

Specifications
for
Fisheries and Oceans Canada
West Vancouver Laboratories – UV Disinfection

Contract No. F1700-180019

October 2018

TABLE OF CONTENTS

Specifications		Pages
Division 01	General Requirements	
01 00 00	General Instructions	4
01 11 00	Summary of Work	3
01 33 00	Submittal Procedures	5
01 33 01	Project Record Documents	1
01 35 29.06	Health and Safety Requirements	4
01 53 01	Temporary Facilities	1
01 61 00	Materials and Equipment	2
01 91 13.13	Start-up and Commissioning	2
01 91 13.16	Operations and Maintenance	2
Division 15	Mechanical	
15 01 00	Mechanical General Provisions	5
15 35 00	Mechanical	4
Division 26	Electrical	
26 05 00	Common Work Results – Electrical	8
26 05 20	Wire and Box Connectors (0-1000V)	3
26 05 21	Wires and Cables (0-1000V)	4
26 05 22	Connectors and Terminations	2
26 05 29	Hangars and Supports for Electrical Systems	2
26 05 31	Splitter, Junction, Pull Boxes, and Cabinets	2
26 05 34	Conduits, Conduit Fastenings and Conduit Fittings	4
26 05 44	Installation of Cables in Ducts	3
26 28 21	Moulded Case Circuit Breakers	2
Division 31	Earthworks	
31 23 01	Excavation, Trenching, and Backfilling	7
As-Built Reference Drawings		
5426-1	Existing Sand Filter Layout – Plan View	
5426-2	Existing Sand Filter Layout – Section A-A	
5426-3	Existing Sand Filter Layout – Section B-B	
Construction Drawings		
C1.1	Demolition Plan	
C1.2	UV Addition Layout	
E01	Electrical Site Plan	
E05	Electrical Area Enlargement - Sand Filter Building	
E06	Electrical Area Enlargement – Boiler Room	
E10	Electrical Sections and Elevations	



Division 01 - General Requirements

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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 with Tender, a construction schedule on the "Construction Schedule" form included in the Tender Documents, showing anticipated progress stages and final completion of work within time period required by Contract Documents. The schedule is to be updated monthly or as required 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 Science Enterprise Center operation hours will need to be coordinated and approved by Laboratory staff. |
| 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. |

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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 **Construction Drawing alignments and elevations were obtained from existing asbuilts and checked in the field. It is the Contractors responsibility to ensure the dimensions are accurate when setting out the work.**
- .2 The detailed layout is the responsibility of the Contractor.
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 if they were included with plans referred to in Article 1 of Articles of Agreement.

- 12. Relics and Antiquities** .1 Relics and antiquities such as cornerstones and similar objects found on site or in buildings to be demolished, shall remain property of the Owner. Protect such articles and request directives from Departmental Representative.
- .2 Give immediate notice to Departmental Representative if evidence of archaeological finds are encountered during construction, and await his written instructions before proceeding with work in that area.
- 13. 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.
- 14. 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

Fisheries and Oceans Canada (DFO) is looking for experienced Contractors to supply and install two UV filtration units including all construction services in relation to the upgrade to the sand filter system with two UV Reactors at the West Vancouver Laboratories.

The present section describes the scope of work which comprises:

- **UV Disinfection Upgrades to Sand Filter System**

The UV Disinfection Upgrades involves modifying the existing pipe configuration of the sand filter system to achieve a quality of water suitable for the use in aquaculture. This will involve cutting and removing existing 300mm Schedule 80 PVC pipe and associated fittings, installing new 300mm Schedule 80 PVC pipe with associated valves and fittings, and procuring and installing two UV Reactors in the configuration shown on the drawings.

- **Electrical Requirements**

Involves installing an electrical conduit and associated materials between the sand filter building and the main electrical room required to provide the necessary power to run the UV Reactors. The full electrical scope of work is described in section 26 05 00 Common Work Results – Electrical.

1.1 Work Covered by Contract Documents

.1 Work of this Contract comprises and shall be further identified as “the Work” and shall include the following:

.1 Contractor to modify existing West Vancouver Laboratories sand filtration process to include UV disinfection reactors in tandem capable of providing a 60mJ dosage at a maximum flow rate of 8,000 Liters per minute (LPM).

.2 Contractor to install two UV disinfection reactors that must meet the following minimum criteria:

UV Transmittance: 90%

Dose Input: 60mJ/cm²

Flow Rate (of two reactors together): (Maximum flow rate 8000 LPM)

Vessel Material: Schedule 80 Grey PVC

Body Size: 14” (356mm)

I/O Port Flange Size: 12” (305mm)

Vessel Length (A): 94.41” (2398mm)

Port to Port (B): 72.80” (1849mm)

Flange Outer Diameter (C): 21.0” (533mm)

Centerline to Port Flange (D): 19.81” (503mm)

Maintenance Clearance (E): 80” (2032mm)

Lamp Count: 9 or equivalent lamps for desired dose and flow

Wattage: 2880 or equivalent for desired dose and flow

Pressure Rating: 50 PSI

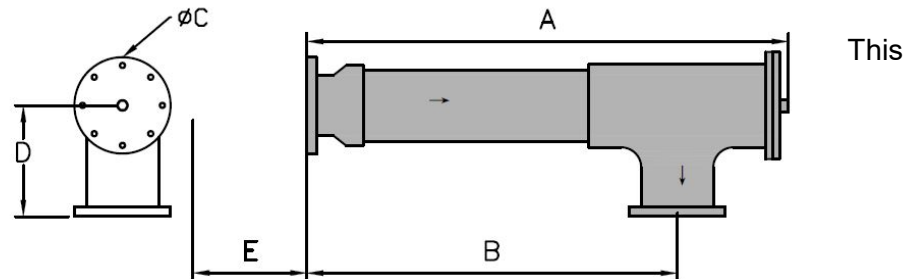


Figure 1. Figure showing the reference points for UV Reactor body dimensions. Flow arrows indicate the inlet and outlet of UV Reactor.

Alternative body dimensions and configuration will need to be submitted to Contracting Authority for review and approval by the engineer.

- .3 Modify and remove the existing schedule 80 piping configuration as shown on the construction drawings.
- .4 Install pipes and fittings in the configuration shown on the construction drawings. All pipes unless otherwise noted on the construction drawings to be Schedule 80 PVC
- .5 The Contractor will be required to coordinate shut down and by-pass of sand filters with departmental representatives and give a maximum shut-down time to complete all the work described on the construction drawings.
- .6 All electrical and controls work as indicated on the electrical drawing package. A summary of electrical work is included in Section 26 05 00 Common Work Results – Electrical.
- .7 All site restoration work as needed to restore the site to original or better conditions including asphalt restoration, reinstallation of chain link fencing and regrading of landscaped areas must be completed by the Contractor prior to de-mobilizing from site.
- .8 Temporary construction fencing as described in section 01 53 01 Temporary Facilities.
- .9 All other work as indicated in the contract drawings and specifications.

1.1 Work Sequence

- .1 Contractor to construct Work in a single stage to accommodate Laboratory Staff's continued use of premises during construction.
- .2 Contractor to co-ordinate Daily Progress Schedule with Laboratory Staff and co-ordinate with Laboratory Staff's daily operation during construction to minimize interference with normal operating procedures. This will include at a minimum a weekly schedule of all construction activities and highlighting any activities that could interfere with water

flow to aquarium.

- .3 Contractor to adhere to all Work Safe BC requirements and maintain access for emergency personnel in the event of an emergency.

1.2 Contractor Use of Premises

- .1 Contractor to co-ordinate use of premises with Project Authority according to weekly construction plans including use of laydown areas for equipment storage, power disruption and changes to regular water flow. Weekly meetings will be required with Contractor, Project Authority and Laboratory staff during construction operations.
- .2 Water and Electricity will be provided on an as is and where is basis.
- .3 Parking, Staging and Storage locations will be at the discretion of the Project Authority.
- .4 Obtain and pay for use of additional storage or work areas needed for operations under this Contract if insufficient space is available on site.
- .5 Contractor will be permitted to work during normal Laboratory operation hours (Monday to Friday, 8:00 to 16:00). Work outside of normal Laboratory operation hours will need to be coordinated and approved by Project Authority.

1.3 Laboratory Staff Occupancy

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

1.4 Existing Services

- .1 Contractor to notify and gain permission from Project Authority and utility companies prior to interruption of services.
- .2 Where Work involves breaking into or connecting to existing services, Contractor to give Project Authority 72 hours' notice for necessary interruption of mechanical or electrical service throughout course of work. Contractor to minimize duration of interruptions. Contractor facility access Monday to Friday 7:00am-5:00 pm is unrestricted. Work hours outside of this should be outlined in the construction schedule and pre-approved by Project Authority.
- .3 Contractor to provide alternative routes for DFO personnel and vehicular traffic if Work impedes normal operations.
- .4 Contractor to establish location and extent of existing service lines in area of work which may be affected by construction activities before starting Work. Notify Project Authority of findings in writing.

- .5 Contractor to 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 and water supply. Adhere to approved schedule and provide written notice to Project Authority 72 hours in advance of work to be completed.
- .6 Contractor to provide temporary facilities as defined in section 01 53 01 when directed by Project Authority to maintain critical building and tenant systems.
- .7 Where unknown services are encountered (water lines, power lines etc) , Contractor to immediately advise Project Authority and confirm findings in writing.
- .8 Protect, relocate or maintain existing active services. When inactive services are encountered, cap off in manner approved by Project Authority
- .9 Contractor to record locations of maintained, re-routed and abandoned service lines and advise Project Authority and confirm findings in writing.
- .10 Construct hoarding (fencing) in accordance with Section 01 53 01 – 1.10.

1.5 Delivery and Installation

.1 Units to be delivered and installed by March 31, 2019.

.2 Delivery Address:

*4160 Marine Drive
West Vancouver BC
V7V1N6*

1.6 Documents Required

- .1 Maintain at job site, one (1) copy of each document as follows and have available for Project Authority or other Departmental Authorities or regulators:
 - .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 by the Project Authority.
 - .2 Maintain documents in clean, dry, legible condition.
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- .3 Make documents available at all times for inspection by Project Authority

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 coordinated 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 coordinated.
- .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 from 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 coordinated, 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.

- .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.

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 | 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 West Vancouver Laboratories
4160 Marine Drive
West Vancouver, BC
V7V 1N6
- .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 | Provide sanitary facilities for work force in accordance with governing regulations and ordinances. |
| | | .2 | Post notices and take such precautions as required by local health authorities. Keep 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 | 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 | 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. |
| 1.5 | Substitution | .1 | Proposals for substitution may be submitted only after award of Contract. Such requests must include statements of respective costs of items originally specified and proposed substitutions. |
| | | .2 | Proposals will be considered by Departmental Representative if: |

- .1 Products selected by Tenderer from those specified are not available; or
 - .2 Delivery date of products selected from those specified would unduly delay completion of Contract; or
 - .3 Alternative products to those specified, which are brought to attention of, and considered by, Departmental Representative as equivalent to those specified and will result in credit of Contract amount.
- .3 Should proposed substitution be accepted either in part or in whole, assume full responsibility and costs when substitution affects other work on project. Pay for drawing changes required as result of substitution.
- .4 All credits arising from approval of substitutions will be credited to Contract in such amounts as may be determined by Departmental Representative and Contract price will be adjusted accordingly. No substitutions will be permitted without prior written approval of Departmental Representative.

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 sand filter and UV plant. |
| | | .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 Laboratory 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 Laboratory Staff in accordance with Section 3.5 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 | Treatment System | .1 | Retain and pay for the services of the authorized manufacturers' representatives to be on-site for the startup of both mechanical and electrical/control systems and operator training. |
| 3.3 | Supply and distribution | .1 | After sterilization of the supply pipe and UV Reactors open valve on new supply line to supply laboratory. |
| | | .2 | Take records of operation of existing sand filters to ensure system is functioning effectively. |
| | | .3 | Take records of operation of UV Reactors ensuring constant illumination occurs. |

- .4 Take records of pressure in system before and after treatment.
 - .5 Departmental Representative to be informed if any component is not working as intended.
- 3.4 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.
- 3.5 System Operation**
- .1 The System shall be handed over during a minimum two week 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 two week hand over period with the Hatchery Staff.

***** END OF SECTION *****

PART 1 - GENERAL

- | | | | |
|------------|---------------------------|----|---|
| 1.1 | General | .1 | Not used |
| 1.2 | Maintenance Manual | .1 | <p>On completion of project, submit to Departmental Representative four (4) copies of Operations Data and Maintenance Manual in English made up as follows:</p> <ul style="list-style-type: none"> .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. <p>.2 Include following information plus data specified.</p> <ul style="list-style-type: none"> .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: <ul style="list-style-type: none"> .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. <p>.3 Neatly type lists and notes. Use clear Drawings, diagrams or manufacturers' literature.</p> <p>.4 Include one complete set of final shop Drawings bound separately indicating corrections and changes made during fabrication and installation.</p> |

**1.3 Maintenance
Materials**

- .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 15 - Mechanical

PART 1 - GENERAL

- | | | | |
|------------|--|----|---|
| 1.1 | General | .1 | Not Used |
| 1.2 | Scope | .1 | This section includes general requirements for mechanical work. |
| 1.3 | Shop Drawings | .1 | The Contract Drawings show the locations of major components and the piping configuration in schematic form with only major components identified. |
| | | .2 | Prior to fabrication, submit four complete sets of Shop Drawings and data sheets covering all details of equipment, materials and fabrication intended for installation under this Contract, and in accordance with the Contract Documents. |
| | | .3 | All Shop Drawings submitted for approval shall be certified by the manufacturer and carefully checked by the Contractor, noting all changes required and shall bear the Contractor's approval stamp and signature prior to submitting to the Departmental Representative for approval; drawings will not be considered if not previously checked by the Contractor. |
| 1.4 | Equipment Requirements and Installation | .1 | Permit equipment maintenance and disassembly by use of unions or flanges to minimize disturbance to connecting piping and duct systems and without interference from the building structure or equipment. |
| | | .2 | Provide accessible means for lubricating equipment including permanent lubricated "lifetime" bearings. |
| | | .3 | Base mounted equipment to be mounted on chamfered edge housekeeping pads a minimum of 50 mm high and 50 mm larger than equipment dimensions all around. |
| | | .4 | Pipe drain lines to drains. Provide piped drains from pump packing glands to building drain. |
| | | .5 | Equipment, floor plates and ceiling plates shall line up with building walls wherever possible. |
| | | .6 | Provide all structural work required for foundation and support of the units, foundation bolts, sleeves, washers, nuts, shims, and templates to locate position of bolts. |
| | | .7 | Install pumps, motors and other equipment as shown on the drawings, in accordance with the manufacturer's |

instructions and as directed by the Departmental Representative.

- .8 Motors shall be aligned, shimmed, and coupled to fit driven shaft to satisfy the tolerance given by the equipment manufacturer.
- .9 For anchorage, embed anchor bolts sufficiently to prevent pull-out. Provide minimum of 25 mm of grout between bedplate and foundation; fill void; finish to approval; do not remove wedges before grout is set.
- .10 Align piping to avoid excessive forces on fixed equipment when piping connections are tightened.
- .11 Pipes shall not be bolted to equipment until grouting and alignment are completed. Bolting shall be done so that no stresses are set up in the flanges.

1.5 Pipe Hangers and Supports

- .1 Fabricate hangers, supports and sway braces in accordance with ANST B31.1 and requirements of ULC C203.
- .2 Suspend hangers from steel channels or angles. Submit anchorage system for review. Acceptable products Grinnell Fig. 202, 194, 213, 195.
- .3 Use split adjustable steel ring hanger on piping less than 38 mm diameter. Use clevis type for 38 mm diameter and above. Acceptable products Grinnell Fig. 104, 160, 65.
- .4 For copper pipe, use copper finish tubing hangers Grinnell Fig. CT-109, CT-65 tube strap.
- .5 For pipes supported from floor, use adjustable pipe support saddle welded to pipe support and fabricated base to suit, bolted to floor. Grinnell Fig. 264.
- .6 Pipe 38 mm diameter and smaller may rest on cast wall bracket and held by U-bolt, Grinnell Fig. 213, 137; or may be strapped to wall using Fig. 126, 231, 262.
- .7 Use rod diameters and spacing for pipe supports as shown in table with the following exceptions.
 - .1 Support plumbing piping in accordance with more stringent requirements of authorities having jurisdiction.

- .2 Support plastic piping in accordance with manufacturer's recommendations.

Pipe Size	Rod Diameter	Maximum Steel	Spacing Copper
NPS 1/2	-	-	1.5m
NPS 1, 3/4	10 mm	2.1m	1.8m
NPS 1 1/2	10 mm	2.7m	2.4m
NPS 2	10 mm	3.0m	2.7m
NPS 2 1/2-3	10 mm	3.6m	3.0m
NPS 4	16 mm	4.2m	3.6m

- .8 Submit arrangement and type of hangers and wall hooks for review.
- .1 Place support within 300 mm of each horizontal elbow.
 - .2 Hangers shall be three piece minimum standard, consisting of hanger, rod and pipe attachment.
 - .3 Med steel wall hooks may be used to support non-expanding piping.
 - .4 Isolate copper piping from ferrous hanger.

1.6 Escutcheons and Plates

- .1 Provide on pipes passing through finished walls, partitions, floors and ceilings.
- .2 Use chrome or nickel plated brass with set screws for ceiling or wall mounting.
- .3 Inside diameter shall fit around finished pipe. Outside diameter shall cover opening or sleeve.

1.7 Tests

- .1 Give 24 hours notice of date when tests will be made.
- .2 Conduct tests in presence of Departmental Representative.
- .3 Leave work exposed until tested and approved.
- .4 Bear costs including re-testing and making good.
- .5 Hydraulically test water supply systems at 860 kPa and maintain test pressure without loss for 4 hours.
- .6 Test fuel oil systems to CSA B139.
- .7 Test drainage, waste and vent piping to code.

1.8 Dielectric Couplings

- .1 Provide wherever pipes of dissimilar metals are joined.

- .2 Provide insulating unions for pipe sizes NPS 2 and under and flanges for pipe sizes over NPS 2.
 - .3 Provide felt or rubber gaskets to prevent dissimilar metals contact.
- 1.9 Instruction of Operating Staff**
- .1 Provide nameplates for all valves and pieces of equipment, supplied by either the Contractor or others, as directed by the Departmental Representative.
 - .2 Nameplates to be laminated plastic with black face and white centre of minimum size 90 x 40 x 2.5 mm nominal thickness, engraved with 6 mm high lettering. Use 25 mm lettering for major equipment, as directed by Departmental Representative.
 - .3 Fasten nameplates securely in conspicuous place. Where nameplates cannot be mounted on a cool surface, provide standoffs or hang from chain.
 - .4 Identify equipment type and number of service zone, as applicable. eg. shut-off valve, pressure relief valve, etc.
 - .5 Submit list of equipment nameplates for review prior to engraving.
- 1.10 Identification of Piping**
- .1 Identify all piping with markers showing identification of pipe and directional flow arrows.
 - .2 Use block capital letters 50 mm high for pipes of 75 mm nominal and larger diameter, and not less than 20 mm high for smaller diameters.
 - .3 Use direction arrows 150 mm long by 50 mm wide for piping of 75 mm nominal or larger diameter and 100 mm long by 20 mm wide for smaller diameters.
 - .4 Use waterproof plastic marker tapes for pipes and tubing of 19 mm and smaller diameter.
 - .5 Acceptable Product: WH Brady identification tapes and bands and Seton Name Plate Corporation Setmark pipe markers.
 - .6 Locate identification as follows:
 - .1 Identify piping runs at least once in each room.

- .2 Do not exceed 5 m between identifications in open areas.
- .3 Identify both sides where piping passes through walls, partitions and floors.
- .4 Where piping is concealed in pipe chase or other confined space, identify at point of entry and leaving, and at each access opening.
- .5 Identify piping at starting and ending points of runs and at each piece of equipment.
- .6 Identify piping at major manual and automatic valves immediately upstream of valves. Where this is not possible, place identification as close to valve as possible.
- .7 Identify branch, equipment or building served after such valve.

**1.11 Temporary and
Trial Usage**

- .1 Temporary or trial usage by the Owner of any mechanical machinery, apparatus, equipment, or any other work or materials supplied under the contract before final written acceptance by the Departmental Representative, is not to be construed as an evidence of the acceptance of same by the Owner. The Owner shall have the privilege of such temporary and trial usage as soon as the Contractor shall claim that said work is completed. Any damage caused by defective material or workmanship through temporary or trial usage by the Owner shall be the responsibility of the Contractor.

END OF SECTION

PART 1 - GENERAL

- 1.1 General** .1 Not Used
- 1.1 Scope** .1 The work and materials covered by this section include the furnishing and installation of the pump and associated mechanical equipment.
- 1.3 Related Work Specified Elsewhere** .1 Mechanical General Provisions Section 15 01 00
- 1.4 Standard** .1 Cast Iron Pipe: AWWA C151
Cast Iron Flanges: ASA B16.1
Galvanized Iron Pipe: ASTM A120
Malleable Iron Pipe Fittings: ASTM A107
- .2 Install piping in accordance with the requirements of the latest edition of the British Columbia Plumbing Code.
- 1.5 Certificates** .1 Provide written certificate that components are compatible, and where applicable, certified for intended use by nationally recognized testing agency.

PART 2 – PRODUCTS

- .1 Refer to Construction Drawings

PART 3 - EXECUTION

- 3.1 General** .1 Install all pipework, fittings, equipment and fixtures to the satisfaction and approval of the Departmental Representative.
- .2 Run exposed pipework parallel to walls and ceilings neatly grouped in parallel lines.
- .3 Temporarily plug ends of pipework to keep foreign matter out before final connections are made.
- 3.2 Tolerances** .1 All horizontal drain leaders above ground shall be graded to one percent slope, unless otherwise shown on the Drawings.
- .2 All drain lines and horizontal lines of soil and waste piping shall be graded two percent minimum unless otherwise shown on the Drawings.

**3.3 Installation
of Pipework**

- .3 Horizontal branches of all pipework shall be graded downwards so that they may be completely drained through risers, fixtures or drain cocks. Minimum slope one-half of one percent.
- .1 Do no cutting that may impair the strength of the building. Drill no holes, except for expansion bolts and small screws in the structure without obtaining prior approval from the Departmental Representative.
- .2 Pipes passing through roofs, floors or other areas requiring waterproofing shall be flashed by the Contractor. Seal pipe passing through walls and floors inside the building with flexible caulking applied into space between pipe and sleeve or as detailed.
- .3 Run all piping parallel to building lines. Fasten supports to inserts in concrete. Do not use perforated band iron for hangers. All hanger rods are to have machine threads capable of vertical adjustment after pipe is erected.
- .4 Piping, ducts, and equipment shall be thoroughly cleaned of dirt, cuttings and other foreign substances. Should any pipe, duct or other part of systems be obstructed by any foreign matter, disconnect, clean and re-connect whenever necessary for purpose of locating and removing obstructions. Repair work damaged in the course of removing obstructions.
- .5 Provide temporary bracing and supports to adequately support the pipe during installation.
- .6 Take care to prevent damage to the pipe, pipe coatings and the adjacent structure during erection. Make good all damage. Completely repaint all ferrous pipework and fittings after installation is completed.
- .7 Where the required piping is not shown on the plans or shown only diagrammatically, install pipes in such a way as to conserve head room and interfere as little as possible with free use of the space through which they pass.
- .8 Install all valves so as to facilitate servicing or re-packing.
- .9 Erect and support all piping in a manner that will not put undue strain on pumps, tanks, equipment or adjacent piping.
- .10 Install eccentric reducers in horizontal piping to permit drainage and eliminate air pockets.

- .11 Where pipe sizes differ from connections to equipment, install reducing fittings close to equipment. Reducing bushings are not permitted.
- .12 Use non-corrosive lubricant or teflon tape applied to male threads.
- .13 Install flanges or unions to permit removal of equipment without disturbing piping systems.

3.4 Welding of Steel Pipe

- .1 Do pipe welding in accordance with the current AWWA Specification C-206-62. The welding operators and supervisors employed and the welding procedure shall be qualified in accordance with the current CSA Standard W-47 Welding Specification Code. Each operator's certificate of qualification and experience record shall be on file at the site, and shall be made available to the Departmental Representative on request. Each operator shall be currently qualified for the P number covering the material on which he will be engaged as prescribed in the Welding Qualification Code, latest revision.
- .2 The Departmental Representative reserves the right to specifically test, at no cost to the Owner, the qualification of individual welders employed by the Contractor. Any welder who does not perform satisfactorily in the Departmental Representative's test shall be removed from the job at no cost to the Owner.
- .3 All welding shall be shielded metal-arc welding process. Welded pipe joints shall be single-V butt joints, using a root gap of 1.6 mm. Welds shall be full penetrating welds. Care shall be exercised to keep the interior pipe lining free from damage during welding. Longitudinal weld seams shall be on opposite sides of the pipe at the joint. Welding shall not be carried on when weather conditions, in the opinion of the Departmental Representative, are unsatisfactory and would impair the quality of the welds.
- .4 The minimum distance between the edges to adjacent circumferential welds shall be 50 mm. If this requirement cannot be satisfied, stress-relieving of the welds must be undertaken.

3.5 Valve, Equipment and Appurtenance

- .1 Install all valves, equipment and appurtenances to manufacturer's instructions and these Specifications.

**3.6 Final Inspection
and Start-up**

- .1 Subject to systems and equipment to operational test. All new fittings to be subject to pressure test of 1.5x working pressure.
- .2 During tests, stop any leaks and remove and repair any defective part. Perform test over again until satisfactory results are obtained.
- .3 Provide pump, temporary connections and labour required for tests.
- .4 Carry out the following before final inspection:
 - .1 complete construction and site restoration
 - .2 complete all painting and finishing
 - .3 align and adjust all equipment
 - .4 where applicable, mail equipment warranty form to manufacturer. Provide the Owner with a copy of the original warranty for any equipment which has a warranty period longer than one year.
- .5 Notify Departmental Representative at least 48 hours prior to start-up.

END OF SECTION

Division 26 - Electrical

1.4 SCOPE OF WORK

- .1 This project involves the installation of new UV treatment reactors at the DFO West Vancouver Laboratories. The electrical scope of the project includes, but is not limited to, the following items of work:
 - .1 Disconnection and removal of existing electrical service feeders between Pumphouse and Sand Filter Building.
 - .2 Removal of existing millwork within Sand Filter Building.
 - .3 Supply and installation of new Sand Filter Building feeders from Main Electrical Room.
 - .4 Supply and installation of conduit between Sand Filter Building and Main Electrical Room.
 - .5 Supply of asphalt cutting, trenching, backfilling, asphalt repair, and supporting materials as required.
 - .6 Supply of scanning, coring and cutting for concrete penetrations for new Sand Filter Building feeders.
 - .7 Supply and installation of all necessary materials required to transition and mount conduit to berth face wall and underside of wharf deck.
 - .8 Termination of Sand Filter Building feeders onto existing, spare 100A, 3P circuit breaker located within Main Electrical Room panel DP3.
 - .9 Termination of Sand Filter Building feeders onto existing main circuit breaker within Sand Filter Building service panel.
 - .10 Supply and installation of 60A, 2P circuit breaker within existing Sand Filter Building service panel.
 - .11 Installation of UPS within Sand Filter Building.
 - .12 Supply and installation of UPS service feeders from existing service panel.
 - .13 Supply and installation of 25A, 2P, enclosed circuit breakers fed from UPS.
 - .14 Supply and installation of TECK cabling routed along ceiling from enclosed circuit breakers to UV treatment reactor panels, including all necessary materials to mount cabling.
 - .15 Supply and installation of unistrut and threaded rods necessary for the support of TECK cabling routed from ceiling to UV treatment panels.
 - .16 Termination and labelling of all field wiring and circuit breakers.
 - .17 Testing and configuration of UPS to suit UV system voltage.

1.5 DRAWING NOTATION

- .1 The electrical work for this project involves the installation of new electrical and the re-use or relocation of some existing equipment. In all cases the Contractor shall assume that it has to supply and install all electrical equipment. Standard notations are used on the Plans to assist the Contractor in identifying what work needs to be done. These standard notations are defined as follows:
 - .1 “All equipment is proposed unless noted otherwise” – This notation is used on Plans where the majority of the equipment on the drawing is to be supplied and installed by the Contractor. The notation means that the Contractor shall perform

all work shown on the drawing except for equipment shown as existing (i.e. to remain).

- .2 "All equipment is existing unless noted otherwise": - This notation is used on Plans where the majority of the equipment is existing. The notation means that the Contractor shall perform only the work identified.

1.6 CODES AND STANDARDS

- .1 Complete installation in accordance with CSA C22.1-2015 except where specified otherwise.

1.7 CARE, OPERATION AND START-UP

- .1 Instruct Consultant and operating personnel in the operation, care and maintenance of systems, system equipment and components.
- .2 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with all aspects of its care and operation.

1.8 PERMITS, FEES AND INSPECTION

- .1 Submit to Electrical Inspection Department and Supply Authority necessary number of drawings and specifications for examination and approval prior to commencement of Work.
- .2 Pay associated fees.
- .3 Notify Consultant of changes required by Electrical Inspection Department prior to making changes.
- .4 Furnish Certificates of Acceptance from authorities having jurisdiction on completion of work to Consultant.

1.9 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect equipment from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan related to Work of this Section.

1.10 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

- .2 Operation and Maintenance Data: submit operation and maintenance data for Pumps and Electrical Equipment for incorporation into manual.
 - .1 Provide for each system and principal item of equipment as specified in technical sections for use by operation and maintenance personnel.
 - .2 Operating instructions to include following:
 - .1 Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.
 - .2 Start up, proper adjustment, operating, lubrication, and shutdown procedures.
 - .3 Safety precautions.
 - .4 Procedures to be followed in event of equipment failure.
 - .5 Other items of instruction as recommended by manufacturer of each system or item of equipment.
 - .3 Print or engrave operating instructions and frame under glass or in approved laminated plastic.
 - .4 Post instructions where directed.
 - .5 For operating instructions exposed to weather, provide weather-resistant materials or weatherproof enclosures.
- .3 Ensure operating instructions will not fade when exposed to sunlight and are secured to prevent easy removal or peeling.

Part 2 Products

2.1 DESIGN REQUIREMENTS

- .1 Operating voltages: to CAN3-C235.
- .2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard.
 - .1 Equipment to operate in extreme operating conditions established in above standard without damage to equipment.
- .3 Language operating requirements: provide identification nameplates for control items in English.
- .4 Use one nameplate for each language.

2.2 MATERIALS AND EQUIPMENT

- .1 Provide materials and equipment in accordance with Section 01 61 00 – Common Product Requirements.
- .2 Equipment and material to be CSA certified. Where there is no alternative to supplying equipment which is not CSA certified, obtain special approval from Electrical Inspection Department.

- .3 Factory assemble control panels and component assemblies.

2.3 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

- .1 Verify installation and co-ordination responsibilities related to motors, equipment and controls, as indicated.

2.4 WARNING SIGNS

- .1 Warning Signs: in accordance with requirements of authority having jurisdiction and Consultant.
- .2 Decal signs, minimum size 175 x 250 mm.

2.5 WIRING TERMINATIONS

- .1 Ensure lugs, terminals, screws used for termination of wiring are suitable for either copper or aluminum conductors.

2.6 EQUIPMENT IDENTIFICATION

- .1 Identify equipment cabinets with nameplates as follows:
 - .1 Nameplates:
Lamicoid 3 mm thick plastic engraving sheet, white face, black core, mechanically attached with self-tapping screws or permanent self-adhesive, 20 x 90 mm, 1 line, 8 mm high letters.
- .2 Identify electrical equipment with labels as follows:
 - .1 Labels:
Embossed plastic labels with 6mm high letters unless specified otherwise.
- .3 Allow for average of twenty-five (25) letters per nameplate and label.
- .4 Nameplates for terminal cabinets and junction boxes to indicate system.
- .5 Terminal cabinets and pull boxes: indicate system.

2.7 WIRING IDENTIFICATION

- .1 Identify wiring with permanent indelible identifying markings, either numbered or coloured plastic tapes, on both ends of cable.
- .2 Colour code: to CSA C22.1.
- .3 Use colour coded wires in communication cables, matched throughout system.

2.8 CONDUIT AND CABLE IDENTIFICATION

- .1 Colour code conduits, boxes and metallic sheathed cables.

- .2 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15 m intervals.
- .3 Colours: 25 mm wide prime colour and 20 mm wide auxiliary colour.

	Prime	Auxiliary
Communication Systems	Green	Blue
Security Systems	Red	Yellow

2.9 MANUFACTURERS AND CSA LABELS

- .1 Visible and legible, after equipment is installed.

2.10 FINISHES

- .1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.
- .2 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.
- .3 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Consultant.
 - .2 Inform Consultant of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

3.2 INSTALLATION

- .1 Do complete installation in accordance with CSA C22.1 except where specified otherwise.
- .2 Do overhead and underground systems in accordance with CAN/CSA-C22.3 No.1 except where specified otherwise.

3.3 NAMEPLATES AND LABELS

- .1 Ensure manufacturer's nameplates, CSA labels and identification nameplates are visible and legible after equipment is installed.

3.4 CONDUIT AND CABLE INSTALLATION

- .1 Install conduit and sleeves prior to pouring of concrete.
 - .1 Sleeves through concrete: schedule 40 plastic, sized for free passage of conduit, and protruding 50 mm.
- .2 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.
- .3 Install cables, conduits and fittings embedded or plastered over, close to building structure so furring can be kept to minimum.

3.5 MOUNTING HEIGHTS

- .1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.
- .2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.

3.6 CO-ORDINATION OF PROTECTIVE DEVICES

- .1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings.

3.7 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.8 FIELD QUALITY CONTROL

- .1 All electrical work to be carried out by qualified, licensed electricians or apprentices as per the conditions of the Provincial Act respecting manpower vocational training and qualification. Employees registered in a provincial apprentices program shall be permitted, under the direct supervision of a qualified licensed electrician, to perform specific tasks - the activities permitted shall be determined based on the level of training attained and the demonstration of ability to perform specific duties.
- .2 The work of this division to be carried out by a contractor who holds a valid Master Electrical contractor license as issued by the Province that the work is being constructed in.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Materials and installation for wire and box connectors.

1.2 RELATED SECTIONS

- .1 Section 26 05 00 – Common Work Results – Electrical.

1.3 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-C22.2No.18.1-06, Metallic Outlet Boxes
 - .2 CAN/CSA-C22.2No.18.2-06, Nonmetallic Outlet Boxes
 - .3 CAN/CSA-C22.2No.18.3-04 (R2011), Conduit, Tubing, and Cable Fittings
 - .4 CAN/CSA-C22.2No.18.4-04 (R2011), Hardware for the Support of Conduit, Tubing
 - .5 CAN/CSA-C22.2No.18.5-02 (R2011), Positioning Devices
 - .6 CSA C22.2No.65-03(R2008)], Wire Connectors.
- .2 Electrical and Electronic Manufacturers' Association of Canada (EEMAC)
 - .1 EEMAC 1Y-2, 1961 Bushing Stud Connectors and Aluminum Adapters (1200 Ampere Maximum Rating).
- .3 National Electrical Manufacturers Association (NEMA)

1.4 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Contract Documents.
- .2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard and other recyclable packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
- .4 Divert unused wiring materials from landfill to metal recycling facility as approved by Engineer.

Part 2 Products

2.1 MATERIALS

- .1 Pressure type wire connectors to: CSA C22.2No.65, with current carrying parts of copper sized to fit copper conductors as required.

- .2 Fixture type splicing connectors to: CSA C22.2No.65, with current carrying parts of copper sized to fit copper conductors 10 AWG or less.
- .3 Bushing stud connectors: to EEMAC 1Y-2 to consist of:
 - .1 Connector body and stud clamp for copper conductors.
 - .2 Clamp for stranded copper conductors.
 - .3 Stud clamp bolts.
 - .4 Bolts for copper conductors.
 - .5 Sized for conductors as indicated.
- .4 Clamps or connectors for armoured cable and flexible conduit as required to: CAN/CSA-C22.2No.18 (all subsections).

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for wire and box connectors installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Consultant or provide photographic evidence of areas of concern.
 - .2 Inform Consultant of unacceptable conditions immediately upon discovery.
- .2 Proceed with installation only after unacceptable conditions have been remedied.

3.2 INSTALLATION

- .1 Remove insulation carefully from ends of conductors and:
 - .1 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CSA C22.2No.65.
 - .2 Install fixture type connectors and tighten. Replace insulating cap.
 - .3 Install bushing stud connectors in accordance with EEMAC 1Y-2.

3.3 CLEANING

- .1 Progress Cleaning: clean in accordance with Contract Documents.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Contract Documents.
- .3 Waste Management: separate waste materials for recycling in accordance with Contract Documents.

- .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 26 05 20 - Wire and Box Connectors - 0 - 1000 V.

1.2 REFERENCES

- .1 CSA C22.2 No .0.3-09, Test Methods for Electrical Wires and Cables.

1.3 PRODUCT DATA

- .1 Submit product data in accordance with Contract Documents.

Part 2 Products

2.1 BUILDING WIRES

- .1 Conductors: stranded for 10 AWG and larger. Minimum size: 12 AWG.
- .2 Copper conductors: size as indicated, with 600 V insulation of cross-linked thermosetting polyethylene material rated RW90 XLPE, Jacketted.
- .3 Copper conductors: size as indicated, with thermoplastic insulation type TWU rated at 600 V.

2.2 TECK 90 CABLE

- .1 Cable: in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Conductors:
 - .1 Grounding conductor: copper as indicated.
 - .2 Circuit conductors: copper as indicated, size as indicated.
- .3 Insulation:
 - .1 Cross-linked polyethylene XLPE.
 - .2 Rating: , 600 V.
- .4 Inner jacket: polyvinyl chloride material.
- .5 Armour: interlocking galvanized steel.
- .6 Overall covering: thermoplastic polyvinyl chloride, compliant to applicable Building Code classification for this project.
- .7 Fastenings:

- .1 One hole aluminum straps to secure surface cables 50 mm and smaller. Two hole steel straps for cables larger than 50 mm.
- .2 Channel type supports for two or more cables at 300 mm centers.
- .3 Threaded rods: 6 mm diameter to support suspended channels.
- .8 Connectors:
- .9 Watertight approved for TECK cable.

2.3 CONTROL CABLES

- .1 Type: LVT: [2] soft annealed copper conductors, sized as indicated:
 - .1 Insulation: thermoplastic.
 - .2 Sheath: thermoplastic jacket.
- .2 Type: low energy 300 V control cable: stranded annealed copper conductors sized as indicated LVT: [2] soft annealed copper conductors, sized as indicated:
 - .1 Insulation: polyethylene.
 - .2 Shielding: braid over each pair.
 - .3 Overall covering: PVC jackets.
- .3 Type: 600 V stranded annealed copper conductors, sizes as indicated:
 - .1 Insulation: polyethylene.
 - .2 Shielding: braid over each pair of conductors.
 - .3 Overall covering: PVC.

2.4 STANDARDS (UTP AND DATA CABLING)

- .1 Except where specifically modified within this specification, the installation shall, as minimum, comply with the latest issues of the following standards:
 - .1 CAN/CSA-T527, "Commercial Building Grounding and Bonding Requirements for Telecommunications"
 - .2 CAN/CSA-T528-93(R2001), "Design Guideline for Administration Telecommunications Infrastructure in Commercial Buildings"
 - .3 CAN/CSA-C22.2 No. 182.4, "Plugs, Receptacles, and Connectors for Communication Systems".
 - .4 EIA/TIA Bulletin TSB-36, Technical Systems Bulletin Additional Cable Specifications for Unshielded Twisted Pair Cables, Electronic Industries Association (USA), November 1991.
 - .5 The installation shall, as minimum, comply with the latest issues of the following Building Codes: All municipal By-laws, Provincial Codes, The BC Building Code, The Canadian Electrical Code, Canadian Labour Code, and the BC Fire Code. In the case of conflict or discrepancy the more stringent code shall apply.
 - .6 TIA/EIA-606-A

Part 3 Execution

3.1 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results - Electrical.
- .2 Perform tests using method appropriate to site conditions and to approval of Consultant and local authority having jurisdiction over installation.
- .3 Perform tests before energizing electrical system.

3.2 GENERAL CABLE INSTALLATION

- .1 Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors - (0-1000 V).
- .2 Cable Colour Coding: to Section 26 05 00 Common Work Results for Electrical.
- .3 All cabling shall be installed in conduit except in electrical/mechanical rooms where cabling is terminated.

3.3 INSTALLATION OF BUILDING WIRES

- .1 Install wiring as follows:
 - .1 In conduit systems in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

3.4 INSTALLATION OF TECK90 CABLE (0 -1000 V)

- .1 Group cables wherever possible on channels.
- .2 Install cable exposed, securely supported by straps or hangers.

3.5 INSTALLATION OF ARMOURED CABLES

- .1 Group cables wherever possible on channels.

3.6 TESTING GENERAL

- .1 Cabling and connectors to be tested by an experienced company employing trained technicians with minimum 5 years experience in data cabling industry. Provide at the time of tender the name of the company to be performing the connection and testing of cables, a listing of the qualifications of the technicians to be performing the work and a listing major jobs completed by the company.
- .2 The Departmental Representative reserves the right to approve or reject any company being proposed to perform this work based on that company's previous experience or training.

- .3 Testing to include verification of cable configurations between connected equipment.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Materials and installation for connectors and terminations.

1.2 RELATED SECTIONS

- .1 Section 26 05 00 – Common Work Results – Electrical

1.3 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA C22.2No.65-03 (R2008) Wire Connectors
 - .2 CSA C22.2 No.41-07, Grounding and Bonding Equipment.

1.4 PRODUCT DATA

- .1 Submit product data in accordance with Contract Documents.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect hangers and supports from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

Part 2 Products

2.1 CONNECTORS AND TERMINATIONS

- .1 Copper compression connectors to CSA C22.2No.65 as required sized for conductors.

Part 3 Execution

3.1 INSTALLATION

- .1 Install terminations, and splices in accordance with manufacturer's instructions.

.2 Bond and ground as required to CSA C22.2No.41.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 26 05 00 – Common Work Results - Electrical.

1.2 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Contract Documents.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store the materials indoors off of the ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect hangers and supports from nicks, scratches, and blemishes.
- .4 Replace defective or damaged materials with new.

Part 2 Products

2.1 SUPPORT CHANNELS

- .1 Select channel as indicated in the drawings:
 - .1 U shape, galvanized steel, size 41 x 41 mm, 2.5 mm thick, surface mounted and suspended.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for hangers and supports installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Consultant or provide photographic evidence of areas of concern.
 - .2 Inform Consultant of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 INSTALLATION

- .1 Secure equipment to poured concrete with expandable inserts.
- .2 Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.

- .3 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.
- .4 Fasten exposed conduit or cables to building construction or support system using straps.
 - .1 One-hole stainless steel straps to secure surface conduits and cables 50 mm and smaller.
 - .2 Two-hole stainless steel straps for conduits and cables larger than 50 mm.
 - .3 Beam clamps to secure conduit to exposed steel work.
- .5 Suspended support systems.
 - .1 Support individual cable or conduit runs with 6 mm dia threaded rods and spring clips.
 - .2 Support 2 or more cables or conduits on channels supported by 6 mm dia threaded rod hangers where direct fastening to building construction is impractical.
- .6 For surface mounting of two or more conduits use channels at 1000 mm on centre spacing.
- .7 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.
- .8 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.
- .9 Do not use wire lashing or perforated strap to support or secure raceways or cables.
- .10 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Engineer.
- .11 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

3.3 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

END OF SECTION

PART 1 GENERAL

1.1 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA C22.1-15, Canadian Electrical Code, Part 1, 23th Edition.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Contract Documents.
- .2 Product Data:
 - .1 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Provide shop drawings: in accordance with Contract Documents.

1.3 DELIVERY, STORAGE AND HANDLING

- .1 Waste Management and Disposal:
 - .1 Separate waste materials for recycling in accordance with Contract Documents.

PART 2 PRODUCTS

2.1 JUNCTION AND PULL BOXES

- .1 NEMA 4X stainless steel construction with screw-on flat covers for surface mounting. All mounting hardware to be stainless steel.
- .2 Provide hinged lockable covers where noted on the drawings.
- .3 Covers with 25 mm minimum extension all around, for flush-mounted pull and junction boxes.
- .4 Provide Type 10 underground pull boxes that meet the requirements of the Ministry Electrical and Signing Material Standards Section 201 and the Plans.

2.2 CABINETS

- .1 Provide enclosures that meet the requirements of the Ministry of Transportation and Infrastructure Electrical and Signing Material Standards Section 402 and the Plans (with heating as noted in the plans).
- .2 Equipment layouts shown on the drawings represent approximate locations only. Contractor shall provide shop drawings for the kiosks and cabinets including detailed

- equipment layout drawings and cabinet/kiosk dimensions. Provide detailed parts lists of the kiosk components and equipment to be installed in the kiosk.
- .3 Supply enclosures manufactured by Ministry of Transportation approved suppliers.
 - .4 Provide a fold down shelf permanently fastened to each door for holding testing equipment or documentation.
 - .5 All end of wire segments and all access points between source and destination shall be labeled. Wire labeling shall adhere to the nomenclature as noted on the Drawings. The Contractor shall provide a sample of the proposed labeling to the Department's Representative for approval prior to installation.
 - .6 Notify the Departmental Representative five working days prior to the anticipated completion of the cabinet. The Owner's Representative will inspect the completed cabinet at the Supplier's facilities.
 - .7 Supply all cabinets with a complete set of their respective as-built design drawings in the plan pouches.

PART 3 EXECUTION

3.1 SPLITTER INSTALLATION

- .1 Mount plumb, true and square to building lines.
- .2 Extend splitters full length of equipment arrangement except where indicated otherwise.

3.2 JUNCTION, PULL BOXES AND CABINETS INSTALLATION

- .1 Install pull boxes in inconspicuous but accessible locations.
- .2 Mount cabinets with top not higher than 2 m above finished floor.
- .3 Install equipment and terminal blocks as indicated in cabinets.
- .4 Only main junction and pull boxes are indicated. Install pull boxes so as not to exceed 30 m of conduit run between pull boxes.

3.3 IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 01 - Common Work Results - Electrical.
- .2 Install size 2 identification labels indicating system name, voltage, and phase.

END OF SECTION

PART 1 GENERAL

1.1 RELATED SECTIONS

- .1 Section 26 05 00 – Common Work Results - Electrical

1.2 REFERENCES

- .1 Canadian Standards Association (CSA)
 - .1 CAN/CSA C22.2 No. 18-98(R2003), Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware, A National Standard of Canada.
 - .2 CSA C22.2 No. 45-M1981(R2003), Rigid Metal Conduit.
 - .3 CSA C22.2 No. 56-04, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
 - .4 CSA C22.2 No. 83-M1985(R2003), Electrical Metallic Tubing.
 - .5 CSA C22.2 No. 211.2-M1984(R2003), Rigid PVC (Unplasticized) Conduit.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Contract Documents.
- .2 Product data: submit manufacturer's printed product literature, specifications and datasheets.
 - .1 Submit cable manufacturing data.
- .3 Quality assurance submittals:
 - .1 Test reports: submit certified test reports.
 - .2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .4 Instructions: submit manufacturer's installation instructions.

1.4 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for recycling in accordance with Contract Documents.
- .2 Place materials defined as hazardous or toxic waste in designated containers.
- .3 Ensure emptied containers are sealed and stored safely for disposal away from children.

PART 2 PRODUCTS

2.1 CABLES AND REELS

- .1 Provide cables on reels or coils.

- .1 Mark or tag each cable and outside of each reel or coil, to indicate cable length, voltage rating, conductor size, and manufacturer's lot number and reel number.
- .2 Each coil or reel of cable to contain only one continuous cable without splices.
- .3 Identify cables for exclusively dc applications.
- .4 Reel and mark shielded cables rated [2,001] volts and above.

2.2 CONDUITS

- .1 Rigid metal conduit: to CSA C22.2 No. 45, hot dipped galvanized steel threaded.
- .2 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings.
- .3 Rigid PVC conduit: to CSA C22.2 No. 211.2.
- .4 Flexible metal conduit: to CSA C22.2 No. 56, liquid-tight flexible metal.

2.3 CONDUIT FASTENINGS

- .1 One hole steel straps to secure surface conduits 50 mm and smaller. Two hole steel straps for conduits larger than 50 mm.
- .2 Beam clamps to secure conduits to exposed steel work.
- .3 Channel type supports for two or more conduits at 1500 mm oc.
- .4 Threaded rods, 6 mm diameter, to support suspended channels.

2.4 CONDUIT FITTINGS

- .1 Fittings: manufactured for use with conduit specified. Coating: same as conduit.
- .2 Factory "ells" where 90 degree bends are required for 25 mm and larger conduits.
- .3 Watertight connectors and couplings for EMT. Set-screws are not acceptable.

2.5 EXPANSION FITTINGS FOR RIGID CONDUIT

- .1 Weatherproof expansion fittings with internal bonding assembly suitable for 100 mm linear expansion.
- .2 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19 mm deflection.
- .3 Weatherproof expansion fittings for linear expansion at entry to panel.

2.6 FISH CORD

- .1 Polypropylene.

PART 3 EXECUTION

3.1 INSTALLATION

- .1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.
- .2 Conceal conduits except in mechanical and electrical service rooms.
- .3 Surface mount conduits except where they are in a secure area designated as a wire chase already. Concealed conduit may be required in aesthetic locations. If in doubt, consult Owner and Consultant for direction.
- .4 Use rigid hot dipped galvanized steel threaded conduit except where specified otherwise.
- .5 Use electrical metallic tubing (EMT) indoors as specified.
- .6 Use rigid pvc conduit underground.
- .7 Use liquid tight flexible metal conduit for connection to devices.
- .8 Bend conduit cold:
 - .1 Replace conduit if kinked or flattened more than 1/10th of its original diameter.
- .9 Mechanically bend steel conduit over 19 mm diameter.
- .10 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.
- .11 Install fish cord in empty conduits.
- .12 Remove and replace blocked conduit sections.
 - .1 Do not use liquids to clean out conduits.
- .13 Dry conduits out before installing wire.

3.2 SURFACE CONDUITS

- .1 Run parallel or perpendicular to building lines.
- .2 Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.
- .3 Run conduits in flanged portion of structural steel.
- .4 Group conduits wherever possible on suspended or surface channels.
- .5 Do not pass conduits through structural members except as indicated.
- .6 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

3.3 CONCEALED CONDUITS

- .1 Run parallel or perpendicular to building lines.
- .2 Do not install horizontal runs in masonry walls.
- .3 Do not install conduits in terrazzo or concrete toppings.

3.4 CONDUITS UNDERGROUND

- .1 Slope conduits to provide drainage.
- .2 Waterproof joints (pvc excepted) with heavy coat of bituminous paint.

3.5 CLEANING

- .1 Proceed in accordance with Contract Documents.
- .2 Clean all underground ducts with a mandrel prior to pulling cables.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 26 05 01 - Common Work Results - Electrical.

1.2 REFERENCES

- .1 Canadian Standards Association, (CSA International)
- .2 Insulated Cable Engineers Association, Inc. (ICEA)

1.3 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Contract Documents.
- .2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard and other recyclable packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
- .4 Unused material must not be disposed of into sewer system, into streams, lakes, onto ground or in other location where it will pose health or environmental hazard.
- .5 Divert unused metal and wiring materials from landfill to metal recycling facility as approved by Engineer.
- .6 Do not dispose of preservative treated wood through incineration.
- .7 Do not dispose of preservative treated wood with other materials destined for recycling or reuse.
- .8 Dispose of treated wood, end pieces, wood scraps and sawdust at sanitary landfill approved by Engineer.
- .9 Fold up metal banding, flatten and place in designated area for recycling.

Part 2 Products

2.1 NOT USED

- .1 NOT USED

Part 3 Execution

3.1 CABLE INSTALLATION IN DUCTS

- .1 Install cables as indicated in ducts.
 - .1 Do not pull spliced cables inside ducts.
- .2 Install multiple cables in duct simultaneously.
- .3 Use CSA approved lubricants of type compatible with cable jacket to reduce pulling tension.
- .4 To facilitate matching of colour coded multi-conductor control cables reel off in same direction during installation.
- .5 Before pulling cable into ducts and until cables are properly terminated, seal ends of lead covered cables with wiping solder; seal ends of non-leaded cables with moisture seal tape.
- .6 After installation of cables, seal duct ends with duct sealing compound.

3.2 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 01 - Common Work Results – Electrical.
- .2 Perform tests using qualified personnel. Provide necessary instruments and equipment.
- .3 Check phase rotation and identify each phase conductor of each feeder.
- .4 Check each feeder for continuity, short circuits and grounds. Ensure resistance to ground of circuits is not less than 50 megohms.
- .5 Pre-acceptance tests.
 - .1 After installing cable but before splicing and terminating, perform insulation resistance test with 1000 V megger on each phase conductor.
 - .2 Check insulation resistance after each splice and/or termination to ensure that cable system is ready for acceptance testing.
- .6 Acceptance Tests
 - .1 Ensure that terminations and accessory equipment are disconnected.
 - .2 Ground shields, ground wires, metallic armour and conductors not under test.
 - .3 High Potential (Hipot) Testing.
 - .1 Conduct hipot testing at in accordance with manufacturer's recommendations.
 - .4 Leakage Current Testing.
 - .1 Raise voltage in steps from zero to maximum values as specified by manufacturer for type of cable being tested.
 - .2 Hold maximum voltage for specified time period by manufacturer.

- .3 Record leakage current at each step.
- .7 Provide Departmental Representative with list of test results showing location at which each test was made, circuit tested and result of each test.
- .8 Remove and replace entire length of cable if cable fails to meet any of test criteria.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Materials for moulded-case circuit breakers.

1.2 RELATED SECTIONS

- .1 Section 26 05 00 – Common Work Results - Electrical

1.3 REFERENCES

- .1 Canadian Standards Association (CSA International).
 - .1 CSA-C22.2 No. 5-09, Moulded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, tenth edition, and the second edition of NMX-J-266-ANCE).

1.4 SUBMITTALS

- .1 Submit product data in accordance with Submittal Procedures.
- .2 Include time-current characteristic curves for breakers with ampacity of 20 A and over or with interrupting capacity of 22,000 A symmetrical (rms) and over at system voltage.
- .3 Include time-current characteristic curves for all 600V breakers.

1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in Contract Requirements.
- .2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard and other recyclable packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
- .4 Divert unused metal materials from landfill to metal recycling facility as approved by Engineer.
- .5 Fold up metal banding, flatten and place in designated area for recycling.

Part 2 Products

2.1 BREAKERS GENERAL

- .1 Moulded-case circuit breakers: to CSA C22.2 No. 5

- .2 Bolt-on moulded case circuit breaker: quick- make, quick-break type, for manual and automatic operation with temperature compensation for 40 degrees C ambient.
- .3 Common-trip breakers: with single handle for multi-pole applications.
- .4 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting.
 - .1 Trip settings on breakers with adjustable trips to range from 3-8 times current rating (600V breakers).
- .5 Circuit breakers with interchangeable trips as indicated.
- .6 Circuit breakers to have the following minimum symmetrical rms interrupting capacity rating:
 - .1 120/240V Breakers: 10kA
 - .2 120/208V Breakers: 18kA
 - .3 600V Breakers 25kA

2.2 THERMAL MAGNETIC BREAKERS

- .1 Moulded case circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping and instantaneous tripping for short circuit protection.
 - .1 Circuit breaker for heat trace circuit shall be of the type recommended by the heat trace manufacturer.

Part 3 Execution

3.1 INSTALLATION

- .1 Install circuit breakers as indicated.

END OF SECTION

Division 31 - Earthworks

PART 1 - GENERAL

- | | | | |
|------------|---|----|---|
| 1.1 | General | .1 | Not used. |
| 1.2 | Related Work Specified elsewhere | .1 | Conduits, Conduit Fastenings and Conduit Fittings
Section 26 05 34 |
| 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 Building 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 Departmental Representative 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 2 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 Departmental Representative 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		
25 mm	[100]	-	-	-
19 mm	[75-100]	-	-	-
12.5 mm	-	-	-	-
9.5 mm	[50-100]	-	-	-
4.75 mm	[30-70]	-	-	-
2.00 mm	[20-45]	-	-	-
0.425 mm	[10-25]	-	-	-
0.180 mm	-	-	-	-
0.075 mm	[3-8]	-	-	-

.3 Imported Granular Fill:

- .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		
200 mm	-	-	-	-
75 mm	[100]	-	-	-
50 mm	-	-	-	-
37.5 mm	-	-	-	-
25 mm	[45-100]-	-	-	-

19 mm	-	-	-	-
12.5 mm	-	-	-	-
9.5 mm	-	-	-	-
4.75 mm	[25-70]	-	-	-
2.00 mm	-	-	-	-
0.425 mm	[5-25]	-	-	-
0.180 mm	-	-	-	-
0.075 mm	[0-10]	-	-	-

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 .
 - .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 Departmental Representative.
 - .2 Remove concrete, masonry, paving, walks, demolished foundations and rubble, and other obstructions encountered during excavation.
 - .3 Excavation must not interfere with normal 45° splay of bearing from bottom of any footing.
 - .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 For trench excavation, unless otherwise authorized by Departmental Representative in writing, do not excavate more than 30 m of trench in advance of installation operations and do not leave open more than 15 m at end of day's operation.
 - .6 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 Where any part of the neat trench width is under a traveled area, to a minimum of 95% of maximum laboratory density obtained using ASTM Method D698-70, Method D.
 - .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 travelled or untraveled paved 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