detail drawing C9.
 - 19.** Contractor to expose and replace curb stop and drain from raceway ponds. Replacement to match detail 1 on dwg C8.
 - 20.** Contractor to backfill and compact trench sections in accordance with detail on dwg C9 and geotechnical specifications.
 - 21.** Contractor to perform neat pavement cut prior to excavation. Pavement restoration to be in accordance with detail on dwg C9.
 - 22.** Contractor to isolate and shutdown water lines as directed by departmental representative. Contractor to empty ponds as necessary and as directed by departmental representative.
 - 23.** Contractor to pump and de-water trench as needed to ensure trench is free from water during excavation and backfilling.
 - 24.** Contractor to use hand excavation techniques within 300mm of existing utilities.
 - 25.** Contractor to pay special attention to excavation near building foundation and ensure excavation within building foundation perimeter meets geotechnical requirements.
 - 26.** If replacement of existing watermains is required, replacement watermain to be PVC DR 18 pressure pipe conforming to AWWA C90 & certified to CAN/CSA-b137.3.
 - 27.** Scheduling of pavement restoration works are to be completed as per specifications section "01 01 00 - Project Description".

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- 1. General** .1 Not used
- 2. Documents Required** .1 Refer to Section 01 11 00 – 1.6 for Documents Required.
- 3. Definition of Roles**
- .1 The “Owner” of this project is the Department of Fisheries and Oceans (DFO).
- .2 The “Contractor” for this project will be selected after the tender process and the “Contractor’s” designated representative will be identified to the “Owner” in writing.
- .3 The “Departmental Representative” and the “Contract Administrator” are synonymous terms and represent the designated representative of the “Owner.” This person or persons will be identified by the “Owner” in writing to the “Contractor.”
- .4 The “Engineer” and “Consultant” are synonymous terms and represent the “Owner’s” outside consultants. Communication between the “Contractor” and “Engineer” will be directed through the “Departmental Representative” and not communicated directly unless authorized by the “Departmental Representative.”
- 4. Work Schedule**
- .1 Submit a construction schedule to the Departmental Representative, showing anticipated progress stages and final completion of work within time period required by Contract Documents. The schedule is to be updated bi-weekly or as required by the Departmental Representative. Any changes to the schedule must be reviewed and approved by the Departmental Representative.
- .2 Contractor will be permitted to work during normal hatchery operation hours (Monday to Friday, 8:00 to 16:00). Work outside of normal hatchery operation hours will need to be co-ordinated and approved by hatchery staff.
- .3 All work as specified in the contract drawings and specifications shall be completed according to section 2-b of the project description.
- 5. Contractor's Use of Site**
- .1 Do not unreasonably encumber site with materials or equipment.
- .2 Move stored products or equipment which interfere with operations of Departmental Representative or other contractors.

- .3 Obtain and pay for use of additional storage or work areas needed for operations.
 - .4 Maintain reasonable access.
 - .5 Maintain a reasonably clean and safe site.
- 6. Codes and Standards**
- .1 Perform work in accordance with National Building Code of Canada, latest edition, and any other code of provincial or local application provided that in any case of conflict or discrepancy, the more stringent requirements shall apply.
 - .2 Observe and enforce construction safety measures required by Canadian Construction Safety Code, Provincial Government, WorkSafeBC, Workplace Hazardous Materials Information System Requirements, including training of all workers on the job site, and municipal status and authorities.
 - .3 Meet or exceed requirements of specified standards, codes and referenced documents.
 - .4 Where work is situated on land managed by different legislative bodies the contractor will meet the requirements set out by the authorities responsible. In any case of conflict between the requirements set out by the authorized body and these contract documents, the more stringent requirements shall apply.
- 7. Project Meetings**
- .1 Departmental Representative will arrange project meetings and assume responsibility for setting times and recording and distributing minutes.
- 8. Existing Conditions**
- .1 Inspect surfaces and conditions before commencing work and report defects to the DFO representative. No work to commence until conditions are acceptable. Commencement of work will indicate acceptance of surfaces and conditions.
- 9. Setting out of Work**
- .1 Locate and preserve general reference points.
 - .2 Employ qualified person to lay out work in accordance with control lines and grades provided by Departmental Representative.
 - .3 Supply stakes and other survey markers required for this work.

- .4 The detailed layout is the responsibility of the Contractor. Detailed layout will be performed at the Contractor's expense.

10. Location of Equipment and Fixtures

- .1 Location of equipment, fixtures and outlets indicated or specified is to be considered as approximate. The contractor is responsible for verifying those locations in the field prior to commencing the work.

11. Additional Drawings

- .1 Departmental Representative may furnish additional drawings to assist proper execution of work. These drawings will be issued for clarification only. Such drawings shall have same meaning and intent as the drawings included within the Table of Contents.

12. Site Maintenance and Clean-up

- .1 Maintain the working area in an orderly manner and not encumbered with equipment, materials, or debris.
- .2 Clean-up to be a continuing process from the start of the work to final acceptance of the project. At all times, and without further order, keep property on which work is in progress free from accumulations of waste materials or rubbish caused by employees or by the work. Accumulations of waste materials which might constitute a fire hazard will not be permitted. Spillage from the Contractor's hauling vehicles on traveled public or private roads to be promptly cleaned up. On completion of construction, remove all temporary structures, rubbish, and waste materials resulting from construction operations and dispose of offsite at Contractor's expense.

13. Ambiguities

- .1 In the event of discrepancies and ambiguity in the contract document, manufacturers guidelines and relevant provincial and federal regulations the Contractor shall notify the Departmental Representative for clarification. The more stringent requirement shall apply unless otherwise instructed in writing by the Departmental Representative.

END OF SECTION

Part 1 General**1.1 Work Sequence**

- .1 Sequence work to accommodate Hatchery Staff's continued use of premises during construction.
- .2 Co-ordinate Progress Schedule and co-ordinate with Hatchery Staff during construction.
- .3 Maintain fire access/control.

1.2 Contractor Use of Premises

- .1 Coordinated use of site until Substantial Performance.
- .2 Co-ordinate use of premises under direction of the Departmental Representative and Hatchery Staff.
- .3 Water and Electricity will be provided on an as is and where is basis.
- .4 Parking, Staging and Storage locations will be at the discretion of the Hatchery Staff and Departmental Representative.
- .5 Obtain and pay for use of additional storage or work areas needed for operations under this Contract.
- .6 Contractor will be permitted to work during normal hatchery operation hours (Monday to Friday, 8:00 to 16:00). Work outside of normal hatchery operation hours will need to be coordinated and approved by hatchery staff.

1.3 Hatchery Staff Occupancy

- .1 Hatchery Staff will occupy premises during entire construction period for execution of normal operations.
- .2 Co-operate with Hatchery Staff in scheduling operations to minimize conflict and to facilitate normal Hatchery usage.

1.4 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 Departmental Representative 72 hours' notice for necessary interruption of Mechanical or electrical service throughout course of work. Minimize duration of interruptions. Carry out work at times as directed by governing authorities with minimum disturbance to vehicular traffic and tenant operations.
- .3 Provide alternative routes for personnel and vehicular traffic.
- .4 Establish location and extent of service lines in area of work before starting Work. Notify Departmental Representative of findings.

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- .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 building and tenant systems.
 - .7 Where unknown services are encountered, immediately advise Departmental Representative and confirm findings in writing.
 - .8 Protect, relocate or Departmental Representative maintain existing active services. When inactive services are encountered, cap off in manner approved by authorities having jurisdiction.
 - .9 Record locations of maintained, re-routed and abandoned service lines.
 - .10 Construct hoarding (fencing) in accordance with Section 01 53 01 – 1.10.

1.6 Documents Required

- .1 Maintain at job site, one (1) copy of each document as follows:
 - .1 Contract Drawings.
 - .2 Specifications.
 - .3 Addenda.
 - .4 Reviewed Shop Drawings.
 - .5 List of Outstanding Shop Drawings.
 - .6 Change Orders.
 - .7 Other Modifications to Contract.
 - .8 Field Test Reports.
 - .9 Copy of Approved Work Schedule.
 - .10 Health and Safety Plan and Other Safety Related Documents.
 - .11 Other documents as specified.
- .2 Maintain documents in clean, dry, legible condition.
- .3 Make documents available at all times for inspection by Departmental Representative.

Part 2 Products

2.1 NOT USED

- .1 Not used.

Part 3 Execution

3.1 NOT USED

.1 Not used.

END OF SECTION

Part 1 General**1.1 Administrative**

- .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 review of submittals.
- .9 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved 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 Submit drawings stamped and signed by professional engineer registered or licensed in British Columbia of Canada.
- .3 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.
- .4 Allow 15 days for Departmental Representative review of each submission.
- .5 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.

- .6 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.
- .7 Accompany submissions with transmittal letter, 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.
- .8 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.
- .9 After Departmental Representative review, distribute copies.
- .10 Submit electronic copy and 6 prints of shop drawings for each requirement requested in specification Sections and as Departmental Representative may reasonably request.

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- .11 Submit 6 electronic copies of product data sheets or brochures for requirements requested in specification Sections and as requested by Departmental Representative where shop drawings will not be prepared due to standardized manufacture of product.
 - .12 Submit 6 copies of test reports for requirements requested in specification Sections and as requested by Departmental Representative.
 - .1 Report signed by authorized official of testing laboratory that material, product or system identical to material, product or system to be provided has been tested in accord with specified requirements.
 - .2 Testing must have been within 3 years of date of contract award for project.
 - .13 Submit 6 copies of certificates for requirements requested in specification Sections and as requested by Departmental Representative.
 - .1 Statements printed on manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements.
 - .2 Certificates must be dated after award of project contract complete with project name.
 - .14 Submit 6 copies of manufacturers instructions for requirements requested in specification Sections and as requested by Departmental Representative.
 - .1 Pre-printed material describing installation of product, system or material, including special notices and Material Safety Data Sheets concerning impedances, hazards and safety precautions.
 - .15 Submit 6 copies of Manufacturer's Field Reports for requirements requested in specification Sections and as requested by Departmental Representative.
 - .16 Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.
 - .17 Submit 3 copies and electronic copy of Operation and Maintenance Data for requirements requested in specification Sections and as requested by Departmental Representative.
 - .18 Delete information not applicable to project.
 - .19 Supplement standard information to provide details applicable to project.
 - .20 If upon review by Departmental Representative, no errors or omissions are discovered or if only minor corrections are made, copies 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.

1.3 Photographic Documentation

- .1 Submit electronic copy of colour digital photography in jpg format, standard resolution monthly with progress statement as directed by Departmental Representative.
- .2 Project identification: name and number of project and date of exposure indicated.

1.4 Certificates and Transcripts

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

1.5 Inspection and Testing

- .1 The requirements for Inspection and Testing required under this contract are detailed throughout the contract documents.
- .2 All Inspection and Testing required by the contract document and/or relevant provincial and federal regulations shall be completed by the Contractor at his cost. All inspections and testing shall be carried out by an independent certified testing agency.
- .3 Supply certifications for all independent testing agencies to the Departmental Representative prior to commencement of work.
- .4 The Contractor shall promptly provide copies of all inspection and tests to the Departmental Representative.
- .5 The Contractor shall notify the Departmental Representative at least 48 hours in advance of all testing, for an opportunity to be present.
- .6 All subsequent work and testing required due to unsatisfactory work shall be completed by the Contractor at his cost.
- .7 The contractor shall provide access and assistance when additional sampling / testing is required by the Departmental Representative.
- .8 Prior to road paving, the Contractor shall arrange for the subgrade and road bases to be tested and inspected by a geotechnical engineer. The geotechnical engineer shall also test and inspect all pavement. The tests and inspections should be performed at the Contractor's expense and submitted to the Departmental Representative for review.

- .9 All pipe bedding, pipe cushion and granular backfill shall be reviewed and approved by the geotechnical engineer. All trench subgrade, pipe bedding and base gravels to be reviewed and approved by a geotechnical engineer. The tests and inspections should be performed at the Contractor's expense and submitted to the Departmental Representative for review.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

PART 1 - GENERAL

- 1.1 General** .1 Not used
- 1.2 Documents Required** .1 Refer to Section 01 11 00 – 1.6 for Documents Required.
- 1.3 Workmanship Standards** .1 Make available on site one (1) copy of each workmanship standard called for under "Reference Standards" in project Specifications.
- 1.4 Record Drawings** .1 Departmental Representative will provide two (2) sets of white prints for record drawing purposes.
- .2 Maintain project "as-built" record drawings and record accurately significant deviations from Contract Documents caused by site conditions and changes ordered by Departmental Representative.
- .3 Contractor to print IFC drawing set in black and white and mark "as-built" changes in red.
- .4 Record following information:
- .1 Horizontal and vertical location of underground utilities and appurtenances referenced to permanent surface improvement.
 - .2 Location of internal utilities and appurtenances concealed in construction referenced to visible and accessible features of structure.
 - .3 Field changes of dimension and detail.
 - .4 Changes made by Change Order or Field Order.
 - .5 At completion of project and prior to final inspection, neatly transfer "as-built" notations to second set and submit both sets to Departmental Representative.

END OF SECTION

Part 1 General**1.1 Related Requirements**

- .1 Section 01 33 00 – SUBMITTAL PROCEDURES.

1.2 Reference Standards

- .1 Canada Labour Code, Part 2, Canada Occupational Safety and Health Regulations
- .2 Province of British Columbia
 - .1 Workers Compensation Act, RSBC 1996 - Updated 2012.

1.3 Action and Informational Submittals

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit site-specific Health and Safety Plan: Within 7 days after date of Notice to Proceed and prior to commencement of Work. Health and Safety Plan must include:
 - .1 Results of site specific safety hazard assessment.
 - .2 Results of safety and health risk or hazard analysis for site tasks and operation found in work plan.
- .3 Submit 1 weekly submittal to Departmental Representative.
- .4 Submit copies of reports or directions issued by Federal, Provincial and Territorial health and safety inspectors.
- .5 Submit copies of incident and accident reports.
- .6 Submit WHMIS MSDS - Material Safety Data Sheets.
- .7 Departmental Representative will review Contractor's site-specific Health and Safety Plan and provide comments to Contractor within 3 days.
- .8 Departmental Representative's review of Contractor's final Health and Safety plan should not be construed as approval and does not reduce the Contractor's overall responsibility for construction Health and Safety.
- .9 Medical Surveillance: where prescribed by legislation, regulation or safety program, submit certification of medical surveillance for site personnel prior to commencement of Work, and submit additional certifications for any new site personnel to Departmental Representative.
- .10 SPEC NOTE: If there are specific emergency response procedures for the Building, Facility or Site, then the Departmental Representative/DCC Representative or Consultant must provide the Contractor with the details for consideration of incorporation into the Contractor's on-site Contingency and Emergency Plan as a component of the site specific health and safety plan.

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

1.4 Filing of Notice

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

.2 Contractor shall be responsible and assume the Principal Contractor role for the work zone. Contractor shall provide a written acknowledgement of this responsibility within 3 weeks of contract award. Contractor to submit written acknowledgement to Departmental Representative.

.3 Work zone locations include:

.1 Kitimat Hatchery – 283 Haisla BLVD, Kitimat B.C.

.4 Contractor shall agree to install proper site separation and identification in order to maintain time and space at all times throughout life of project.

1.5 Safety Assessment

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

1.6 Meetings

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

1.7 Regulatory Requirements

.1 Not used.

1.8 Project Site Conditions

.1 Work at site will involve contact with:

.1 Departmental Representative.

1.9 General Requirements

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

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

1.10 Responsibility

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

.2 SPEC NOTE: Use the following paragraph for Construction Projects in the Province of Ontario: N/A

.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.

1.11 Compliance Requirements

.1 Comply with Workers Compensation Act, B.C.

.2 Comply with R.S.Q., c. S-2.1, an Act respecting Health and Safety, and c. S-2.1, r.4 Safety Code for the Construction Industry.

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

.4 Comply with Occupational Health and Safety Act, General Safety Regulations, O.I.C.

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

1.12 Unforeseen Hazards

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

.2 When unforeseen or peculiar safety-related factor, hazard, or condition occur during performance of Work, advise WorkSafeBC and follow procedures in accordance with Acts and Regulations of BC having jurisdiction and advise Departmental Representative verbally and in writing.

1.13 Health and Safety Co-Ordinator

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

.1 Have site-related working experience specific to activities associated with the site.

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

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

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

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

1.14 Posting of Documents

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

1.15 Correction of Non Compliance

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

1.16 Blasting

- .1 Not used.

1.17 Powder Actuated Device

- .1 Use powder actuated devices only after receipt of written permission from Departmental Representative.

1.18 Work Stoppage

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

Part 2 Products**2.1 NOT USED**

- .1 Not used.

Part 3 Execution**3.1 NOT USED**

- .1 Not used.

END OF SECTION

PART 1 - GENERAL

- 1.1 General** .1 Not used
- 1.2 Access** .1 Provide and maintain adequate access to project site.
.2 If authorized to use existing roads for access to project site, maintain such roads for duration of Contract and make good damage resulting from Contractor's use of roads.
- 1.3 Departmental Representative's Site Office** .1 Not Required.
- 1.4 Storage Sheds** .1 Provide adequate weather tight sheds with raised floors, for storage of materials, tools, and equipment which are subject to damage by weather.
- 1.5 Sanitary Facilities** .1 Contractor to provide sanitary facilities for own work force in accordance with governing regulations and ordinances.
.2 Post notices and take such precautions as required by local health authorities. Keep areas and premises in sanitary condition.
- 1.6 Power** .1 Arrange, pay for and maintain temporary electrical power supply in accordance with governing regulations and ordinances.
- 1.7 Water Supply** .1 Arrange, pay for and maintain temporary water supply in accordance with governing regulations and ordinances.
- 1.8 Heating and Ventilating** .1 Maintain minimum temperature of 10°C or higher where specified as soon as finishing work is commenced and maintained until acceptance of structure by Departmental Representative.
.2 Maintain ambient temperature and humidity levels as required for comfort of office personnel.
- 1.9 Drainage** .1 Refer to Section 01 57 01 for site drainage and pumping requirements.
- 1.10 Hoarding** .1 Provide hoarding (fencing) as needed to protect public and private property from injury or damage. Provide lockable gates within hoarding for access to site by workers and vehicles. Make site accessible to Departmental Representative for inspection upon request.

END OF SECTION

PART 1 - GENERAL

- 1.1 General** .1 Not used
- 1.2 Traffic Management** .1 Traffic management shall comply with the requirements of British Columbia's Ministry of Transport and Infrastructure over the entire contract period, specifically the latest edition of "Traffic Control Manual for Work on Roadway".
- .2 The Contractor shall be responsible for acquiring and complying with all required permitting required by British Columbia's Ministry of Transport and Infrastructure.
- .3 During progress of the Works, make adequate provision to accommodate normal traffic along streets and highways immediately adjacent to or crossing the Works so as to minimize inconvenience to the general public.
- .4 Inform all owners or occupants of properties where access is affected in advance of proposed works.
- .5 When working on travelled ways:
1. Place equipment in such position as to present a minimum of interference and hazard to the travelling public.
 2. Keep equipment units as close together as working conditions will permit and preferably on same side of travelled way.
 3. Do not leave equipment on travel led way overnight.
 4. Do not close any lanes of road or highway without prior approval of the Departmental Representative. Before re-routing traffic erect suitable signs and devices as approved by the Departmental Representative.
 5. Provide and maintain reasonable road access and egress to property fronting along or in vicinity of work under contract unless approved otherwise by the Departmental Representative.

END of SECTION

PART 1 - GENERAL

- 1.1 General** .1 Not used
- 1.2 Disposal of Wastes** .1 All waste and rubbish materials shall be disposed to an approved landfill. Disposal of waste or rubbish material to land or burning will NOT be accepted.
- .2 Discharge of water containing chlorine or other chemical compounds into waterways is prohibited.
- 1.3 Drainage** .1 Provide temporary drainage and pumping as necessary to keep excavations and site free from surface water and groundwater.
- .2 Pumping of water containing silt in suspension into waterways, sewer or drainage systems prohibited.
- .3 The Contractor shall control disposal or runoff of water containing suspended materials or harmful substances in accordance with this contract document and applicable Federal and Provincial standards.
- 1.4 Site Clearing and Plant Protection** .1 Protect trees and plants on site and adjacent properties where indicated.
- .2 Minimize stripping of topsoil and vegetation.
- .3 Restrict tree removal to those areas designated by Departmental Representative.
- 1.5 Erosion and Sedimentation Control** .1 The Contractor must prepare Erosion and Sedimentation Control Plan and implement siltation control measures for all excavation to minimise siltation of ditches, watercourses and storm water systems.
- .2 Siltation control shall include but not be limited to installation of silt fences and construction of sedimentation ponds as shown in the contract documents. Siltation control shall meet the standards described in Land Development Guidelines for the Protection of Aquatic Habitat published jointly by the BC Ministry of Environment and Department of Fisheries and Oceans. Siltation control measures shall remain in place until completion of construction. Contractor shall implement

erosion and sedimentation control measures during the construction process.

- .3 Contractor shall ensure that all works is performed to prevent release of sediment laden or hydrocarbon contaminated (e.g. oil, grease, hydraulic fluid, or fuel) water from the site boundary. This includes ensuring no water flows are pumped or channeled to bypass the sediment control facilities.
- .4 Erosion and sedimentation control measures shall include but not be limited to retention of existing vegetation, installation of silt fences, and construction of settlement ponds. Sedimentation control measures shall remain in place until completion of construction.
- .5 Contractor shall ensure that sediment and hydrocarbon control facilities are frequently visually inspected and repaired as necessary.

1.6 Hazardous Materials Handling and Storage

- .1 Hazardous materials including, but not limited to, fuels, bitumens, cement, paints, solvents, cleaners, dust suppressants, used fuel and oil filters, and other construction materials shall be stored and handled to minimize lose and to allow containment and recovery in the event of a spill.
- .2 The Contractor shall designate area(s) for the transfer and temporary storage of hazardous materials and wastes. The designated area(s) shall be used by the Contractor as a transfer and temporary storage area for potentially hazardous materials and wastes. The area(s) shall be clearly labeled and appropriately controlled.
- .3 The Contractor shall maintain proper Workplace Hazardous Material Information Systems (WHMIS) labels and Material Safety Data Sheets (MSDS) for all hazardous materials used and stored on site.
- .4 Discharge of waste or volatile materials, such as mineral spirits, oil or paint thinner into waterways, storm or sanitary sewers is prohibited.
- .5 Discharge of water containing chlorine or other chemical compounds into waterways is prohibited.

1.7 Special and General Waste, Rubbish and Garbage

- .1 Special Waste generated in the course of the construction activities shall be handled and disposed of in compliance with the British Columbia Special Waste Regulation. As defined by these regulations, Special Wastes include, but are not limited to, such things as waste asbestos, oils, greases, lubricants, solvents, batteries, polychlorinated biphenyls (PCBs), paints and used spill cleanup materials.

- .2 When handling, storing, and removing Special Wastes, the Contractor shall maintain the following records: Inventories of types and quantities of Special Wastes generated, stored, or removed; manifests identifying Special Waste haulers and disposal destinations; MSDS and disposal certification documents.
- .3 Non-hazardous solid wastes, such as but not limited to, waste wood, asphalt, concrete, and metals shall be disposed of at an approved and licensed disposal facility in compliance with the British Columbia Waste Management Act.
- .4 The Contractor shall establish regular clean up and disposal programs so as to prevent the unnecessary accumulation of excessive solid waste and contain all garbage related to the project.

1.8 Equipment Operation

- .1 Contractor shall maintain construction equipment in good condition and free of excess oil and grease.
- .2 Waste oils and other materials related to equipment shall be removed from site upon completion of project.
- .3 Maintenance of equipment shall be confined to specific areas such that spills can be contained and collected before contaminants reach ditches, watercourses, and storm water systems.
- .4 There shall be no discharge of wash water to ditches, watercourses or storm water systems from trucks and equipment related to concrete supply, pumping, or placing equipment.
- .5 Equipment operation shall be limited to hours acceptable to the community.
- .6 Any fuel spills shall be absorbed immediately.
- .7 Contractor shall have fuel absorbents on site and shall deal with any spills which should occur immediately.

**1.9 Work Adjacent
to Drainage Courses and
Waterways**

- .1 Contractor shall implement siltation control measures for all excavation. Siltation shall include but not be limited to installation of silt fences and construction of sedimentation ponds. Siltation control measures shall remain in place until completion of construction.
- .2 The Contractor must develop and implement an Erosion and Sediment Control Plan and have this plan reviewed by the Departmental Representative prior to site preparation and construction of works involving excavation and fill placement. These facilities must be maintained by the Contractor and be working effectively to control discharges from the site.
- .3 Prohibit operation of construction equipment in waterways without Departmental Representative's approval and approval of Fisheries authorities.
- .4 Do not use waterway beds for borrow material.
- .5 Do not dump excavated fill, waste material or debris in waterways.
- .6 Design and construct temporary crossings so that minimum erosion is caused to waterways.
- .7 Construction and excavation wastes, overburden, soil, or other substances deleterious to aquatic life must be disposed of or placed in such a manner so as to prevent their entry into any ditch, watercourse, or storm water system.
- .8 All excavated material is to be side-cast as far as possible from ditches, trenches, or storm water systems to prevent its re-entry into the watercourse. Spoil must be removed offsite or spread out, levelled and seeded to promote re-vegetation and reduce surface erosion.
- .9 Contractor shall remove any equipment from near watercourse area if not required, or broken down.

**1.10 Spill Prevention and
Emergency Response**

- .1 The Contractor shall develop a Spill Prevention and Emergency Response Plan and distribute it to the Departmental Representative and Owners of the project prior to commencing any work.
- .2 The Contractor shall complete a daily visual inspection of all hazardous material and equipment for signs of leakage. Daily visual inspection will include, among other things ensuring that all personal protective equipment and other emergency response equipment is in its place.
- .3 The Contractor shall maintain a readily available supply of spill emergency response material and equipment on site at

all times in effective working condition appropriate to the scale of the project.

- .4 The Contractor shall deal with any spills which occur immediately.
- .5 The Contractor shall report any environmental incident or spill/release of a substance to the Departmental Representative and to the Provincial Emergency Program of the Ministry of Attorney General in accordance with the Spill Reporting Regulations of the Waste Management Act.

END OF SECTION

PART 1 - GENERAL

1.1 General

- .1 Use new material and equipment unless otherwise specified.
- .2 Provide material and equipment of specified design and quality, performing to published ratings and for which replacement parts are readily available.
- .3 Use products of one manufacturer for equipment or material of some type or classification unless otherwise specified.

1.2 Manufacturers' Instructions

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

1.3 Delivery and Storage

- .1 Deliver, store, and maintain package material and equipment with manufacturers' seals and labels intact.
- .2 Prevent damage, adulteration and soiling of material and equipment during delivery, handling and storage. Immediately remove rejected material and equipment from site.
- .3 Store material and equipment in accordance with supplier's instructions.
- .4 Touch-up damaged factory finished surfaces to Departmental Representative's satisfaction. Use primer or enamel to match original. Do not paint over name plates.

1.4 Conformance

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

END OF SECTION

PART 1 - GENERAL

- 1.1 General** .1 Not used
- 1.2 Description** .1 Commissioning includes the start-up of individual systems and equipment, the start-up of the entire system as a cohesive unit, and the training of operators and turnover of the operating valves and water supply system.
 .2 Commissioning shall include the General Contractor and all necessary Sub-contractors and/or Suppliers involved in equipment or systems installation.
- 1.3 Related Work Specified Elsewhere** .1 Operations and Maintenance – Section 01 91 13.16
- 1.4 Hatchery Staff** .1 The Contractor shall have the Hatchery Staff in attendance at all system start-ups. Contractor to inform Departmental Representative prior to system start-ups with date and time.
 .2 The Contractor is to facilitate the training of Hatchery Staff in accordance with Section 3.4 System Operation.

PART 2 - PRODUCTS

- 1.1 General** .1 Contractor to supply all required equipment and material for startup, commissioning and hand over period of the water supply infrastructure.

PART 3 – EXECUTION

- 3.1 Power Supply** .1 Where modifications and/or additions to existing electrical equipment or apparatus are required, ensure that all changes are made in accordance to CSA 22.2. Obtain CSA re-certification of the modified electrical equipment.
- 3.2 Supply and distribution** .1 Pressure test the system in accordance with section 33 11 01 of the specifications.
- 3.3 Maintenance Manual** .1 Refer to Section 01 91 13.16. These manuals to be prepared, reviewed, approved and distributed to the Owner, prior to turn-over.

3.4 System Operation

- .1 The System shall be handed over during a period in which the contractor is to facilitate the authorized training of the proposed Hatchery Staff Operator(s) and oversee the initial operation of the system. Ensuring that the system is operating as designed.
- .2 Substantial Completion under the terms of the contract may be granted after, but not before, the hand over period with the Hatchery Staff and successful operation of the system.

END OF SECTION

PART 1 - GENERAL

- 1.1 General** .1 Not used
- 1.2 Maintenance Manual** .1 On completion of project, submit to Departmental Representative four (4) hard copies and one (1) digital copy of Operations Data and Maintenance Manual in English made up as follows:
- .1 Bind data in vinyl hard covered, 3-ring loose leaf binder for 215 x 280 mm size paper.
 - .2 Enclose title sheet, labeled "Operation Data and Maintenance Manual", project name, date, and list of contents.
 - .3 Organize contents into applicable Sections of work to parallel project specification break-down. Mark each Section by labeled tabs protected with celluloid covers fastened to hard paper dividing sheets.
 - .4 Digital copy to be placed on USB flash drive (or multiple as required by file size).
- .2 Include following information plus data specified.
- .1 Maintenance instruction for finished surface and materials.
 - .2 Copy of hardware and paint schedules.
 - .3 Description, operation and maintenance instructions for equipment and systems, including complete list of equipment and parts list. Indicate nameplate information such as make, size, capacity, serial number.
 - .4 Names, addresses and phone numbers of sub-contractors and suppliers.
 - .5 Guarantees, warranties and bonds showing:
 - .1 Name and address of projects.
 - .2 Guarantee commencement date of Final Certificate of Completion.
 - .3 Duration of guarantee.
 - .4 Clear indication of what is being guaranteed and what remedial action will be taken under guarantee.
 - .5 Signature and seal of Contractor.
 - .6 Additional material used in project listed under various Sections showing name of manufacturer and source of supply.
- .3 Neatly type lists and notes. Use clear Drawings, diagrams or manufacturers' literature.

**1.3 Maintenance
Materials**

- .4 Include one complete set of final shop Drawings bound separately indicating corrections and changes made during fabrication and installation.
- .1 Where supply of maintenance materials is specified, deliver to Departmental Representative as follows:
 - .1 Materials in unbroken cartons, or if not supplied in cartons, they shall be strongly packaged.
 - .2 Clearly mark as to content.
 - .3 If applicable give colour, room number or area where material used.

END OF SECTION

Division 03 – Concrete

PART 1 - GENERAL

- 1.1 General** .1 Not Used
- 1.2 Description** .1 This section specifies requirements for all plain and reinforced cast-in-place concrete as described herein and as shown on the Drawings, or reasonably implied to provide a complete structure.
- 1.3 Reference Standards** .1 Do cast-in-place concrete work in accordance with the latest issues of:
 - .1 CSA CAN3-A23.1-M - Concrete Materials and Methods of Concrete Construction.
 - .2 CSA CAN3-A23.2-M - Methods of Test for Concrete.
 - .3 CSA CAN3-A23.3-M - Code for the Design of Concrete Structures for Buildings.
 .2 Keep a copy of the above CSA Standards on site for the duration of the work. "Standard" referred to later in this Specification means these CSA Standards.
- 1.4 Related Work Specified Elsewhere** .1 Not Applicable
- 1.5 Mix Design** .1 Submit certified copy of mix design showing concrete mix design conforming to specified requirements.

PART 2 - PRODUCTS

- 2.1 Materials**
 - .1 Cement: to CSA CAN3-A5-M, normal Type 10 unless otherwise specified.
 - .2 Water, fine aggregates, normal weight coarse aggregates: to CSA CAN3-A23.1-M, Group 1, unless otherwise specified.
 - .3 Form work lumber: plywood and wood form work materials to CSA CAN3-A23.1-M.
 - .4 Form ties: removable or snap-off metal ties, fixed or adjustable length, free of devices leaving holes larger than 25 mm diameter in concrete surface.
 - .5 Reinforcing bars: billet steel, grade 400 deformed bars to CSA G30.12-M unless indicated otherwise. Provide with identifying marks.
 - .6 Welded steel wire fabric: to CSA G30.5; provide in flat sheets only.

- .7 Air-entraining admixtures: to CSA CAN3-A266.1-M.
- .8 Non-shrink grout: premixed compound consisting of metallic aggregate, cement, water reducing and plasticizing agents, of pouring consistency, capable of developing compressive strength of 50 MPa at 28 days.
- .9 Dry pack: premixed or non-premixed composition of non-metallic aggregate, cement and sufficient water for the mixture to retain its shape when made into a ball by hand and capable of developing compressive strength of 50 MPa at 28 days.

2.2 Concrete Mix

- .1 Except where indicated or specified otherwise, use concrete designed to meet all of the following:
 - .1 Compressive cylinder strength at 28 days of 28 MPa.
 - .2 Maximum coarse aggregate size of 20 mm.
 - .3 Water/cement ratio maximum of .55.
 - .4 Slump between 50 mm and 80 mm at time and point of deposit.
 - .5 Air content of 5%, plus or minus 1%, except in slabs requiring hard trowelling where it is not to exceed 3%.
- .2 Admixtures: obtain written approval of Departmental Representative before using admixtures other than air entraining agents or water reducing agents. When permitted, use only in accordance with Standard.
- .3 Mass density: supply only concrete with air dry unit mass between 2,150 and 2,500 kg/m³ unless otherwise specified.
- .4 Prior to execution of the work, provide a statement certifying that the materials, including admixtures, are in accordance with this Specification and evidence that the mix proportions selected will produce concrete of the specified quality and strength.

PART 3 - EXECUTION

3.1 Workmanship

- .1 Notify Departmental Representative 24 hours prior to the anticipated time of any concrete pour.

-
- .2 Obtain the inspection and approval by the Departmental Representative of the preparation for all pours before placing concrete.
- .3 Ensure pipework are not disturbed during concrete placement.
- 3.2 Waterpipe**
- .1 Correctly position all pipes, sleeves, bolts, hangers and other inserts in the concrete as required by other trades or as shown on the Drawings.
- .2 Obtain approval by the Departmental Representative of all sleeves, ducts, pipes or other openings (except openings less than 100 x 100 mm in floors and walls) which are not shown on the Structural Drawings before placing concrete.
- 3.3 Inspection and Testing**
- .1 Where required, the Owner will employ an independent testing firm to make the required field and laboratory tests in accordance with the Standard for field control of concrete quality during construction. Make available materials, space and equipment as are necessary for the tests.
- 3.4 Curing**
- .1 Cure concrete in accordance with the Standard. Obtain approval of the Departmental Representative for each method used.
- 3.5 Ready-Mix Concrete**
- .1 Obtain approval by the Departmental Representative of the ready-mix manufacturers before ordering.
- 3.6 Failure to Meet Requirements**
- .1 When any concrete is not in accordance with these Specifications or the applicable standards, obtain Departmental Representative's ruling on whether to remove and replace it or apply the remedies provided in the applicable Standards to the Departmental Representative's approval.

END OF SECTION

Division 31 – Earthworks

PART 1 - GENERAL

- 1.1 General** .1 Permits: All permits to be obtained and paid by the Contractor.

PART 2 - PRODUCTS

- 2.1 Materials** .1 Topsoil: Materials shall be stripped down to full depth where it contacts non-organic soil, from the building, road and parking areas as shown on the Site Plan.

PART 3 - EXECUTION

- 3.1 Preparation**
- .1 Rough Grading: Cut and machine grade the site area.
- .2 Finish Grading: Uniformly smooth grade all areas covered by the project, including excavated and filled sections and adjacent transition areas. The finished surface shall be compacted and free from irregular surface changes. The finish surface shall be at the established grade and shall be graded to drain water away from the building.
- 3.2 Protection**
- .1 Benchmarks: Provide for preservation of existing benchmarks and establishing new benchmarks. The Contractor should advise the authority concerned of any action that would affect the location of elevations of any geodetic monuments so that proper steps may be taken to protect or move them correctly.
2. Site Drainage: Provide for site drainage during the entire period of construction in an approved manner to avoid flooding elsewhere, and to avoid creating a nuisance to adjacent areas. Keep all excavations free from water during the entire progress of the work. Upon completion of project, reinstate the site.
3. Access Roads: Must be maintained to prevent the accumulation of mud on the roads.

END of SECTION

PART 1 - GENERAL

- | | | | |
|---|----|--|--------------------|
| 1.1 General | .1 | Not used. | |
| 1.2 Description | .1 | This section specifies general requirements for supplying and processing of aggregates to be stockpiled or incorporated into work. Specific requirements for physical properties of aggregate properties are given in the related work sections. | |
| 1.3 Related Work Specified Elsewhere | .1 | Watermains | Section 33 11 01 |
| | .2 | Granular Base | Section 32 11 23 |
| | .3 | Granular Subbase | Section 32 11 16.1 |
| | .4 | Excavation, Trenching and Backfilling | Section 31 23 01 |
| 1.4 Source Approval | .1 | Source of materials to be incorporated into work or stockpiled requires approval. | |
| | .2 | Inform Departmental Representative of proposed source of aggregates and provide access for sampling at least two (2) weeks prior to commencing production. | |
| | .3 | If, in opinion of Departmental Representative, materials from the proposed source do not meet, or cannot reasonably be processed to meet specified requirements, procure an alternative source or demonstrate that material from source in question can be processed to meet specified requirements. | |
| | .4 | Should a change of material source be proposed during work, advise Departmental Representative two (2) weeks in advance of proposed change to allow sampling and testing. | |
| | .5 | Acceptance of a material at source does not preclude future rejection if it is subsequently found to lack uniformity, or if it fails to conform to requirements specified, or if its field performance is found to be unsatisfactory. | |
| 1.5 Production Sampling | .1 | Aggregate will be subject to continual sampling during production. | |
| | .2 | Provide Departmental Representative with ready access to source and processed material for purpose of sampling and testing. | |

- .3 Bear the cost of sampling and testing of aggregates which fail to meet specified requirements.

PART 2 - PRODUCTS

2.1 Materials

- .1 Aggregate Quality: sound, hard, durable material free from soft, thin, elongated or laminated particles, organic material or other deleterious substances.
- .2 Flat and elongated particles are those whose greatest dimension exceeds five times their least dimension.
- .3 Fine aggregates satisfying requirements of applicable section shall be one, or a 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 shall be one of following:
 - .1 Crushed rock or gravel.
 - .2 Gravel composed of naturally formed particles of stone.

PART 3 - EXECUTION

3.1 Development of Aggregate Source

- .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 Where clearing is required, leave a screen of trees between area and roadways as directed.
- .3 Clear, grub and strip an area ahead of quarrying or excavating operation sufficient to prevent contamination of aggregate by deleterious materials.
- .4 When operating in stratified deposits, use excavation equipment and methods that will produce a uniform, homogeneous aggregate.

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- .5 When excavation is completed, dress sides of excavation to a nominal 1.5:1 slope, and provide drains or ditches as required to prevent surface standing water.
- .6 Trim off and dress slopes of waste material piles and leave site in a neat condition.
- 3.2 Processing**
- .1 Process aggregate uniformly using methods that prevent contamination, segregation and degradation.
- .2 Blend aggregates if required to obtain gradation requirements specified. Use approved methods and equipment.
- .3 Blending to increase percentage of crushed particles or decrease percentage of flat and elongated particles is permitted.
- .4 Wash aggregates, if required to meet specifications. Use only equipment approved by Departmental Representative.
- 3.3 Handling**
- .1 Handle and transport aggregates to avoid segregation, contamination and degradation.
- 3.4 Stockpiling**
- .1 Stockpile aggregates on site in locations indicated or designated. Do not stockpile on completed pavement surfaces where damage to pavement may result.
- .2 Stockpile aggregates in sufficient quantities to meet project schedules.
- .3 Prevent intermixing of different materials.
- .4 Reject intermixed or contaminated materials. Remove and dispose of rejected materials.
- .5 Coning of piles or spilling of material over edges of pile will not be permitted.
- .6 During winter operations, prevent ice and snow from becoming mixed into stockpile or in material being removed from stockpile.
- 3.5 Stockpile Clean-up**
- .1 Leave stockpile site in a tidy, well drained condition, free of standing surface water.
- .2 Leave any unused aggregates in neat compact stockpiles as directed.

**** END OF SECTION ****

1.1 GENERAL	.1	Section 31 22 16.1 refers to those portions of the work that are unique to reshaping and compacting existing subgrade. This section must be referenced to and interpreted simultaneously with all other sections pertinent to the works described herein.	
1.2 Related Work			
	.1	Roadway Excavation, Embankment and Compaction	31 24 13
	.2	Aggregates: General	31 05 17
1.3 Samples	.1	Samples may be required.	
1.4 Inspection and Testing	.1	As required by the Departmental Representative and Specifications.	
2.0 PRODUCTS			
2.1 Materials	.1	Additional embankment material (subgrade fill) to be in accordance with Section 31 24 13.- Roadway Excavation, Embankment and Compaction and Section 31 05 17 – Aggregates: Generals.	
3.1 EXECUTION			
3.2 Scarifying and Shaping	.1	Scarify subgrade in accordance with width and depth shown on Contract Drawings.	
	.2	Pulverize and break down scarified material to 50 mm maximum soil clod size. Stones larger than 75 mm to be removed.	
	.3	Blade and trim pulverized material to elevation and cross-section dimensions shown on Contract Drawings.	
	.4	Where deficiency of material exists, add and blend in specified new material.	
	.5	Dispose excess material off-site.	
3.2 Compaction	.1	Compaction equipment to be capable of obtaining required densities in materials on project. Where existing subgrade constructed of imported material, compact to density not less than as specified by contract drawings, in compliance with ASTM D1557. Departmental Representative may accept satisfactory proof rolling as evidence of acceptable	

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- compaction of existing native subgrade.
 - .2 Shape and roll alternately to obtain smooth, even and uniformly compacted subgrade surface.
 - .3 Apply water as necessary during compaction to obtain specified density. If material is excessively moist, aerate by scarifying with suitable equipment until moisture content is suitable for compaction.
 - .4 In areas not accessible to rolling equipment, compact to specified density with mechanical tampers.
- 3.3 Repair of Soft Areas**
- .1 Correct soft areas by removing unsuitable material to depth and extent as directed by Departmental Representative. Replace with specified material and compact to specified density.
- 3.4 Finished Tolerances**
- .1 Reshape compacted surface to within plus or minus 15 mm of specified grade and cross-section but not uniformly high or low.
 - .2 Ensure finished subgrade has no irregularities exceeding 15 mm when checked with a 3 m straight edge placed in any direction.
 - .3 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.
- 3.5 Maintenance**
- .1 Maintain reshaped surface in condition conforming to this Section until succeeding material is applied or until reshaped subgrade is accepted by Departmental Representative.

**** END OF SECTION ****

PART 1 - GENERAL

- 1.1 General** .1 Not used.
- 1.2 Related Work Specified elsewhere**
- .1 Watermains Section 33 11 01
- .2 Hot mix asphalt concrete paving Section 32 12 16
- 1.3 Definitions**
- .1 Common excavation: excavation of materials of whatever nature, which are not included under definitions of rock excavation including dense tills, hardpan, frozen materials and partially cemented materials which can be ripped and excavated with heavy construction equipment.
- .2 Over-excavation: excavation below design elevation of bottom of specified bedding, and including backfilling of resultant excavation with specified material, as authorized by the Departmental Representative.
- .3 Topsoil: material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping and seeding.
- 1.4 Protection of Existing Features**
- .1 Existing Utility Services
- .1 Size, depth and location of existing utilities and structures as indicated are for guidance only. Completeness and accuracy are not guaranteed.
- .2 Prior to commencing any excavation work, notify applicable owner or authorities, establish location and state of use of buried utilities and structures. Clearly mark such locations to prevent disturbance during work.
- .3 Confirm locations of buried utilities by careful test excavations and/or radio detection equipment.
- .4 Maintain and protect from damage, water, sewer, gas, electric, telephone and other utilities and structures encountered. Obtain direction of Departmental Representative before moving or otherwise disturbing utilities or structures.
- .5 Record location of maintained, re-routed and abandoned underground lines.
- .6 Any damage to existing utility services caused by the Contractor shall be rectified by the Contractor at his or her own cost.

- .2 Existing Bulding and Surface Features:
 - .1 The Contractor and Departmental Representative shall perform a condition survey of existing buildings, trees and other plants, lawns, fencing, service poles, wires, rail tracks and paving, survey bench marks and monuments which may be affected by work.
 - .2 Protect existing buildings and surface features which may be affected by work from damage while work is in progress and repair damage resulting from work.
 - .3 Where excavation necessitates root or branch cutting, do so only with written approval of the Departmental Representative.

1.5 Shoring, Bracing and Underpinning

- .1 Comply with Section 01 35 29.06 – Health and Safety Requirements and applicable local regulations and to protect existing features.
- .2 Engage services of qualified professional Engineer who is registered in province or territory in which work is to be carried out to design and inspect cofferdams, shoring, bracing and underpinning required for work.
- .3 At least 3 weeks prior to commencing work, submit design and supporting data.
- .4 Design and supporting data submitted to bear the stamp and signature of qualified professional Engineer registered in the Province of British Columbia.
- .5 Professional Engineer responsible for design of temporary structures to submit proof of insurance coverage for professional liability except where Engineer is employee of contractor, in which case contractor shall submit proof that work by professional engineer is included in contractor's insurance coverage.

1.6 Submission of Imported Material Specifications

- .1 At least one week prior to commencing work, inform the Departmental Representative of proposed source of fill materials, proposed use/location within the contract and provide associated specifications/grading curves for review by the Departmental Representative.

PART 2 - PRODUCTS

2.1 Materials

.1 **Approved Trench/Native Material:**

- .1 Approved trench/native material is selected material from excavation or other sources, approved by Departmental Representative for use intended, unfrozen and free from rocks larger than 75 mm, cinders, ashes, sods, refuse or other deleterious materials

.2 **Bedding Material:**

- .1 Crushed, pit run or screened stone, gravel or sand consisting of hard durable particles free from clay lumps, cementation, organic material, frozen material and other deleterious materials.
- .2 Gradations to be within limits specified when tested to ASTM C136-84a and ASTM C117-84. Sieve sizes to CAN/CGSB-8.1-87 rather than ASTM E11-81.

Sieve Designation	% Passing	
	Type 1	Type 2
25 mm	[100]	[100]
19 mm	[90-100]	[90-100]
12.5 mm	[65-85]	[70-100]
9.5 mm	[50-75]	
4.75 mm	[25-50]	[40-70]
2.36 mm	[10-35]	[25-52]
1.18 mm	[6-26]	[15-38]
0.600 mm	[3-17]	[6-27]
0.300 mm		[3-20]
0.075 mm	[0-5]	[0-8]

Type 1: standard Gradation

Type 2: to be used only in dry trench

conditions and with departmental representatives prior approval

.3 **Imported Granular Fill:**

- .1 As per Geotechnical Recommendations.

PART 3 - EXECUTION

- 3.1 Site Preparation**
- .1 Remove obstructions, ice and snow, from surfaces to be excavated within limits indicated.
 - .2 Cut pavement or sidewalk neatly along limits of proposed excavation in order that surface may break evenly and cleanly.
- 3.2 Stripping of Topsoil**
- .1 Do not handle topsoil while in wet or frozen condition or in any manner in which soil structure is adversely affected.
 - .2 Commence topsoil stripping of areas as directed by the Departmental Representative after area has been cleared of brush, weeds, and grasses and removed from site.
 - .3 Strip topsoil to depths as directed by the Departmental Representative. Avoid mixing topsoil with subsoil.
 - .4 Stockpile in locations as directed by the Departmental Representative. Stockpile height not to exceed 2 m.
 - .5 Dispose of unused topsoil as directed by the Departmental Representative.
- 3.3 Stockpiling**
- .1 Stockpile fill materials in areas designated by the Departmental Representative. Stockpile granular materials in manner to prevent segregation.
 - .2 Protect fill materials from contamination.
- 3.4 Cofferdams, Shoring, Bracing and Underpinning**
- .1 Construct temporary works to depths, heights and locations as indicated or approved by Geotechnical Engineer.
 - .2 During backfill operation:
 - .1 Unless otherwise indicated or directed by the Departmental Representative, remove sheeting and shoring from excavations.
 - .2 Do not remove bracing until backfilling has reached respective levels of such bracing.
 - .3 Pull sheeting in increments that will ensure compacted backfill is maintained at an elevation at least 300 mm above toe of sheeting.

- .3 When sheeting is required to remain in place, cut off tops at elevations indicated or directed by the Departmental Representative.
- .4 Upon completion of substructure construction:
 - .1 Remove cofferdams, shoring and bracing.
 - .2 Remove excess materials from site and restore water courses to conditions indicated or as directed by the Departmental Representative.

3.5 Excavation

- .1 Excavate to lines, grades, elevations and dimensions as directed by the Geotechnical Engineer and Contract Drawings.
- .2 Remove concrete, masonry, paving, walks, demolished foundations and rubble, and other obstructions encountered during excavation.
- .3 Excavation must be in accordance with Geotechnical Drawings and Specifications.
- .4 Do not disturb soil within branch spread of trees or shrubs that are to remain. If excavating through roots, excavate by hand and cut roots with sharp axe or saw. Seal cuts with approved tree wound dressing.
- .5 Trench excavation should be advanced in accordance with Geotechnical Drawings and Specifications.
- .6 Dispose of surplus and unsuitable excavated material off site.
- .7 Do not obstruct flow of surface drainage or natural watercourses.
- .8 Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft or organic matter.
- .9 Notify Departmental Representative when soil at bottom of excavation appears unsuitable and proceed as directed by Departmental Representative.
- .10 Obtain Departmental Representative approval of completed excavation.
- .11 Remove unsuitable material from trench bottom to extent and depth directed by Departmental Representative.

- .12 Where required due to unauthorized over- excavation, correct as follows:
 - .1 Fill under bearing surfaces and footings with concrete specified for footings.
 - .2 Fill under other areas with Imported fill compacted to at least 95% maximum density.
 - .3 Hand trim, make firm and remove loose material and debris from excavations. Where material at bottom of excavation is disturbed, compact foundation soil to density at least equal to undisturbed soil. Clean out rock seams and fill with concrete mortar or grout to approval of Departmental Representative.

3.6 Backfilling

- .1 Do not proceed with trench backfilling operations until Departmental Representative has inspected installations.
- .2 Do not place backfill in freezing weather without written permission of Departmental Representative.
- .3 Backfilling around pipe and installation:
 - .1 Place bedding and surround material as specified by contract drawings and manufacturers instruction.
 - .2 Place layers simultaneously on sides of installed work to equalize loading.
 - .3 Do not backfill around or over cast-in-place concrete within 24 hours after placing.
- .4 Place backfill material in uniform layers not exceeding 300 mm in thickness up to restoration zone in traveled areas or top of trench in untraveled areas. Compact each layer before placing succeeding layer.
- .5 Compact backfill materials to the following Modified Proctor densities in accordance with ASTM D1557
 - .1 In untraveled areas, to a density at least equal to density of adjacent undisturbed soil.
 - .2 Backfilling for "Travelled areas" should be in accordance with the Geotechnical Drawings and specifications.
 - .3 Use caution in the pipe bedding zone to avoid damage to the pipeline. Compaction of bedding material to be in accordance with manufacturer's instructions.

3.8 Inspection and Testing

- .1 Testing of materials and compaction will be carried out by a independent testing laboratory, at the cost of the Contractor.

- .2 Perform nuclear densitometer test minimum every 150m length of installed pipe or conduit within road or travelled areas.
- .3 Contractor to pay all costs of testing and re-testing if compaction is below standard.

3.9 Restoration

In untraveled areas:

- .1 Reinstate subbase in accordance with 32 11 16.1 Granular Subbase specification.
- .2 Reinstate base in accordance with 32 11 23 Granular Base specification.
- .3 Reinstate pavement to match existing or as otherwise stated on the contract drawings.

In gravel surfaced traveled areas:

- .1 Reinstate sub-base course with approved excavated material similar to the original road surface, or use imported pit-run gravel, as directed by Departmental Representative.
- .2 Gravel or approved material to be 75 mm minus, uniformly graded gravel.
- .3 Gravel sub-base to be 200 mm deep.
- .4 Provide a 100 mm minimum course of 20 mm minus, crushed, base material on the surface.

END OF SECTION

1.0 GENERAL	.1	Section 31 24 13 refers to those portions of the work that are unique to roadway excavation, embankment construction and compaction. This section must be referenced to and interpreted simultaneously with all other sections pertinent to the works described herein.	
1.1 Related Work	.1	Environmental Protection	Section 01 57 01
	.2	Aggregates: General	Section 31 05 17
	.3	Excavating, Trenching and Backfilling	Section 31 23 01
1.2 References	.1	Not applicable.	
1.3 Definitions	.1	Common Excavation: To Section 31 23 01 Excavating, Trenching and Backfilling - 1.3.	
	.2	Waste material: material unsuitable for use in work or surplus to requirements.	
	.3	Borrow material: material obtained from areas outside limits of work and required for construction of embankments or for other portions of work.	
	.4	Embankment (subgrade fill): material derived from usable excavation and placed above original ground or stripped surface up to subgrade elevation.	
	.5	Imported embankment fill: approved granular material, supplied by Contractor and obtained from off-site sources, to be used for embankment fill up to subgrade elevation.	
	.6	Pavement structure: combination of layers of unbound or stabilized granular subbase, base, and asphalt or concrete surfacing.	
	.7	Subgrade elevation: elevation immediately below pavement structure.	
1.4 Protection of Work Property and Public	.1	Comply with General Conditions, Clause 4.3, Protection of Work Property and the Public.	
1.5 Blasting	.1	No blasting allowed for this project.	
1.6 Disposal	.1	Refer to Section 31 23 01 - Excavating, Trenching and Backfilling - 1.7 for re-use and off-site disposal requirements.	
1.7 Permits and Approvals	.1	Comply with permitting requirements before commencing any work.	

2.0 PRODUCTS

- 2.1 General** .1 Unless shown otherwise on Standard Detail Drawings or, where applicable, Contract Drawings materials specified in 2.2 of this Section are approved for their respective uses.
- 2.2 Specified Materials** .1 Backfill for embankment fill (subgrade fill) to be:
- .1 Approved native or imported granular material.
 - .2 Pit run gravel.
 - .3 Pit run sand.
 - .4 River sand.
- .2 Pit fines, cyclone sand and overburden may be utilized if approved by the Departmental Representative, but will not be acceptable if moisture content is too high to permit compaction to the specified density.
- 2.3 Materials** .1 Refer to Section 31 05 17 Aggregates: General for specifications for approved granular materials.

3.0 EXECUTION

- 3.1 General** .1 Clear and grub limits of excavation and/or embankment fill.
- .2 Strip all organic material to specified limits and specified depth or as directed by Departmental Representative. Do not handle topsoil while in wet or frozen condition or in any manner in which soil structure is adversely affected. Remove all debris. Stockpile and place topsoil as specified.
- .3 Surface drainage:
- .1 Provide suitable temporary ditches or other approved means of handling drainage prior to excavation and during construction to protect construction area and adjacent and other affected properties. Provide siltation controls to protect natural watercourses or existing municipal drainage facilities.
 - .2 Comply with Section 01 57 01.- Environmental Protection.
- 3.2 Excavation** .1 Notify Departmental Representative sufficiently in advance of excavation operations for initial cross-sections to be taken.

- .2 Notify Departmental Representative whenever unsuitable materials are encountered in cut sections and remove unsuitable materials to depth and extent as directed by Departmental Representative.
- .3 If, during excavation, material appearing to conform to classification for rock is encountered, notify Departmental Representative in sufficient time to enable measurements to be made to determine volume of rock.

3.3 Inspection of Native Surface

- .1 Prior to placing embankment fill, proof roll graded native surface, using fully loaded single or dual axle dump truck. Departmental Representative may authorize use of other acceptable proof rolling equipment. Remove soft or other unstable material. Replace with approved embankment fill and compact replacement fill as per contract drawings in compliance with ASTM D1557. (All following references to density imply compliance with ASTM D1557).

3.4 Placing

- .1 Place material only on clean unfrozen surface, properly shaped and compacted and free from snow or ice.
- .2 Begin spreading material on crown line or high side of one-way slope.
- .3 Place materials using methods which do not lead to segregation or degradation.
- .4 Place material to full width in uniform layers and compact to specified densities.
- .5 Shape each layer to smooth contour and compact to specified density before succeeding layer is placed.
- .6 Remove and replace that portion of any layer in which material becomes segregated during spreading.
- .7 Where shown on Contract Drawings or as directed by Departmental Representative, scarify or bench existing slopes in side hill or sloping sections to ensure proper bond between new materials and existing surfaces.
- .8 Where fill material consists principally of rock:
 - .1 Place to full width in layers of sufficient depth to contain maximum sized rocks, but in no case is layer thickness to exceed 1 m.

- .2 Individual rock fragments not exceeding 1.5 m in horizontal dimension permitted provided their vertical dimension does not exceed one third of fill section depth.
- .3 Carefully distribute rock material to fill voids with smaller fragments to form compact mass.
- .4 Fill surface voids at subgrade level with rock spalls or selected material to form an earth-tight surface.
- .5 Do not place boulders and rock fragments with dimensions exceeding 150 mm within 300 mm of subgrade elevation.

3.5 Compaction

- .1 Compaction equipment to be capable of obtaining required densities in materials on project.
- .2 Compact to density as per contract drawings.
- .3 Shape and roll alternately to obtain smooth, even and uniformly compacted layers.
- .4 Apply water as necessary during compaction to obtain specified density. If material is excessively moist, aerate by scarifying with suitable equipment until moisture content is suitable for compaction.
- .5 In areas not accessible to rolling equipment, compact to specified density with mechanical tampers.
- .6 Finish slopes to neat condition, true to line and grade.
 - .1 Remove boulders encountered in cut slopes and fill resulting cavities.
 - .2 Hand finish slopes that cannot be finished satisfactorily by machine.

3.6 Finished Tolerances

- .1 Ensure finished subgrade surface within plus or minus 15 mm of specified grade and cross-section but not uniformly high or low.
- .2 Ensure finished subgrade surface has no irregularities exceeding 15 mm when checked with a 3 m straight edge placed in any direction.
- .3 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.

3.7 Proof Rolling

- .1 For proof rolling use fully loaded single or dual axle dump truck.

- .2 Departmental Representative may authorize use of other acceptable proof rolling equipment.
- .3 Proof roll top of embankment fill upon completion of fine grading and compaction.
- .4 Make sufficient passes with proof roller to subject every point on surface to three separate passes of loaded tire.
- .5 Where proof rolling reveals areas of unsuitable subgrade:
 - .1 Remove unsuitable embankment material to depth and extent directed by Departmental Representative.
 - .2 Replace with approved embankment material and compact in accordance with this section.

3.8 Place Topsoil

- .1 Place, spread and grade topsoil as shown on Contract Drawings.
- .2 Restore planted areas with topsoil, ground cover, and plants or shrubs to match existing planted areas as shown on Contract Drawings.

3.9 Maintenance

- .1 Maintain finished embankment fill in condition conforming to this section until succeeding material is applied or until granular base is accepted by Departmental Representative.

**** END OF SECTION ****

Division 32 – Roads and Site Improvements

PART 1 - GENERAL

- 1.1 General** .1 Not used.
- 1.2 Description** .1 This section specifies requirements for supplying, producing and placing gravel or quarried stone as a granular sub-base to lines, grades and typical cross- sections indicated on plans or as directed.
- 1.3 Related Work Specified Elsewhere**
 - .1 Excavation, Trenching and Backfilling Section 31 23 01
 - .2 Granular Base Section 32 11 23

PART 2 - PRODUCTS

- 2.1 Materials** .1 Granular sub-base material to Section 32 11 16.1 and following requirements:
 - .1 Gradation to be within following limits when tested to ASTM C136-76 and ASTM C117-80, (AASHDTO T11-78 and T27-78) and having a smooth curve without sharp breaks when plotted on a semi-log grading chart to ASTM E11-70 (1977).

ASTM Sieve Designation	% Passing
75 mm	- 100
25 mm	55 - 100
4.75 mm	25 - 100
2.00 mm	15 - 80
0.425 mm	4 - 50
0.075 mm	0 - 8

- .2 Other properties as follows:
 - .1 Liquid Limit: ASTM D423-66(1972) (AASHTO T89-70) Maximum 25
 - .2 Plasticity Index: ASTM D424-59(1971) (AASHTO T90-70) Maximum 6
 - .3 Los Angeles Abrasion: ASTM C131-76 (AASHTO T96-77) Gradation 'A' Max % Loss by Weight 50

PART 3 - EXECUTION

3.1 Inspection of Existing

-
- | | | |
|------------------------------|----|---|
| Sub-grade Surface | .1 | Do not place granular sub-base until finished sub-grade is inspected and approved. |
| 3.2 Placing | .1 | Place material only on a clean, unfrozen surface, properly shaped and compacted and free from snow or ice. |
| | .2 | Place granular sub-base materials using methods which do not lead to segregation or degradation. |
| | .3 | Place material in uniform layers not exceeding 200 mm when compacted or to such other depth as approved. |
| | .4 | Shape each layer to a smooth contour and compact to specified density before the succeeding layer is placed. |
| | .5 | Remove and replace portion of a layer in which material has become segregated during spreading. |
| 3.3 Compacting | .1 | Compact to a density of not less than 100% standard proctor maximum dry density in accordance with ASTM D698. |
| | .2 | Shape and roll alternately to obtain a smooth, even and uniformly compacted sub-base. |
| | .3 | Apply water as necessary during compaction to obtain specified density. If sub-base is excessively moist, aerate by scarifying with suitable equipment until moisture content is corrected. |
| | .4 | In areas not accessible to rolling equipment compact to specified density with approved mechanical tampers. |
| 3.4 Finish Tolerances | .1 | Finish compacted surface to within + 25 mm of established grade but not uniformly high or low. |
| | .2 | Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance. |

- 3.5 Proof Rolling**
- .1 For proof rolling, use a fully loaded tandem dump truck.
 - .2 Departmental Representative may authorize use of other acceptable proof rolling equipment.
 - .3 Proof roll at level in sub-base indicated. If alternative proof rolling equipment is authorized, Departmental Representative will determine level of proof rolling.
 - .4 Make passes as directed by Departmental Representative.
 - .5 Where proof rolling reveals areas of defective sub-base, remove and replace in accordance with this section at no extra cost.
- 3.6 Maintenance**
- .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 General** .1 Not used.
- 1.2 Description** .1 This section specifies requirements for supplying, producing and placing crushed gravel or quarried stone as a granular base to lines, grades and typical cross-sections indicated, or as directed.
- 1.3 Related Work Specified Elsewhere**
 - .1 Aggregates: General Section 31 05 17
 - .2 Granular Sub-Base Section 32 11 16.1

PART 2 - PRODUCTS

- 2.1 Materials** .1 Granular base material to Section 32 11 23 and following requirements:
 - .1 Gradation to be within following limits when tested to ASTM C136-76 and ASTM C117-80 (AASHTO T11-78 and T27-78) and giving a smooth curve without sharp breaks when plotted on a semi-log grading chart.

ASTM Sieve		%
Passing Designation		
19.0	mm	100
9.5	mm	60 - 100
4.75	mm	40 - 80
2.36	mm	30 - 60
1.18	mm	20 - 40
0.30	mm	8 - 20
0.075	mm	2 - 7

- .2 Liquid Limit:
ASTM D423-66(1972) (AASHTO T89-76) Maximum 25
- .3 Plasticity Index
ASTM D424-59(1971) (AASHTO T90-70) Maximum 6
- .4 Los Angeles Abrasion
ASTM C131-76 (AASHTO T96-77) Gradation 'A' Max. % loss by weight 45
- .5 Crushed fragments: at least 60% of fragments within the following size range to have at least 1 freshly fractured face.

Passing	to	Retained on
19.0 mm		4.75 mm

PART 3 - EXECUTION

3.1 Inspection of Underlying Sub-Base or Sub-Grade

- .1 Do not place granular base until finished sub-base surface is inspected and approved.

3.2 Placing

- .1 Place material only on a clean, unfrozen surface, properly shaped and compacted and free from snow and ice.
- .2 Place using methods which do not lead to segregation or degradation of aggregate.
- .3 Place material in uniform layers not exceeding 200 mm when compacted or to such other depth as approved by Departmental Representative.
- .4 Shape each layer to a smooth contour and compact to specified density before succeeding layer is placed.
- .5 Remove and replace that portion of a layer in which material becomes segregated during spreading.

3.3 Compacting

- .1 Compact to a density not less than 100% standard proctor maximum dry density in accordance with ASTM D698.
- .2 Shape and roll alternately to obtain a smooth, even and uniformly compacted base.
- .3 Apply water as necessary during compacting to obtain specified density. If material is excessively moist, aerate by scarifying with suitable equipment until moisture content is corrected.
- .4 In areas not accessible to rolling equipment, compact to specified density with approved mechanical tampers.

3.4 Finish Tolerances

- .1 Finished base surface shall be within +/- 10 mm of established grade but not uniformly high or low.
- .2 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.

3.5 Proof Rolling

- .1 For proof rolling, use a fully loaded tandem axle dump truck.
- .2 Departmental Representative may authorize use of other acceptable proof rolling equipment.

- .3 Proof roll top of base upon completion of fine grading and compaction.
- .4 Make passes as directed by Departmental Representative.
- .5 Where proof rolling reveals defective base or sub-base, remove defective materials to depth and extent directed and replace with new materials in accordance with Section 32 11 16.1 and Section 32 11 23 at no extra cost.

3.6 Maintenance

- .1 Maintain finished base in a condition conforming to this section until succeeding material is applied or until acceptance.

END OF SECTION

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- 1.0 GENERAL**
- .1 Section 32 12 16 refers to those portions of the work that are unique to the supply and placement of hot-mix asphalt concrete paving. This section must be referenced to and interpreted simultaneously with all other sections pertinent to the works described herein.
- 1.1 Related Work**
- .1 Excavating, Trenching and Backfill Section 31 23 01
- .2 Granular Base Section 32 11 23
- .3 Granular Subbase Section 32 11 16.1
- 1.2 Material Certification**
- .1 Upon request, submit manufacturer's test data and certification that asphalt cement meets requirements of this section.
- 1.3 Submission of Mix Design**
- .1 Submit asphalt concrete mix design and trial mix test results to Departmental Representative for review at least one week prior to commencing work.
- 1.4 Inspection and Testing**
- .1 Testing laboratory to be approved by Departmental Representative.
- 2.0 PRODUCTS**
- 2.1 Materials**
- .1 Asphalt cement: to CGSB-16.3-M90, Grade 80 - 100.
- .2 Reclaimed asphalt pavement (RAP): Crush and screen so that 100% of reclaimed asphalt pavement material passes 37.5 mm screen before mixing.
- .3 Aggregates: to Section 31 05 17 – Aggregates: General and following requirements:
- .1 Crushed stone or gravel consisting of hard, durable, angular particles, free from clay lumps, cementation, organic material, frozen material and other deleterious materials.

- .2 Gradations to be within limits specified when tested to ASTM C136 and ASTM C117.

Sieve Designation		Percent Passing				
		*Lower Course #1	*Lower Course #2	*Upper Course #1	Upper Course #2	*Fine Mix
25.0	mm	100	--	--	--	--
19.0	mm	--	100	100	--	--
12.5	mm	70 – 85	84 – 99	84 – 99	100	--
9.5	mm	--	73 – 88	73 – 88	--	100
4.75	mm	40 – 65	50 – 68	50 – 68	55 – 75	80 – 100
2.36	mm	32 – 53	35 – 55	35 – 55	38 – 58	64 – 89
1.18	mm	26 – 44	27 – 46	27 – 46	28 – 47	48 – 76
0.600	mm	18 – 36	18 – 36	18 – 36	20 – 36	32 – 60
0.300	mm	10 – 26	10 – 26	10 – 26	10 – 26	16 – 42
0.150	mm	4 – 17	4 – 17	4 – 17	4 – 17	6 - 23
0.075	mm	3 - 8	3 – 8	3 – 8	3 – 8	4 - 10

***Footnote to asphalt mix-type selection:**

Lower Course #1: Arterial and collector, lower course only.

Lower Course #2: Local, lower course only.

Upper Course #1: Arterial and collector, upper course only.

Upper Course #2: Local, surface course only.

Fine Mix: Skim patch on existing asphalt surface.

- .3 Coarse aggregate is aggregate retained on 4.75 mm sieve and fine aggregate is aggregate passing 4.75 mm sieve when tested to ASTM C136.

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

.5 Do not use aggregates having known polishing characteristics in mixes for upper courses.

- .6 Sand equivalent: to ASTM D2419. Min: 40

- .7 Magnesium Sulphate soundness: to ASTM C88. Max % loss by mass after five cycles:

1. Coarse Aggregate: 15

- 2. Fine Aggregate: 18
- .8 Los Angeles abrasion: Grading B, to ASTM C131. Max % loss by mass:
 - .1 Coarse aggregate, upper course: 25
 - .2 Coarse aggregate, lower course: 35
- .9 Absorption: to ASTM C127. Max% by mass:
 - .1 Coarse aggregate, upper course: 1.75
 - .2 Coarse aggregate, lower course: 2.00
- .10 Max% passing 0.075 mm sieve:
 - .1 Coarse aggregate, upper course: 1.5
 - .2 Coarse aggregate, lower course: 2.0
- .11 Flat and elongated particles: (with length to thickness ratio greater than 3): Max% by mass:
 - .1 Coarse aggregate, upper course: 10
 - .2 Coarse aggregate, lower course: 10
- .12 Crushed fragments: at least 60% of particles by mass within each of following sieve designation ranges, to have at least 2 freshly fractured faces. Material to be tested according to ASTM C136 and ASTM C117.

Determination of amount of fractured material will be in accordance with Ministry of Transportation and Highways' Specification 1-11, Fracture Count for Coarse Aggregate, Method "B", which determines fractured faces by mass.

Passing		Retained On
25 mm	to	12.5 mm
12.5 mm	to	4.75 mm

- .13 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 mix

2.2 Mix Design

- .1 Submit job mix formula to Departmental Representative for review and approval.
- .2 Mix may contain up to a maximum 20% by mass of RAP without a special mix design. 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
			fine
Flow Value	mm	2-4	
Air Voids in Mixture	%	3-6	lower course
		3-5	upper course
		3-5	fine
Voids in Mineral Aggregate	%min.	13	lower course
		14	1 lower

			course 2
		14	upper course 1
		15	upper course 2
		15	fine
	Index of Retained Stability	%min.	75

- .3 Measure physical requirements as follows:
 - .1 Marshall load and flow value: to ASTM D1559.
 - .2 Air voids: to ASTM D3203.
 - .3 Index of Retained Stability: measure in accordance with Marshall Immersion Test (ASTM D1559).
 - .4 Do not change job-mix without prior approval of Departmental Representative. Should change in material source be proposed, new job-mix formula to be submitted to Departmental Representative for review and approval.

3.0 EXECUTION

3.1 Plant and Mixing Requirements

- .1 Batch and continuous mixing plants:
 - .1 To ASTM D995.
 - .2 Heat asphalt cement and aggregate to mixing temperature. Do not heat asphalt cement above 160°C.
 - .3 Before mixing, dry aggregates to a moisture content not greater than 0.5% by mass or to a lesser moisture content if required to meet mix design requirements.
 - .4 Departmental Representative will monitor temperature of completed mix at plant and at paver after considering hauling and placing conditions.

-
- .5 Feed aggregates from individual stockpiles through separate bins to cold elevator feeders.
 - .6 Feed cold aggregates to plant in proportions that will ensure continuous operations.
 - .7 Immediately after drying, screen aggregates into hot storage bins in sizes to permit recombining into gradation meeting job- mix requirements.
 - .8 Store hot screened aggregates in a manner to minimize segregation and temperature loss.
 - .9 Where RAP is to be incorporated into mix:
 - .1 Feed from separate cold feed bin specially designed to minimize consolidation of material. Provide 37.5 mm 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 specified. Dry mix thoroughly, until uniform temperature within plus or minus 5°C of mix temperature is achieved prior to adding new asphalt cement. Do not add new asphalt cement where temperature of dry mix material is above 160°C.
 - .10 Maintain temperature of materials within plus or minus 5°C of specified mix temperature during mixing.
 - .11 Mixing time:
 - .1 In batch plants, dry mix for not less than 10 s. Continue wet mixing as long as necessary to obtain a thoroughly blended mix but not less than 30 s or more than 75 s.
 - .2 In continuous mixing plants, mixing time as required but not less than 45 s.

-
- .2 Dryer drum mixing plant:
- .1 Where RAP to be incorporated into mix, dryer drum mixer to be designed to prevent direct contact of RAP with burner flame or with exhaust gases hotter than 180°C.
 - .2 Feed aggregates to burner end of dryer drum by means of a multi-bin cold feed unit and blend to meet job-mix requirements by adjustments of variable speed feed belts and gates on each bin.
 - .3 Feed RAP from separate cold feed bin designed to minimize reconsolidation of material.
 - .4 Meter total flow of aggregate and RAP by electronic weigh belt system with an indicator that can be monitored by plant operator and which is interlocked with asphalt pump so that proportions of aggregate and RAP and asphalt entering mixer remain constant.
 - .5 Provide for easy calibration of weighing systems for aggregates and RAP without having material enter mixer.
 - .6 Make provision for conveniently sampling full flow of materials from the cold feed.
 - .7 Provide screens or other suitable devices to reject oversize particles or lumps of aggregate and RAP from cold feed prior to entering drum.
 - .8 Provide a system interlock which will stop all feed components if either asphalt or aggregate from any bin stops flowing.
 - .9 Accomplish heating and mixing of asphalt mix in a drum dryer-mixer. 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 a printing recorder that can be monitored by plant operator. Submit printed record of mix temperatures at end of each week, if required.

- .10 Mixing period and temperature to produce a 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, maintained at specified temperatures and designed to prevent segregation.
 - .2 Do not store asphalt mix in storage bins in excess of 12 h.
- .4 Mixing tolerances:
 - .1 Permissible variation in aggregate gradation from job mix (percent of total mass):

.1	4.75 mm sieve and larger	5.5
.2	2.36 mm sieve	4.5
.3	0.600 mm sieve	3.5
.4	0.150 mm sieve	2.5
.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°C.

3.2 Equipment

- .1 Pavers: mechanical grade-controlled self-powered pavers capable of spreading mix within specified tolerances, true to line, grade and crown as shown on Contract Drawings.
- .2 Rollers: sufficient number of rollers of type and weight to obtain specified density of compacted mix.
- .3 Vibratory rollers:
 - .1 Minimum drum diameter: 1200 mm.

- .2 Maximum amplitude of vibration (machine setting): 0.5 mm for lifts less than 40 mm thick.
- .4 Haul trucks: 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 Trucks which cannot be weighed in a single operation on scales supplied will not be accepted.
- .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 a 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, 3.0 m in length, to test finished surface.

3.3 Preparation

- .1 Adjust existing castings to new elevations and protect from asphaltic mix.
- .2 When matching new pavement with existing pavement make vertical cut between existing pavement and new pavement as shown on Contract Drawings.
- .3 Prior to laying mix, clean surfaces of loose and foreign material.

3.4 Transportation of Mix

- .1 Transport mix to job site in vehicles cleaned of foreign material.
- .2 Paint or spray truck beds with light oil, limewater, soap or detergent solution, at least once a day or as required. Elevate

truck bed and thoroughly drain. No excess solution will be permitted.

- .3 Schedule delivery of material for placing in daylight, unless Departmental Representative approves artificial light.
- .4 Deliver material to paver at a uniform rate and in an amount within capacity of paving and compacting equipment.
- .5 Deliver loads continuously in covered vehicles and immediately spread and compact. Deliver and place mixes at temperature within specified range. Temperature of mix upon placement shall not be less than 125°C.

3.5 Placing

- .1 Obtain Departmental Representative's approval of base, existing surface, tack coat, or prime coat prior to placing asphalt.
- .2 Place asphalt concrete to thicknesses, grades and lines as shown on Contract Drawings.
- .3 Placing conditions:
 - .1 Place asphalt mixtures only when air temperature is above 5°C. Place overlay pavement only when air temperature is above 10° C.
 - .2 When temperature of surface on which material is to be placed falls below 10°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 shown on Contract Drawings:
 - .1 Levelling course(s) to thicknesses required but not exceeding 100 mm each.
 - .2 Lower course in layers not to exceed 100 mm each.
 - .3 Surface course in layers of maximum 60 mm 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. 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 If segregation occurs, immediately suspend spreading operation until cause is determined and corrected.
 - .4 Correct irregularities in alignment left by paver by trimming directly behind machine.
 - .5 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.
 - .6 Do not throw surplus material on freshly screeded surfaces.
- .7 When hand spreading is used:
 - .1 Approved wood or steel forms, rigidly supported to assure correct grade and cross section, may be used. 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. Avoid high temperatures which may burn material. Do not use tools at a higher temperature than temperature of mix being placed.

3.6 Compaction

- .1 Roll asphalt continuously to average density not less than 97% of 75 blow Marshall density in accordance with ASTM D1559 with no individual test less than 95%.
- .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 to be pneumatic tired type.
 - .2 Start rolling operations as soon as placed mix can bear weight of roller without undue displacement of material or cracking of surface.
 - .3 Operate roller slowly initially to avoid displacement of material. For subsequent rolling do not exceed 5 km/h for static steel- wheeled rollers and 8 km/h for pneumatic- tired rollers.
 - .4 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 should not exceed compacted lift thickness.
 - .5 Overlap successive passes of roller by at least one half width of roller and vary pass lengths.
 - .6 Keep wheels of roller slightly moistened with water to prevent pick-up of material but do not over-water.
 - .7 Do not stop vibratory rollers on pavement that is being compacted with vibratory mechanism operating.
 - .8 Do not permit heavy equipment or rollers to stand on finished surface before it has been compacted and has thoroughly cooled.

- .9 After traverse and longitudinal joints and outside edge have been compacted, start rolling longitudinally at low side and progress to high side.
 - .10 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.
 - .11 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 Breakdown rolling:
- .1 Commence breakdown rolling immediately following rolling of transverse and longitudinal joint and edges.
 - .2 Operate rollers as close to paver as necessary to obtain adequate density without causing undue displacement.
 - .3 Operate breakdown roller with drive roll or wheel nearest finishing machine. Exceptions may be made when working on steep slopes or super-elevated sections.
 - .4 Use only experienced roller operators for this work.
- .4 Second rolling:
- .1 Use pneumatic-tired, steel wheel or vibratory rollers and follow breakdown rolling as closely as possible and while paving mix temperature allows maximum density from this operation.
 - .2 Rolling to be continuous after initial rolling until mix placed has been thoroughly compacted.
- .5 Finish rolling:
- .1 Accomplish finish rolling with steel wheel rollers while material is still warm enough for removal of roller marks.
 - .2 Conduct rolling operations in close sequence.

3.7 Joints

- .1 General:
 - .1 Remove surplus material from surface of previously laid strip. Do not dispose on surface of freshly laid strip.
 - .2 Construct joints between asphalt concrete pavement and Portland cement concrete pavement as specified.
 - .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 600 mm.
 - .2 Cut back to full depth vertical face and tack face with thin coat of asphalt prior to continuing paving.
 - .3 Compact transverse joints to provide a smooth riding surface.
- .3 Longitudinal joints:
 - .1 Offset longitudinal joints in succeeding lifts by at least 150 mm.
 - .2 Cold joint is defined as joint where asphalt mix is placed, compacted and left to cool below 100°C prior to paving of adjacent lane. If cold joint can not be avoided, tack face of adjacent lane with thin coat of asphalt prior to continuing paving.
 - .3 Overlap previously laid strip with spreader by 100 mm.
 - .4 Before rolling, carefully remove and discard coarse aggregate in material overlapping joint with a lute or rake.
 - .5 Roll longitudinal joints directly behind paving operation.
 - .6 When rolling with static roller, shift roller over onto previously placed lane in order that 100 to 150 mm of drum width rides on newly laid lane, then operate roller to pinch

and press fines gradually across joint. Continue rolling until thoroughly compacted neat joint is obtained.

- .7 When rolling with vibratory roller, have most of drum width ride on newly placed lane with remaining 100 to 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 joint as specified.
- .5 Construct butt joints at locations and to details as shown on Contract Drawings.
- .6 Wherever practical, locate joints under future traffic markings (paint lines).

3.8 Pavement Patching

- .1 Ensure temporary and permanent pavement patching done by handwork conforms to all standards specified for machine placed asphaltic concrete.
- .2 Subbase and base preparation as specified in Section 32 11 16.1 - Granular Subbase and Section 32 11 23 - Granular Base respectively, unless shown otherwise on Contract Drawings.

3.9 Sidewalks, Driveways and Curbs

- .1 Hot-mix asphalt concrete sidewalks, driveways and curbs as shown on Contract Drawings.
- .2 Machine place where practical.
- .3 Ensure placement by handwork conforms to all standards specified for machine placed asphaltic concrete.
- .4 Other than requirements relating specifically to Portland cement concrete, ensure hot-mix asphalt concrete sidewalks and curbs comply with all requirements of Section 03 30 20 - Concrete Walks.
- .5 Ensure hot-mix asphalt concrete driveways comply with all requirements of 32 12 16 - Hot-Mix Asphalt Concrete Paving.

- 3.10 Finished Tolerances**
- .1 Ensure finished asphalt surface within 6 mm of design elevation but not uniformly high or low.
 - .2 Ensure finished asphalt surface does not have irregularities exceeding 6 mm when checked with a 3 m straight edge placed in any direction.
 - .3 Water ponding not permitted.
 - .4 Against concrete gutter, finished asphalt surface to be higher than the gutter by not more than 6mm.
- 3.11 Defective Work**
- .1 Correct irregularities which develop before completion of rolling by loosening upper mix and removing or adding material as required.
 - .2 If irregularities or defects remain after final compaction, remove upper course promptly and lay new material to form a true and even surface and compact immediately to specified density.
- 3.12 Clean-Up**
- .1 Remove lids or covers from all castings and clean any prime, tack coat or hot-mix asphaltic concrete from frames, lids and covers of all castings.

**** END OF SECTION ****

Division 33 - Utilities

PART 1 - GENERAL

- | | | | | |
|------------|---|----|---|------------------|
| 1.1 | General | .1 | Not used | |
| 1.2 | Description | .1 | This section specifies requirements for supplying and installing watermains, fittings, services and appurtenances to lines, grades and dimensions shown on the Drawings or as directed by the Departmental Representative. | |
| 1.3 | Related Work Specified Elsewhere | .1 | Excavation, Trenching and Backfill | Section 31 23 01 |
| | | .2 | Concrete | Section 03 01 00 |
| 1.4 | Certification | .1 | Provide Departmental Representative with certified copy of pipe tests, showing that pipe and gaskets meet specified requirements. | |
| | | .2 | Include manufacturer's drawings and pertinent information and Shop Drawings where required. | |
| 1.5 | Scheduling of Work | .1 | Schedule work to minimize interruptions to existing services. | |
| | | .2 | Submit schedule of expected interruptions for approval by the Departmental Representative and adhere to interruption schedule as approved by the Departmental Representative. | |
| | | .3 | Notify building occupants a minimum of 72 hours in advance of any interruption in services. | |
| | | .4 | Do not interrupt water service for more than 1 hour and confine this period between 10:00 and 16:00 hours local time unless otherwise authorized. | |
| | | .5 | Notify the fire department of any planned or accidental interruption to hydrants. | |
| 1.6 | Alternatives | .1 | To promote development and use of new proprietary products to increase efficiency in installation and provide better service life, alternative materials to those specified will be considered if full descriptive data is submitted to the Departmental Representative in ample time to permit approval without delaying work. | |
| | | .2 | Such data must fully document description and specifications met by such alternative materials including certification from manufacturer that materials meet or exceed | |

requirements for use intended and history, if any, of service in other installations.

- .3 Variations to tendered price, if any, to be proposed when requesting use of alternative materials.

PART 2 - PRODUCTS

2.1 Pipe and Fittings

- .1 Latest revision of all referenced specifications to govern.
- .2 Ductile iron pipe: to AWWA C151 (latest edition), cement mortar lined to AWWA C104 (latest edition).
 - .1 Joints:
 - .1 Mechanical, rubber gaskets with lead tip and double duck backing.
 - .2 Push-on joint with continuous rubber molded ring gasket.
 - .3 Grooved type coupling joint with malleable iron couplings and gaskets.
 - .4 Ensure electrical conductivity across joints.
 - .2 Fittings: to AWWA C110 (latest edition).
 - .3 Polyvinylchloride pressure pipe:
 - .1 Polyvinylchloride class rated pipe: to AWWA C900 (latest edition).
 - .2 Polyvinylchloride series rated pipe: to CSA B137.3 (latest edition).
 - .3 Ductile iron fittings: to AWWA C153 (latest edition).
 - .4 Joints: to be of the elastomeric gasket form.
 - .4 Polyethylene pressure pipe: nominal diameter less than 90 mm to CSA B137.1 (latest edition). Nominal diameter 90 mm or greater to CGSB 41-GP-25M.
 - .1 Polyethylene pipe sizes to be Iron Pipe Size (IPS) outside diameter.
 - .2 Insulation where called for to be 50 mm thick. Insulation to be jacketed in HDPE suitable for continuous exposure to sunlight.
 - .3 Polyethylene to polyethylene joints: to be thermal butt fusion or to AWWA C207 (latest edition) flanged with steel backing flanges.
 - .4 Cast iron fittings with flanged ends: to AWWA C110 (latest edition) for pipe size above 90 mm. Ends flanged to meet ANSI B16.1 (latest edition), 1 725 kPa flanges do not match AWWA C110

(latest edition) flanges and special order must be made if a match to ANSI B16.1 (latest edition), 1 725 kPa flange is required. AWWA C110 (latest edition) flanges are rated for 1 725 kPa water service working pressure.

.5 Polyethylene fittings: to CSA B137.1 (latest edition) for pipe sizes less than 90 mm.

.5 Steel water pipe: to AWWA C200 (latest edition).

.1 Exterior finish: to AWWA C203 (latest edition), hot applied coal tar enamel.

.2 Interior finish: to AWWA C205 (latest edition), cement mortar lined, or coal-tar epoxy to AWWA C210.

.3 Pipe joints: to be mechanical joints, field welded slip joints, butt welded joints, field welded butt straps, flanged joints, threaded joints and grooved victaulic couplings.

.4 Flanges: to AWWA C207(latest edition).

.5 Pipe fittings: to AWWA C208 (latest edition), cement mortar lined to AWWA C205 (latest edition), and exterior protected with hot applied coal tar enamel to AWWA C203-89.

2.2 Valves and Valve Boxes

.1 Gate valves: iron body, bronze mounted, to AWWA C500 (latest edition).

.1 Valves to be solid wedge gate with non-rising stems.

.2 Ends to be flanged at junctions with cast iron fittings.

.3 Ends to be bell or mechanical at junctions with pipe. Joints to be formed with a mechanical seal equivalent to pipe joint.

.4 Position of the valve in line to be vertical.

.5 Stem seal: O-ring or stuffing box type.

.6 Valves to open on counter-clockwise rotation of the wrench nut.

.7 Extension pieces to be used where valve bury is deeper than 1.5 m.

.8 Thrust blocking to be provided on all valves.

.2 Butterfly Valves: to AWWA C504 (latest edition).

.3 Valves: to open in direction corresponding to local standard. Counter-clockwise where no local standard.

.4 Cast iron valve boxes: Nelson type adjustable over a minimum of 450 mm, complete with valve operating extension rod, 30 mm diameter, of such length that when set

on valve operating nut top of rod will not be more than 300 mm below cover. Provide stone ring beneath operating nut. Base to be large round type with minimum diameter of 300 mm. Top of box to be marked as per Departmental Representative direction.

- .5 Underground type indicator valve where required by Departmental Representative. Indicator post to accurately indicate position of valve.
- .6 Air release valves: air release valves employing direct acting kinetic principle. Valves to be fabricated of cast iron body and cover with bronze trim, stainless steel floats with shockproof synthetic seat. Ends to be flanged to AWWA C110 (latest edition).

2.3 Service Connections

- .1 Copper tubing: To CSA Hc7.6 (latest edition), Type K, annealed, for 1 MPa working pressure.
- .2 Copper pipe joints: To be of compression type suitable for 1 MPA working pressure.
- .3 Brass corporation stops: red brass to ASTM B62 (latest edition), compression type, having threads to AWWA C800 (latest edition).
- .4 Brass inverted key-type curb stops: red brass to ASTM B62 (latest edition) compression type without drains. Curb stops to have adjustable bituminous coated cast iron service box with stem to suit depth of bury. Mark top of cast iron box "WATER".
- .5 Double strap service clamps.
- .6 Appropriate sized "tee" connections for services larger than sizes permitted for direct tap or service clamps. Tee connections to be fabricated of same material and to same standards as specified pipe fittings and have ends matching pipe to which they are joined.
- .7 Pressure Reducing Valves to be Watts No. 5U with inlet and outlet threaded to suit individual services applications, if called for on the Drawings.

2.4 Granular Bedding

- .1 Shall be in accordance with 31 23 01 Excavation, Trenching and Backfilling specification.

- .2 Concrete required for cradles, encasement, supports, reaction backing: to Section 03 01 00.

2.5 Chlorine

- .1 The watermains are not to be disinfected with Chlorine.

PART 3 - EXECUTION

3.1 Preparation

- .1 Clean pipes, fittings, valves, hydrants and appurtenances of accumulated debris and water before installation. Carefully inspect materials for defects. Remove defective materials from site.

3.2 Trenching, Backfilling and Restoration

- .1 Trenching, Backfilling and Restoration to Section 31 23 01.

3.3 Concrete Bedding and Encasement

- .1 Do concrete work to Section 03 01 00. Place as indicated or directed.
- .2 Pipe may be positioned on concrete blocks to facilitate placing of concrete. When necessary, rigidly anchor or weight pipes to prevent flotation when concrete is placed.
- .3 Do not backfill over concrete within 24 hours after placement.

3.4 Pipe Bedding

- .1 Place and compact granular bedding to dimensions indicated and provide continuous even support beneath and around the pipe.
- .2 Use bedding material as pipe support during laying and jointing.
- .3 Provide 100 mm (150 mm on rock) minimum bedding material beneath, 200 mm minimum around both sides of pipe and 300 mm above top of pipe as standard trench detail.
- .4 Under wet laying conditions use bedding stone.
- .5 Compact full width of pipe zone to at least 95% maximum density as per ASTM Standard D698 (latest edition), Method D.

3.5 Pipe Installation

- .1 Lay pipes to AWWA C600 (latest edition) for cast iron and ductile iron pipe, and/or manufacturer's standard instructions

- and specifications. Do not use blocks except as permitted in 3.3.2. Contract bedding details shall govern.
- .2 Joint pipes to AWWA C600 (latest edition), AWWA C603 (latest edition), AWWA C206 (latest edition), and/or manufacturer's recommendations.
 - .3 Handle pipe by approved methods. Do not use chains or cables passed through pipe bore so that weight of pipe bears upon pipe ends.
 - .4 Lay pipes true to line and grade. Take up and replace defective pipe. Relay pipe which shows undue settlement after installation.
 - .5 Face socket ends of pipe in direction of laying. For mains on a grade of 2% or greater, face socket ends upgrade.
 - .6 Joint deflection to be not more than half the pipe manufacturer's recommended maximum deflection.
 - .7 Protect installed pipes from ingress of dirt and water or other foreign materials. Whenever work is suspended, install a removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.
 - .8 Position and joint pipes with approved equipment. Do not use excavating equipment to force pipe sections together.
 - .9 Cut pipes as required for special fittings or closure pieces, in a neat manner as recommended by pipe manufacturer, without damaging pipe or its coating and to leave a smooth end at right angles to axis of pipe.
 - .10 Align pipes carefully before jointing.
 - .11 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.
 - .12 Maintain pipe joints clean and free from foreign materials.
 - .13 Avoid displacing gasket or contaminating with dirt or other foreign material. Gaskets so disturbed to be removed, cleaned, lubricated and replaced before jointing is attempted.
 - .14 Complete each joint before laying next length of pipe.

- .15 Minimize deflection after joint has been made to avoid damage.
- .16 Apply sufficient pressure in making joints to ensure that joint is completed to manufacturer's recommendations.
- .17 Block pipes when stoppage of work occurs, in an approved manner to prevent creep during downtime.
- .18 Recheck plastic pipe joints assembled above ground after placing in trench to ensure that no movement of joint has taken place.
- .19 Do not lay pipes when conditions are such that water may enter pipe.
- .20 Do not lay pipe on frozen bedding.
- .21 Protect pipework, hydrants, valves and appurtenances from freezing.
- .22 Upon completion of pipe laying and after the Departmental Representative has inspected work in place, surround and cover pipes with specified material placed to dimensions indicated or directed.

3.6 Valve Installation

- .1 Mount valves to manufacturer's recommendations in locations indicated.
- .2 Support valves located in valve boxes or valve chambers by means of a concrete block, located between valve and solid ground. Valves not to be supported by pipe.
- .3 Install 100 mm x 100 mm x 240 mm pressure treated wood post to mark location of valve box, if required by drawings. Align front face of post toward valve box and write distance to valve box on front face, using white enamel paint. Set post into concrete, 600 mm deep.

3.7 Service Connections

- .1 Construct service connections at right angles to watermain unless otherwise directed. Locate curb stops 300 mm from all existing houses, or as shown on the Drawings.
- .2 Tappings on cast iron or ductile iron pipe may be threaded without service clamps. Double strap service connections with galvanized malleable iron body and neoprene gasket cemented in place may be used. Tappings to conform to the following:

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

- .3 Tappings on PVC pipe to be either PVC valve tees or bronze type service clamps. Service clamps shall have maximum outlet size 25 mm for pipe diameter 100 mm, 40 mm for pipe diameter 150 mm and 50 mm for pipe diameter 200 mm and greater. For larger services use valve tees.
- .4 Tappings for PE pipe shall be PE tapping tees.
- .5 Employ only competent workmen equipped with suitable tools to carry out tapping of mains, cutting and flaring of pipes.
- .6 Tap main at 2:00 o'clock or 10:00 o'clock position only, not closer to a joint nor closer to adjacent service connections than recommended by manufacturer, or 1000 mm, whichever is greater.
- .7 Leave corporation stop valves fully open.
- .8 In order to relieve strain on connections, install service pipe in "Goose Neck" form "laid over" into horizontal position.
- .9 Install rigid stainless steel liners in small diameter plastic pipes with compression fittings.
- .10 Install curb stop with corporation box on services 50 mm or less in diameter. Equip larger services with a gate valve and cast iron box. Set box plumb over stop and adjust top flush with final grade elevation. Leave curb stop valves fully closed.
- .11 Place temporary location marker at ends of plugged or capped unconnected waterlines. Each marker to consist of a 50 mm by 100 mm stake extending from pipe end at pipe

level to 60 mm above grade. Paint exposed portion of stake blue with designation "WATER SERVICE LINE".

3.8 Thrust Blocks

- .1 Do concrete work to Section 03 01 00.
- .2 Place concrete thrust blocks between valves, tees, plugs, caps, bends, changes in pipe diameter, reducers, hydrants and fittings and solid ground as shown on Drawings or as directed by the Departmental Representative.
- .3 Keep joints and couplings free of concrete.

3.9 Hydrostatic and Leakage Testing

- .1 Upon completion of construction of any section, which shall be defined as that pipeline and appurtenances located between any two adjacent line valves, make section ready for testing. Carry out testing in accordance with point 2 of this Section .
- . 2 Before pipe is filled with water, pipe bedding, concreting of all valves and fittings and backfilling to be completed as required in this specification. Fill each section of pipe and allow to remain full of water for a period of at least 24 hours prior to commencement of any pressure tests. Submit pipeline to a test of 1.5 x working pressure applied at highest elevation in each section, with a minimum of 1380 kPa applied at lowest point of test section. Ensure that test pressure does not exceed pipe or thrust restraint design pressures. Maximum allowable leakage rate at test pressure to not exceed 1.25 litres per millimetre diameter of pipe per kilometre per 24 hour period . Minimum duration of test period to be 2 hours. Maximum test pressures should not exceed those specified in CSA B137.3.
- . 3 Perform pressure and leakage testing of ductile iron piping to AWW C600 and AWWA M41.
- .4 Perform pressure and leakage testing of polyvinyl chloride (PVC) piping to AWWA M23 and AWWA C605
- . 5 Perform testing of welded steel piping to AWWA C206 no leakage allowed .
- . 6 Should any test disclose excessive leakage, repair or replace defect and retest section until specified testing requirement is achieved .

3.10 Flushing and Disinfection

- .1 Do in accordance with AWWA-C601-81 or latest revision.
- .2 Flushing and disinfection operations to be under direct control of Departmental Representative. Notify Departmental Representative at least four (4) days in advance of proposed date when disinfection operations to commence.
- .3 Flush water mains through outlets as directed by Departmental Representative. Use sufficient flow to produce a velocity of 1.5 m per second, for 10 min., or until foreign materials have been removed and flushed water is clear.
- .4 Flushing flows to be as follows:

Pipe Size (mm)	Flow (L/s) Minimum
150 and below	38
200	75
250	115
300	150

- .5 Provide connections and pumps required.
- .6 Open and close valves, hydrants, and service connections to ensure thorough flushing.
- .7 When flushing has been completed to satisfaction of Departmental Representative, take at least one sample at the end of each main and branch. Samples to be taken from main stop and copper service line or blow-off. Do not take samples from hydrants or hoses of any kind.
- .8 Samples to be taken in sterilized sample bottles in accordance with the instructions of the Environmental Health Officer, Medical Services, Health & Welfare Canada. Submit for analysis to approved testing laboratory.

END OF SECTION

Geotechnical Specifications

VALVE REPLACEMENT, KITIMAT RIVER HATCHERY, KITIMAT, BC TEMPORARY EXCAVATION SPECIFICATIONS

1.0. GENERAL

The following specifications are intended to be read in conjunction with [REDACTED] Temporary Excavation Drawings, dated February 22, 2019.

1.1 GEOTECHNICAL ENGINEER

The Geotechnical Engineer is [REDACTED]

1.2 REFERENCE DRAWINGS

Department of Fisheries and Oceans (DFO), Kitimat River Project
Contract No.6, Drawings: 22-35-286 to 22-35-293.
Contract No.3, Drawings: 22-35-156 to 22-35-159.

Contractor to confirm building and utility (proposed and existing) offsets and depths prior to excavating.

1.3 SOIL CONDITIONS

Soil conditions are expected to comprise fill material consisting of grey, compact, fine to coarse grained sand with some gravel.

1.4 ADHERENCE TO REGULATIONS

The contractor shall comply with the requirements of all regulatory statutes, federal, provincial and municipal, and comply with the requirements of all government departments including the Department of Fisheries and Oceans, Canada (DFO), the British Columbia Ministry of Environment, and the Municipality for the protection of aquatic habitat during construction of the works. Specifically, the contractor shall ensure that all excavation and construction procedures are undertaken in such a manner as to prevent silt-laden runoff from the work site from entering the downstream drainage system, and shall follow procedures as recommended in the publication, "Land Development Guidelines for the Protection of Aquatic Habitat", as issued by the DFO and the Ministry of Environment, Lands and Parks.

1.5 STABILITY AND GROUND MOVEMENT

Some movement of the ground surrounding the excavation must be expected. Any signs of ground movement or deterioration must be immediately reported to the Geotechnical Engineer.

1.6 HOARDING

Ensure hoarding, adequately braced is provided on all perimeter slopes. Hoarding should meet the requirements of the Authority Having Jurisdiction.

1.7 EROSION CONTROL

Unless noted otherwise, or directed otherwise by the Geotechnical Engineer, protect all soil slopes with 6 x 6 x 10/10 WWM on 6 mil polyethylene sheet. Mesh is to be wire tied to 10 M pins driven 2' into soil at 20' each way.

1.8 UTILITIES

Contractor to verify utility information by independently collecting relevant reference drawings and field verification as required. Work to be carried out without disturbance to adjacent utilities.

2.0 MATERIALS

Samples and technical specifications for proposed alternative materials may be submitted to the Geotechnical Engineer for technical review. Substitutions are subject to review by the General Contractor and/or Prime Consultant for contractual implications.

2.1 TRENCH SUPPORT

Must be designed to meet or exceed OSHA requirements (Section 20.85). Details of trench support must be submitted to the Geotechnical Engineer for technical review.

2.2 DRAINAGE

2.2.1 *Filter Fabric*

Non-woven needle punched Nilex C14, or approved equivalent.

2.3 BACKFILL MATERIAL

Should consist of granular fill composed of inert, clean, tough, durable, mineral particles capable of withstanding the effects of handling, spreading and compaction without excessive degradation or production of deleterious fines. The particles shall be reasonably uniform in quality and free from organic materials and deleterious matter.

Refer to Civil Drawings for backfill specifications around the pipes and valves.

2.4 ENGINEERED FILL

Engineered fill shall be composed of inert, clean, tough, durable, mineral particles capable of withstanding the effects of handling, spreading, and compaction without excessive degradation or production of deleterious fines. The particles shall be uniform in quality and free from organic materials and deleterious matter. Suitable material would be well graded with less than 5% passing the US #200 sieve.

All granular backfill should be placed in 8" thick lifts and compacted to greater than 100% of its Standard Proctor Maximum Dry Density. To avoid excessive wall face movement, compacting equipment should be operated parallel to the wall face and compaction should start at the face and be worked away from the walls.

3.0 TEMPORARY EXCAVATION PROCEDURES

Workers shall be provided with appropriate safety gear. Contractor to carry out a daily site reconnaissance around excavation and perimeter and report any deterioration to the Geotechnical Engineer immediately.

The excavation must be advanced in stages, as indicated in the Temporary Excavation Drawings. Specifications of trench support and details of excavation procedure must be reviewed by the Geotechnical Engineer.

The exposed excavation slopes should be covered by 6-mil polyethylene sheeting and securely tied to the ground during periods of wet weather. This sheeting must be removed prior to placing any backfill.

3.1 EXCAVATION

Prior to excavation the Contractor shall:

- Consult with the relevant authorities for appropriate methods of locating utilities.
- Determine the locations of all structures and underground services that may be affected by the work.
- Obtain approval from the Geotechnical Engineer for excavation procedures and trench support specifications.
- Notify the Geotechnical Engineer and the Utilities Companies 48 hours before commencing the excavation.

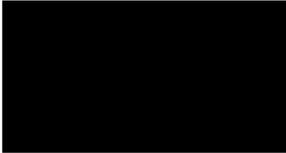
3.2 SITE DRAINAGE

The Contractor is responsible for construction and maintenance of works, site drainage, and sediment control during construction. That may include but not limited to installation of berms and swales, collect and divert via pumping or gravity flow any site water appropriately. At the end of each day of operation and prior to rainfall events, the site shall be graded to direct run-off away from excavation slopes. Adjacent perimeter surface flow to be directed away from excavation slopes. Interior surface flows to be directed to suitable sediment removal system prior to discharge to any sewer.

4.0 QUALITY CONTROL AND TESTING

4.1 BACKFILL

Field density testing to be carried out by a qualified testing agency over the full fill depth during backfill placement. In addition, the Geotechnical Engineer should review the backfilling with respect to material type and placement procedures and to ensure density testing is representative. Only lightweight hand-operated equipment shall be allowed within 3' of adjacent



November 29, 2018
Our File: 118-4459

Department of Fisheries and Oceans Canada
1110 - 401 Burrard Street
Vancouver, BC V6C 3S4

Attention: **Collin Gagné** (Collin.Gagne@dfo-mpo.gc.ca)

**Re: Valves Replacement at
Kitimat River Hatchery, Kitimat, BC
Pavement Recommendations**

Introduction

This document provides construction recommendations for the restoration of pavement areas at the above noted site.

Background Information

Based on existing building drawings (Kitimat River Project Contract No. 10 Hatchery Site Paving Pavement Layout plan, 1983), we understand that there are currently two paved areas surrounding the existing hatchery building.

Paving Area "A" is located to the east of the existing hatchery building and extends to the adjacent concrete ponds. Paving Area "B" extends along the north, west and south sides of the hatchery building. We understand that no traffic load is anticipated for Area "A".

Based on available information, it is envisaged that the natural, undisturbed, subsurface soils at the subject site are generally overlain by at least 4.0 metres of fill. The fill stratum is envisaged to have been placed to raise the original grades to meet the Flood Construction Level and to comprise compact, fine to coarse grained sand with some gravel.

Pavement Structure Recommendations

The above noted fill material is judged to be suitable for use as subgrade course without placement of any additional material, provided it is proof rolled to ensure it meets the compaction requirements. Areas with significant pavement damage or no pavement should be sub-excavated to meet the requirements of this memorandum.

Base course and subbase materials should be compacted to at least 100% of the maximum dry density as determined in accordance with ASTM D698 (Standard Proctor), within 2% of their respective "optimum" moisture contents for compaction. The actual densities achieved should be measured by in-situ density tests.

In addition, any topsoil, unsuitable fill, organic, loosened, softened, disturbed or otherwise deleterious material beneath any pavement footprint areas must be removed prior to installation of the proposed pavement structure. Areas where additional grading is required should be sloped away from the existing hatchery building.

Any engineered fill required to raise grades to support paved areas should be placed on the exposed, undisturbed, subgrade material, or compact fill as described above. Engineered Fill should consist of well-graded granular material with less than 5% fines content and 98% passing a 150 mm (6.0 inch) sieve. Engineered fills should be compacted in maximum 200 mm (8.0 inches) lifts to at least 100% of the maximum dry density as determined in accordance with ASTM D698 (Standard Proctor), within 2% of its optimum moisture content for compaction.

We recommend that the subgrade material be reviewed by Horizon Engineering prior to placing any road structure material. The recommended minimum road structure are indicated in Table 1 and 2 for areas A and B, respectively.

Table 1: Recommended Minimum Asphalt Pavement Structure for Area A

MATERIAL	THICKNESS (mm)
Asphalt Pavement Section	50
Base Course (19 mm minus crushed sand and gravel base course)	100
Subbase Course (75 mm minus crushed gravel and sand)	200

Table 2: Recommended Minimum Asphalt Pavement Structure for Area B

MATERIAL	THICKNESS (mm)
Asphalt Pavement Section	75
Base Course (19 mm minus crushed sand and gravel base course)	100
Subbase Course (75 mm minus crushed gravel and sand)	200

We trust the above provides sufficient information at this time. Should you have any questions, please do not hesitate to contact the undersigned.

For




Ann Castellanos, M.Eng., E.I.T.
Geotechnical Engineer
Nov 29, 2018

For




Karim Karimzadegan, M.A.Sc., P.Eng.
Principal



Appendix A:

Reference Geotechnical Information

May 11, 2017
Our File: 116-3964

DEPARTMENT OF FISHERIES AND OCEANS

1110 – 401 Burrard Street
Vancouver, BC
V6C 3S4

Attention: Lee McCabe (LEANDER.MCCABE@DFO-MPO.GC.CA)

Re: **Proposed New Storage Building
Kitimat River Hatchery, Kitimat, BC
Foundation Design Field Review**

Purpose

We attended the above-noted site on April 11, 2017 to review the subsurface materials in the vicinity of the proposed new storage building for the purpose of foundation design. The site visit and preparation of the subject memorandum were carried out in accordance with our scope of services dated March 14, 2016. Authorization to proceed was received on March 15, 2016.

Site Conditions

The subject site is located on the west bank of the Kitimat River, as shown on Figure 1, approximately 244 kilometres (152 miles) from Queen Charlotte Sound. At the time of our site visit, the subject site was observed to be developed with a large hatchery building at the north portion of the site, hatchery channels at the east portion of the site, a storage building at the south portion of the site, and a small pump building at the north portion of the site, as shown on Figure 2. The subject site was observed to be bounded by the Kitimat River (with adjacent access track) to the northeast and a slope to the southwest, which was observed to have a gradient of approximately 26 degrees. Based on a site plan provided to us by the Client (Site Plan, [REDACTED] Services Ltd., dated March 2, 2017), we understand that the area near the crest (to the northeast) of this slope has an elevation of approximately 13 metres (43 feet), while the area near the toe (to the southwest) has an elevation of approximately 10 metres (33 feet). The area northeast of this slope was observed to be generally flat to the break in slope located near the Kitimat River's southwest bank.

Based on information provided by site personnel, we understand that the existing buildings at the site were constructed in the 1980s and their foundations have performed well. We understand that the proposed new storage building would be located at the west portion of the site (as shown on Figure 2), set back from the adjacent slope crest in order to allow for vehicle access. We understand that the finished floor elevation is located at or above the Flood Construction Level (assumed to be determined by others) and that the building foundation would be constructed near existing grades using conventional strip and pad footings. Based on information provided by a municipal building inspector for the District Municipality of Kitimat, we understand that a frost protection depth of approximately 1.2 metres (4 feet) is typically used in the area and would therefore be applicable to the subject site.

At the time of our site visit on April 11, 2017, the weather was dry and overcast, with a temperature of approximately 5 degrees Celcius. An excavator was provided by Daudet Contracting and one test pit (TP17-1) was carried out at the approximate location indicated on Figure 2 at the time of our site visit.

Observations

Test pit TP17-1 was excavated to a depth of approximately 4.3 metres (14 feet) below adjacent grades, as shown on the test pit log attached. The exposed soil comprised grey, fine to coarse grained sand with some gravel. These materials were observed to be dry to moist and were inferred to be compact and fill. No groundwater seepage was observed during test pit excavation. We envisage that the flat area in the vicinity of the existing and proposed buildings comprises fill materials, which are presumed to have been placed to elevate the subject site to the Flood Construction Level.

At the time of our site visit, no obvious cracks were observed within the visible portions of the existing buildings' foundations.

Recommendations and Conclusions

We envisage that the sand fill materials that are expected to be encountered at the design foundation elevation would be suitable bearing materials for the proposed development provided that foundation subgrades are compacted with a minimum 1000lb plate tamper prior to forming. At this time, based on our site observations and observed performance of existing buildings founded on the same subgrade soil, we recommend a Serviceability Limit States design bearing pressure of 100 kPa (2,000 psf) for footings constructed on these materials. It must be noted that we cannot provide Ultimate Limit State design values or site class for seismic design because our test pit did not advance into the natural ground. It is also understood that the proposed building is not designed as an 'habitable' structure and will function as storage.

Any loosened, softened, disturbed, organic, or otherwise deleterious materials should be removed from footing footprint areas prior to footing construction. Foundation subgrades should be protected from freezing; any frozen subgrade materials should be removed after thawing. [REDACTED] Engineering should be provided with an opportunity to review the exposed foundation subgrades (at least via photographs, provided in a timely fashion) prior to pouring concrete.

For slope stability reasons and based on the observed site geometry, we recommend that the foundation of the proposed building be set back at least 3.0 metres (10 feet) from the adjacent slope crest, as shown on the profile on Figure 3 (see Figure 2 for the location of the profile).

As previously described, we envisage that temporary excavation slopes up to approximately 1.2 metres (4 feet) are required for the proposed development in order to construct the foundation for the proposed building at the locally recommended frost protection depth. We recommend that temporary excavation slopes be no steeper than 1.0 vertical : 1.0 horizontal, provided that the local groundwater table is below the bottom of the excavation. Unshored excavation slopes should be protected with a layer of 6 mil polyethylene sheeting, securely tied to resist wind action. It is recommended that excavated spoil and construction materials be stockpiled no closer than 1.5 metres (5 feet) to the crest of the excavation slopes and the crest of the existing slope at the southwest portion of the site. Any signs of instability such as tension cracks, excessive sloughing, or ground movements should be reported to [REDACTED] Engineering immediately.

█ should be provided with the opportunity to review foundation subgrades. Photographs may suffice for our review of some project components provided that they are of suitable quality and provided in a timely fashion.

Closure

We trust this is sufficient for your current requirements. Please contact us if you have any questions, or if we can provide additional service.

Sincerely,

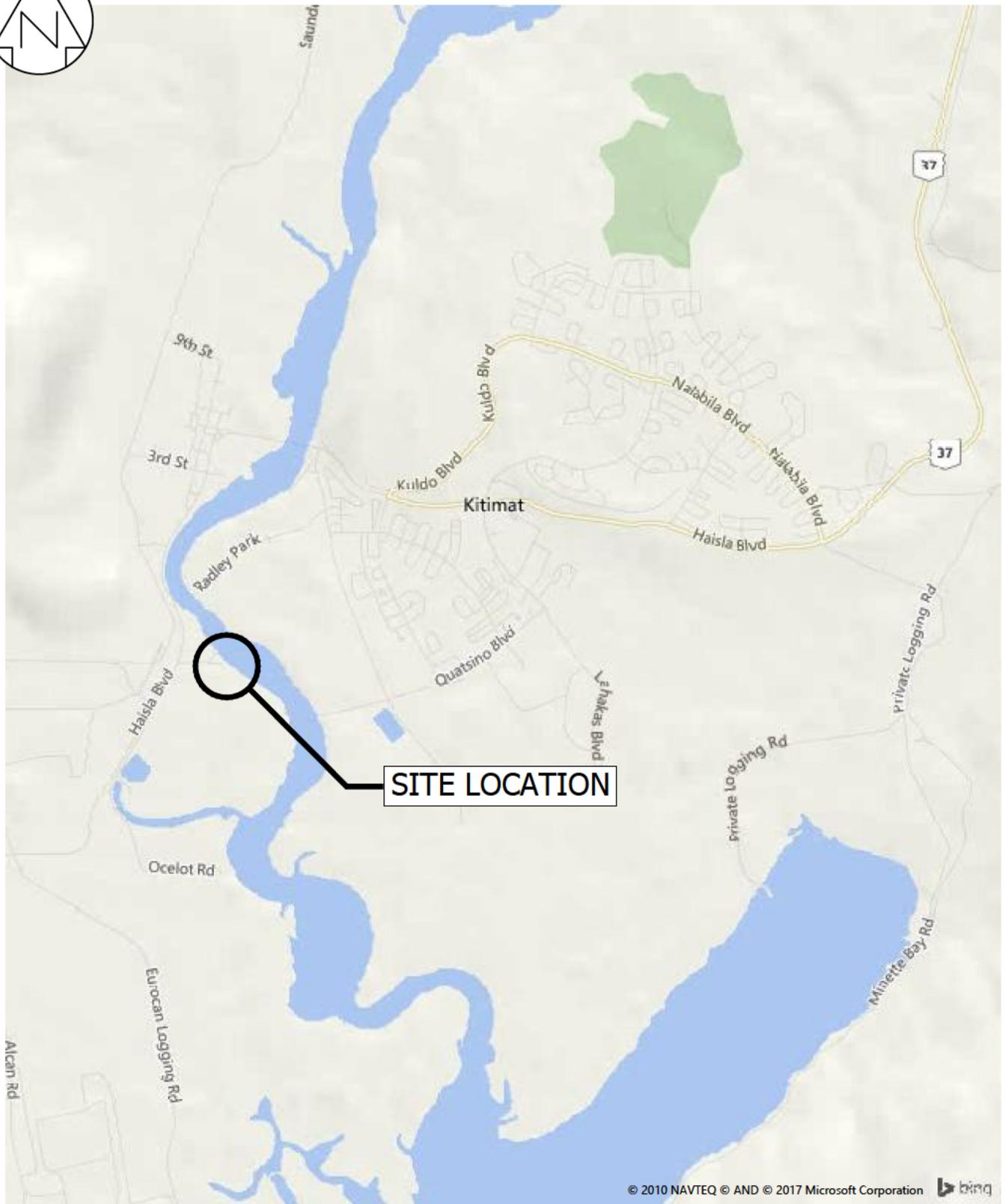
for

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Principal

Attachments: Figure 1 Site Location Plan
 Figure 2 Test Hole Location Plan
 Figure 3 Profile A-A
 Test Pit Log (TP17-1)



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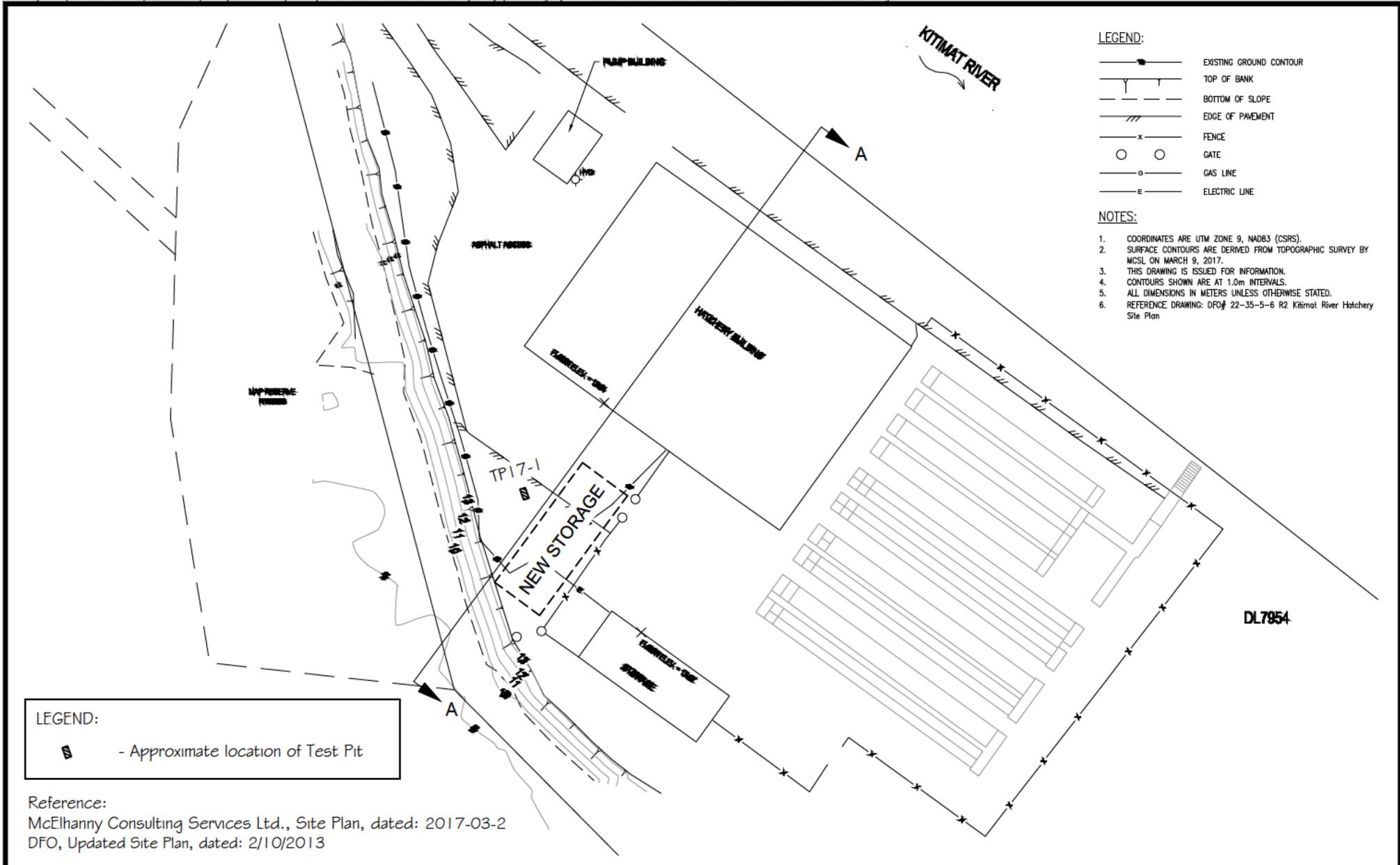
DEPARTMENT OF FISHERIES AND OCEAN

SITE LOCATION PLAN

PROPOSED NEW STORAGE BUILDING
KITIMAT HATCHERY, KITIMAT, BC



Scale:	File No:	Date:	FIGURE: 1
NTS	116-3964	MAY/2017	
Des:	Dwn:	Chk:	Rev:
MP	BB	KK	



- LEGEND:**
- EXISTING GROUND CONTOUR
 - TOP OF BANK
 - BOTTOM OF SLOPE
 - EDGE OF PAVEMENT
 - FENCE
 - GATE
 - GAS LINE
 - ELECTRIC LINE

- NOTES:**
1. COORDINATES ARE UTM ZONE 9, NAD83 (CSRS).
 2. SURFACE CONTOURS ARE DERIVED FROM TOPOGRAPHIC SURVEY BY MCSL ON MARCH 9, 2017.
 3. THIS DRAWING IS ISSUED FOR INFORMATION.
 4. CONTOURS SHOWN ARE AT 1.0m INTERVALS.
 5. ALL DIMENSIONS IN METERS UNLESS OTHERWISE STATED.
 6. REFERENCE DRAWING: DFO# 22-35-5-6 R2 Kitimat River Hatchery Site Plan

LEGEND:
 - Approximate location of Test Pit

Reference:
 McElhanny Consulting Services Ltd., Site Plan, dated: 2017-03-2
 DFO, Updated Site Plan, dated: 2/10/2013

DEPARTMENT OF FISHERIES AND OCEAN	TEST HOLE LOCATION PLAN															
PROPOSED NEW STORAGE BUILDING KITIMAT HATCHERY, KITIMAT, BC		<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 15%;">Scale:</td> <td style="width: 15%;">NTS</td> <td style="width: 15%;">File No:</td> <td style="width: 15%;">116-3964</td> <td style="width: 15%;">Date:</td> <td style="width: 15%;">MAY/2017</td> <td rowspan="2" style="text-align: center; vertical-align: middle;"> FIGURE: 2 </td> </tr> <tr> <td>Des:</td> <td>MP</td> <td>Dwn:</td> <td>BB</td> <td>Chk:</td> <td>KK</td> <td>Rev:</td> </tr> </table>	Scale:	NTS	File No:	116-3964	Date:	MAY/2017	FIGURE: 2	Des:	MP	Dwn:	BB	Chk:	KK	Rev:
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