CITY OF VANCOUVER

CONSTRUCTION SPECIFICATIONS

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PREFACE

The purpose of this manual is to provide standards, specifications, and procedures to ensure that construction *Work* on City *Streets* are carried out in accordance with the best available standards and procedures to provide a safe and quality product and to minimize maintenance requirements and reduce life cycle costs.

All references to Specifications, Master Specifications, Master Municipal Specifications, Technical Specifications, and other similar documents, shall be taken to mean the *Master Municipal Construction Documents (MMCD) Platinum Edition*, Specifications, and Standard Detail Drawings, as amended by the *City of Vancouver Supplemental General Conditions*, *City of Vancouver Construction Specifications* and the *City of Vancouver Standard Detail Drawings*. The *City of Vancouver Supplemental General Conditions, Construction Specifications* and *Standard Detail Drawings* supersede those within the *MMCD* where noted. In all other areas, the *MMCD* General Conditions, Specifications and Drawings are applicable. As such, users of this Manual will also need to refer to the following separate manuals: *Master Municipal Construction Documents (MMCD) Platinum Edition*, City of Vancouver Standard Detail Drawings and City of Vancouver Supplemental General Conditions.

This manual has been coded and indexed to parallel the sections and titles of the *Master Municipal Construction Documents (MMCD) Platinum Edition*. It also includes additional index numbers (sections) not currently used in the *MMCD* documents (denoted with an S, such as 32 15 01S). These additional sections reflect specific *Work* required for working on the City of Vancouver's infrastructure systems.

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1.0 DEFINITIONS

In the *Contract Documents* the following capitalized and italicized words and definitions will apply. Where a definition refers to a paragraph in the *Contract Documents* the definition is contained in that paragraph and the defined term is indicated as capitalized, in quotations and in brackets. Capitalized terms used in this document but not defined herein shall have the meanings given to them in the MMCD General Conditions as supplemented by the *City of Vancouver Supplemental General Conditions*.

1.1	**Areaway**	Add 1.1.1	***"Areaway"*** means a below-grade structure adjacent and attached to a building that encroaches into a City *Street*.
1.2	**Block**	Add 1.2.1	***"Block"*** means an area definition of one *Street* or neighbourhood, between one or more *Streets*, regardless of the distance or number of properties accessing.
1.3	**City Arborist**	Add 1.3.1	***"City Arborist"*** means a person who represents the *City* as an arborist certified by the International Society of Arboriculture.
1.4	**City of Vancouver Supplemental General Conditions**	Add 1.4.1	***"City of Vancouver Supplemental General Conditions"*** means the MMCD General Conditions as supplemented by the City of Vancouver.
1.5	**Condition Survey**	Add 1.5.1	***"Condition Survey"*** means an evaluation of the existing conditions at the *Site*. The survey shall include photos showing existing conditions of all physical features which may be impacted by the *Work* and as outlined in *City of Vancouver Supplemental General Conditions* GC 4.3.10. The survey also includes an assessment of the *Work* to determine if surrounding physical features, properties, and infrastructure are at risk of damage caused by the *Work* and ways to avoid or minimize impacts.
1.6	**Cut**	Add 1.6.1	***"Cut"*** means an excavation made on *City* property for any purpose.
1.7	**Engineer of Record**	Add 1.7.1	***"Engineer of Record"*** means a Professional Engineer(s) registered in good standing with Engineers and Geoscientists BC acting as the design Engineer(s) of Record.
1.8	**Erosion and Sediment Control Plan**	Add 1.8.1	***"Erosion and Sediment Control Plan"*** means a plan outlining the measures to control erosion and sediment on and from the *Site* in accordance with applicable Bylaws and Best Management Practices.

1.9	**Haul Route**	Add 1.9.1	***"Haul Route"*** means the planned route construction vehicles and equipment take to haul materials to and from the *Site*. If the *Site* is not on an official truck route, the *Haul Route* shall be on the shortest route between the *Site* and the closest official truck route.
1. 10	**Maintenance Hole**	Add 1.10.1	***"Maintenance Hole"*** means an access point allowing a person to access an underground utility, commonly referred to as a "manhole". All references to "manholes" in MMCD shall be replaced with "maintenance hole".
1.11	**Road Authority**	Add 1.11.1	***"Road Authority"*** means the body having authority to control, care, and manage a *Street*.
1.12	**Temporary Water Servicing Work Plan**	Add 1.12.1	***"Temporary Water Servicing Work Plan"*** means a document which outlines temporary water servicing installation details. Work Plan to include locations and types of distribution lines and services, disinfection and testing procedures and tie-in locations to the City of Vancouver water system, etc.
1.13	**Truck Plan**	Add 1.13.1	***"Truck Plan"*** means a subset of a Traffic Management Plan that defines the *Haul Route* and all signage required for access to the *Site*.
1.14	**Work Hours**	Add 1.14.1	***"Work Hours"*** means the time when the *Contractor* is on *Site*.

END OF SECTION 01 10 00S

Section 01 14 00S Control of the Work within Municipal Right-of-Way

1.0	**GENERAL**	Add 1.0.1	*Section 01 14 00S* addresses general requirements and procedures to be followed by any *Contractor* working within a City *Street* or right-of-way. This section must be referenced to and interpreted simultaneously with all other sections pertinent to the *Work* described herein, the General Conditions and the *City of Vancouver Supplemental General Conditions*.
1.1	**Related Work**	Add 1.1.1	All Sections of the *MMCD Specifications* and the *City of Vancouver Supplemental General Conditions and City of Vancouver Construction Specifications*.
1.2	**References**	Add 1.2.1	*City of Vancouver Street and Traffic By-Law No. 2849*
		Add 1.2.2	*City of Vancouver Noise Control By-Law No. 6555*
		Add 1.2.3	*City of Vancouver Archaeology / Heritage Resource Protection Policy (E-009)*.
		Add 1.2.4	*Ministry of Transportation and Highways "Traffic Control Manual for Work on Roadways"*.
1.3	**City Engineer**	Add 1.3.1	The *City Engineer* may from time to time delegate to a representative the performance of, or the authority to perform, the duties, responsibilities, rights and obligations of the *City* in respect of which has been designated and appointed as its sole and exclusive agent.
		Add 1.3.2	In the absence of the *City Engineer*, any of the Engineer's assistants, whom the *City Engineer* may designate to supervise the *Work*, shall have (subject to the instructions of the *City Engineer*) full power to decide as to the manner of conducting and executing the *Work* in every particular aspect.
		Add 1.3.3	The *City Engineer* has the authority in an emergency to stop the progress of the *Work* whenever in the *City Engineer's* opinion such stoppage may be necessary to ensure the safety of life, or the *Work* or neighbouring property.
		Add 1.3.4	The *Contractor* shall furnish the *City Engineer* at all times with convenient means of access to all parts of the *Work*, and also with all required assistance, to facilitate thorough examination of the same, and inspection, culling or removal of doubtful or defective material or products and for any other purpose required in connection with the *Work*, or in the discharge of their respective duties.

		Add 1.3.5	The *Contractor* shall afford all facilities for the execution of any *Other Work* which may be undertaken by the *City* or by such parties as may be employed by them, so that such work may be properly and conveniently completed, and the *City Engineer* shall have full authority to make and enforce such regulations as the *City Engineer* may deem necessary for the conduct of the work.
		Add 1.3.6	On all questions relating to the acceptability of material, machinery or plant equipment, classifications of material or work, the proper execution, progress or sequence of the work, quantities and the interpretation of these Specifications or *Drawings*, the decision of the *City Engineer* shall be final and binding.
1.4	**Permits**	Add 1.4.1	No Work shall occur on *Street*, until a Street Use Permit and other applicable permits, as listed in *Section 01 41 00S Municipal Permits*, are obtained from the *City Engineer*, unless otherwise approved in writing by the *City Engineer*.
1.5	**Payment**	Add 1.5.1	Payment for all *Work* performed under this *Section* will be incidental to payment for *Work* described in other *Sections* unless shown otherwise in the *Schedule of Quantities and Prices*.
2.0	**PRODUCTS**		NOT USED
3.0	**EXECUTION**		
3.1	**General**	Add 3.1.1	The *Contractor* shall not deposit any material upon any right-of-way, specifically *Streets*, sidewalks and boulevards, without first obtaining the approval of the *Contractor Administrator*, in consultation with the *City Engineer,* as to the location, manner of placement, nature of the material to be deposited and length of placement of the material.
		Add 3.1.2	The *Contractor* shall maintain the *Work* in a tidy condition and free from the accumulation of waste, debris and waste products, other than that caused by the *Owner*, *Other Contractors* or their employees. At the completion of the *Work*, the *Contractor* shall remove all its rubbish from and about the *Site* and all its tools, scaffolding and surplus materials, and shall leave the *Site* "broom clean" or the equivalent, unless more exactly specified by the *Contract Administrator*. In the case of a *Dispute*, the *Owner* may remove the rubbish and charge the cost to the Contractor as the *Owner* shall determine to be just.
		Add 3.1.3	The *Contractor* shall also remove all false-work, forms, temporary structures, equipment, and site facilities immediately after completing work in any given *Block*. Materials, equipment and all other construction needs not being used directly (one *Block* in either direction) in the vicinity of current work program shall be removed offsite or

to a storage location approved by the *Contract Administrator*, in consultation with the *City Engineer*. If materials, equipment or other construction debris is left in a completed *Block* for a period exceeding 4 *Days*, the *City Engineer* may remove the materials, equipment or other construction debris at the *Contractor's* cost.

Add 3.1.4 The *Contractor* shall regulate their *Work* at all times to provide uninterrupted flow of all watercourses, sewers and drains encountered during the *Work* so that flooding of public or private lands cannot occur as the result of the *Contractor's* operations.

Add 3.1.5 The *Contractor* shall keep all portions of the *Work* well, properly and efficiently drained until completion, and the *Contractor* will be held responsible for all damage which may be caused or result from water backing up or flowing over, through, from or along any part of the *Work*, or which any of the *Contractor's* operations may cause to flow elsewhere.

Add 3.1.6 The *Contractor* must provide and properly maintain, in clean and sanitary condition, suitable and convenient privy or toilet accommodation for the *Contractor's* employees so that they shall not be a source of inconvenience, complaint or nuisance to the public or to others in the vicinity of the *Site*.

3.2 Public Convenience Paramount

Add 3.2.1 The *Contractor* shall maintain all typical services such as mail delivery, garbage pickup, meter reading etc. It is the *Contractor's* responsibility to make suitable arrangements within their construction planning and staging to ensure all services are reasonably maintained.

Add 3.2.2 The *Contractor* shall, at its own expense and risk, deliver to businesses and residents copies of letters advising these persons of intended construction activities. Letters are to be delivered to a minimum radius of one *Block* outside of the construction limits, and to any *Streets* affected by the *Contractor's* traffic control where there is only a single entry / exit access. Letters are to be submitted to the *City Engineer* for review a minimum of 5 *Days* prior to delivery. The *Contractor* shall deliver these letters no sooner than 10 *Days* and no later than 5 *Days* before the start of construction in the affected area.

3.3 Pre-Construction

Add 3.3.1

Prior to commencing any work, the *Contractor* shall:

.1 Complete a BC One Call, and contact all *Third-Party Utilities* to obtain the following:

.1 up-to-date information on the location of their underground mains and services within the *Site* area.

.2 all special procedures required when working near underground mains and services.

.3 instructions for emergency action to be taken in the event of damage to these mains and services.

.4 the contact name and phone number of a utility inspector, if required.

.2 Utilize the City of Vancouver VanMap to obtain record information.

.3 Prepare within a binder or other suitable format 'Locate' information and store onsite at all times (this must be available for review by the *Contract Administrator* or *City Engineer* for the duration of the project).

Add 3.3.2

Inform and consult the *City Engineer* before starting any construction activities in *City*-owned areas with non-traditional construction materials such as, but not limited to, bricks; pavers; granite curbs; public art; cobble stones and wood planks that are of special value to the *City*. Special construction procedures and restoration method may be required. Failure to do so may warrant immediate work stoppage with cost to restore damages bound by the *Contractor*. The *City Engineer* shall be the sole deciding authority on the authenticity of the materials involved.

3.4 Survey

Add 3.4.1

The *Contractor* is responsible for all staking and survey layout required for the completion of all *Work*, as per the *Contract Documents* or as directed by the *Contract Administrator*.

Contractor shall provide the *Contract Administrator* records of all layouts, by way of cut sheet or as otherwise specified by the *Contract Administrator*, a minimum of 48 hours prior to installing any element of the *Work*. Completed layout must also provide confirmation in regards to tie-ins to existing. All installation of elements without the requisite review by the *City Engineer* or their representative is at the *Contractor's* risk.

3.5 Excavations

Add 3.5.1

The *Contractor* shall notify all *Third-Party Utilities* and the *City Engineer* (City of Vancouver Utilities Management Branch) two weeks prior to excavation at or near the *Site* and shall provide *Site* access to a utility inspector as required by *Third-Party Utility* owners.

Add 3.5.2 Before commencing any excavation at the *Place of the Work* the *Contractor* shall:

.1 Expose and determine conclusively the location in the field of all underground utilities and structures indicated in the *Contract Documents* that can be reasonably determined as being at the *Place of the Work*.

.2 Consult with all utility corporations that provide electricity, communication, gas or other utility services in the area of the *Place of the Work*, to similarly expose and conclusively determine the location of all underground utilities for which they have records.

.3 Similarly expose and conclusively determine the location of any other utilities or underground structures that are reasonably apparent in an inspection of the *Place of the Work*.

It shall be the responsibility of the *Contractor* to locate all existing mains and services, including but not limited to: water, gas, electricity, telephone, sewers, drains, catchbasin leads, and culverts to preserve and protect them from damage during the work, and to arrange for their relocation if required.

Add 3.5.3 Trench stability and safety procedures to meet or exceed minimum requirements of accident prevention regulations, current issue, of WorkSafeBC. The *Contractor* is required to provide adequate support to the sides of trenches or other excavations to ensure all pipe installation work is not impacted by adverse conditions. Sides of trenches or other excavations to be adequately supported up until the completion of backfilling. Further, all trenches equal to and over 1.2m in depth shall utilize shoring; certification of trenches, including by a qualified professional, will not be accepted on *City* projects.

Add 3.5.4 The *Contractor* shall provide adequate barricades and lighting around and adjacent to any open excavation or potentially dangerous location or other locations designated by the *City Engineer*.

Add 3.5.5 Without derogating from the *Contractor's* obligation to take all required measures to protect property, and to prevent damage to existing utilities, the *Contractor* shall at a minimum take the following precautions:

.1 The *Contractor* shall excavate the last 300mm over any utility by hand.

.2 The *Contractor* shall excavate around and under all existing utility ducts and pipes with special care and shall support and maintain them in service throughout construction. Where it is necessary to cut, move or

reconnect any existing utilities, the *Contractor* shall make appropriate arrangements with the respective utility owner.

.3 When crossing over an existing utility which is located within 300mm below the bottom of the trench, the *Contractor* shall hand excavate and expose the existing utility. The existing utility shall be examined in the presence of the *City Engineer* and the utility owner. Any damage to the existing utility shall be repaired to the satisfaction of the *City Engineer* and the utility owner at the *Contractor's* expense.

.4 When crossing under an existing utility, the *Contractor* shall hand excavate around the existing utility. If necessary and no details are provided on the *Drawings*, the *Contractor* shall be responsible to notify the utility owner for approval of the *Contractor's* proposed construction details for supporting the utility and advise the *City Engineer* of such approved details.

The utility owner's inspector may be required to comment on any construction practices or requirements before further construction proceeds.

3.6 Surface Repairs

Add 3.6.1 All areas disturbed shall be maintained with competent temporary repair to the satisfaction of the *City Engineer* until such areas are permanently repaired. In the event the *Contractor* fails or neglects to carry out such tasks for whatever reasons, the *City* may do the necessary repairs at the expense of the *Contractor*.

Add 3.6.2 The *Contractor* shall schedule *Work* such that the permanent repair of any *Block* will proceed in a timely manner and permanent restoration will not be delayed due to *Work* proceeding in another area. If, in the opinion of the *City Engineer*, the *Contractor* is proceeding with *Work* on another *Block* without making every effort to finish *Work* on the previous *Block* such that permanent restoration may occur, the *City Engineer* may stop *Work* in the new area subject to the finished restoration being completed. No schedule extensions will be considered for failure to complete the restoration in a timely manner.

Add 3.6.3 Refer to *Section 32 15 01S Surface Restoration* for surface repair specifications.

3.7 Utility Service Interruptions

Add 3.7.1 Maintain existing sewage and storm flows during construction.

Add 3.7.2 The *Contractor* shall avoid interruptions to services where possible and schedule *Work* to minimize interruptions to existing services, when interruption is unavoidable. The use of "cut and replace" methodology will only be permitted with prior written approval from the *City Engineer*.

Add 3.7.3 Under no circumstances shall any storm, sanitary or water service be disturbed or shut-off in any way, unless prior acceptance is granted in writing from the *City Engineer*. Alternative sanitary and water facilities (to be approved by the *City Engineer*) shall be made available to local residents and businesses if their private facilities are inoperable due to any service interruption.

Add 3.7.4 Do not interrupt water service for more than 3 hours and confine this period to between 9:00am and 4:00pm unless otherwise approved by the *City Engineer*. Provide temporary servicing to those customers who cannot accommodate a service interruption during this period as determined by the *City Engineer*, or schedule *Work* to minimize disruption. Customers who cannot generally accommodate a service interruption during this time typically include restaurants, hair salons, hospitals, educational institutions, daycares, process industries, residences with inhabitants who undergo at home dialysis treatment and photo labs.

Add 3.7.5 Unless approved otherwise by the *City Engineer*, no storm or sanitary services to local residents and businesses shall be shut off more than 24 hours.

Add 3.7.6 Submit schedule and details of expected service interruptions to the *Contract Administrator* for approval and adhere to approved schedule. Schedule and details to include:

.1 Methods for temporary servicing.
.2 Timing and duration of any temporary servicing.
.3 Tie-in sequence, method and timing.

Add 3.7.7 Following approval of any service interruption by the *City Engineer*, notify affected residences and businesses, in writing, a minimum of 10 *Days* prior to construction, with a summary of the scope and timing of *Work*. Notices and corresponding distribution area to be approved by the *City Engineer* prior to distribution. Provide a second notice a minimum of 48 hours in advance of each, and any interruption in service (not including sewer service interruptions).

Add 3.7.8 Notify the *City Engineer* of any planned or accidental interruption of water supply to hydrants. Provide records of the hydrant number and location and duration of disruption. Label the hydrant “Out of Service” or “Not in Use”. New hydrants not currently in service are to be bagged until operational.

3.8 Sub-Surface utilities

Add 3.8.1 Measurements and locations of utilities and structures shown on the *Drawings* or VanMap are generally compiled from the most reliable data available but are not

guaranteed to be accurate or complete. All such measurements and locations and any plans or descriptions, verbal or otherwise, are intended only as an aid to the *Contractor*. *Contractor* to take extreme care when working near or around existing utilities or services. Any utility or service disturbed during construction to be rectified to the satisfaction of the *City Engineer* at the *Contractor's* cost.

Add 3.8.2 If an unknown / unidentified connection is encountered during excavation, the *Contractor* shall notify the *City Engineer*, and confirm if the connection is active or not. Services shall not be capped / abandoned without confirmation by the *City Engineer*.

Add 3.8.3 The *Contractor* will be responsible for recording the location of existing, re-routed and / or abandoned underground utilities and supplying this information to the *City Engineer*.

3.9 Use of Non-City Owned Property

Add 3.9.1 The Contractor shall confine operations to the *City Engineer's* approved and specified *Site*. Rights to access any private land or property outside the *Site* boundaries which the *Contractor* requires during construction shall be acquired by the *Contractor* at the *Contractor's* own expense, and the *Contractor* shall make its own arrangements for the use of such land or property and for the compensation of its owners.

3.10 Survey Monuments

Add 3.10.1 If a *Contractor* destroys or disturbs a survey control monument, the *Contractor* shall pay to the *City* the current fee set out in the replacement cost schedule. These fees are outlined in the memo titled *Survey Control Monuments – Recovery Fees* and may be requested by phoning 3-1-1.

Add 3.10.2 The importance of having these monuments intact cannot be over-emphasized. Every effort must be made to avoid their disturbance. If any *Work* is to occur at or near any integrated survey monument, the *Contractor* shall inform the *City Engineer* as soon as possible. This includes but is not limited to, any concrete repairs or replacements, utility construction, or installation of new wheelchair ramps.

Add 3.10.3 These monuments are typically brass caps inset below the sidewalk grade within a metal casing stamped with "Survey Monument" on the lid. They can also be found in either the curb or gutter mounted flush with the concrete. All monument locations and associated classifications are available on VanMap by checking the "Survey Control Monuments - Active" item under the "Property and Cadastral" tab.

Add 3.10.4 A *City* crew will be dispatched to reference the location and elevation of the marker when they are informed of work occurring near a monument. This information will be used to later confirm any disturbance or destruction of the monument after the work is complete.

Add 3.10.5 There may also be other survey markers found at intersection corners such as lead plugs and iron pins. The *City Engineer* should be informed of the location of any new work, so a crew can inspect the area for any existing legal survey marks and reference them as required.

3.11 Archeological Items

Add 3.11.1 Upon discovery at the *Site* of any heritage objects (as defined in the *Heritage Conservation Act (British Columbia)*), the *Contractor* shall:

.1 immediately notify the *City Engineer*.

.2 take all steps not to disturb the item and, if necessary, stop the *Work* insofar as performing such work would endanger the object or prevent or impede its excavation.

.3 take all necessary steps to preserve the item in the same position and condition in which it was found.

.4 comply with all applicable laws and all requirements of governmental authorities with respect to such discovery including pursuant to the *Heritage Conservation Act*.

.5 comply with the *City of Vancouver Archaeology / Heritage Resource Protection Policies and Procedures (E-009)*.

.6 comply with the *General City of Vancouver Guidelines for Archeological Chance Find Management*.

Add 3.11.2 All heritage resources, including but not limited to: articles of archaeological, cultural heritage, and historical value, as well as relics of geological interest including fossils, discovered on or in the area of the *Place of the Work* will be the absolute property of the *City* until which time as they are transferred to authorized repositories as stipulated in any provincial, First Nations, or federal permits for the *Work*. Take reasonable precautions to prevent workers or persons from removing or damaging any such discovery. The *City*'s representative shall issue special instructions for removal and disposal.

END OF SECTION 01 14 00S

Section 01 32 16.19S Construction Schedule

1.0	**GENERAL**	Add 1.0.1	*Section 01 32 16.19S* addresses scheduling procedures to be followed by any *Contractor* retained directly by the *City*, or *Other Contractors* working within a City *Street* or right-of-way, who are requested by the *Contract Administrator* to provide a *Construction Schedule*. This section must be referenced to and interpreted simultaneously with all other sections pertinent to the *Work* described herein.
1.1	**Related Work**	Add 1.1.1	*Section 01 14 00S Control of Work within Municipal Right-of-Way*
		Add 1.1.2	General Conditions and *City of Vancouver Supplemental General Conditions*
1.2	**Reviews**	Add 1.2.1	For all *Work*, completed by a *Contractor* directly retained by the *City*, schedule submissions and reviews shall be as per *2* and *3 of this Section* and any other applicable requirements of the *Contract*.
		Add 1.2.2	For all *Other Work* on the *City* right-of-way, a *Construction Schedule* should be readily available for review by the *Contract Administrator*. If the schedule is not available when requested, or the *Contract Administrator* is of the opinion that the schedule is not suitable for work within the right-of-way, the *Contract Administrator* may suspend such work until a schedule is provided to their satisfaction.
		Add 1.2.3	A *Construction Schedule* and subsequent updates may be a requirement for any permit issued by the *City*.
1.3	**Critical Path Item**	Add 1.3.1	A critical path item is defined as a scope of work which must be completed prior to other work proceeding and without such item being completed leaves limited, or no other tasks being available for construction.
1.4	**Payment**	Add 1.4.1	Payment for all *Work* performed under this *Section* will be incidental to payment for *Work* described in other *Sections* unless shown otherwise in the *Schedule of Quantities and Prices*.
2.0	**PRODUCTS**		
2.1	**Format**	Add 2.1.1	Schedules shall be submitted in digital form through use of PDF or other accepted method and shall be printed on 11x17. Printed forms shall be legible.
		Add 2.1.2	Schedule shall be presented in Gantt form or excel spreadsheet, or another format as directed and accepted by the *Contract Administrator*.

3.0 EXECUTION

3.1 Scheduling

Add 3.1.1 As required by any contract or permit with the *City*, or upon direction from the *Contract Administrator*, the *Contractor* shall have furnished, or shall immediately furnish, the *Contract Administrator* with a complete *Construction Schedule* consistent with the completion dates expected, showing all dates on which each material component of the *Contractor's* proposed program of operations will be performed. The *Construction Schedule* must include the various subdivisions of the *Work* and the dates of the commencing and finishing of each.

Add 3.1.2 Once submitted, the *Contractor* shall immediately advise the *Contract Administrator* of any deviations from, or proposed changes to, the *Construction Schedule*. If, in the opinion of the *Contract Administrator*, the *Construction Schedule* as submitted is inadequate to ensure the completion of the *Work* within the time limited therefore, the *Contract Administrator*, shall have the right to require the *Contractor* to submit a new *Construction Schedule* providing for proper and timely completion of the *Work*.

Add 3.1.3 The *Contractor* shall prepare, and where required submit, the following schedules:

- *Baseline Construction Schedule*.
- *Adjusted Baseline Schedules*.
- Submittal Schedule for *Shop Drawings* and Product Data.
- Submittal Schedule for Samples.
- Submittal Schedule for *Owner*-supplied products.
- Product Delivery Schedule.

Add 3.1.4 Schedules must have critical path items identified complete with suitable periods for completion of the physical work, reviews by the *Contract Administrator* and coordination of *Third-Party Utility* or *Other Contractor* work. Where, in the opinion of the *Contract Administrator*, the *Contractor* has not allowed *Reasonable Time* for reviews and completion of the *Work*, the schedule may be rejected and requested to be revised.

Add 3.1.5 Schedules must have hold points and material tests identified.

Add 3.1.6 Include complete sequence of construction activities. Include dates for commencement and completion of each major element of construction including, but not limited to, the following:

.1 Commencement Date
.2 Traffic Control Implementation
.3 Environmental Protection Measures Implementation

.4 Mobilization
.5 Clearing
.6 Removals (should be broken up by area, e.g. between *Blocks*)
.7 Excavation (broken up by area)
.8 Watermains (broken up by *Blocks*, e.g. Tee to Tee)
.9 Storm and Sanitary Sewers (broken up by *Maintenance Hole* to *Maintenance Hole*, services by *Block*)
.10 Streetlighting (broken up by area)
.11 Signals (broken up by intersection/location)
.12 Signage supply and installation
.13 Tie-ins to existing by *Contractor*
.14 Tie-ins to existing by City forces
.15 Tie-ins to existing by others
.16 Work by City forces
.17 Work by others
.18 *Third-Party Utility* adjustments
.19 Curb and sidewalk preparation
.20 Curb and sidewalk pouring
.21 Road gravel preparation
.22 Paving
.23 Line painting
.24 Landscape restoration
.25 *Substantial Performance*
.26 Deficiency rectification
.27 Demobilization
.28 *Total Performance*

Add 3.1.7 Show projected percentage of completion of each item as of first day of month. Indicate progress of each activity to date of submission schedule.

Add 3.1.8 Show changes occurring since previous submission of schedule:

- Major changes in scope.
- Activities modified since previous submission.
- Revised projections of progress and completion.
- Other identifiable changes.

Add 3.1.9 Provide a narrative report to define:

- Problem areas, anticipated delays, and impact on schedule.
- Corrective action recommended and its effect.

Add 3.1.10 Include schedule for submitting *Shop Drawings*, product data and samples if required. Indicate dates for submitting, review time, resubmission time, float time, and last date for meeting fabrication schedule. Include dates when *Owner*-supplied products will be required. Include dates when reviewed submittals will be required from the *City*.

Add 3.1.11 Distribute copies of revised progress schedule to:

- *Contract Administrator*
- Job site office.
- *Subcontractors*.
- Other concerned parties as directed by the *Contract Administrator*.

Add 3.1.12 The *Contract Administrator* may instruct the *Contractor* to adjust work sequencing and to perform work 'out of sequence' as to operation or location, with no compensation owing to the *Contractor*.

END OF SECTION 01 32 16.19S

Section 01 33 00S Submittal Procedures

1.0	**GENERAL**	Add 1.0.1	*Section 01 33 00S* addresses submittal procedures, *Shop Drawings*, product data sheets and samples, which require review by the *City Engineer*. This section must be referenced to and interpreted simultaneously with all other sections pertinent to the *Work* described herein.
		Add 1.0.2	*Shop Drawings*, product data sheets and samples are required for any product.
1.1	**Related Work**	Add 1.1.1	All Sections of the *MMCD Specifications*, General Conditions, the *City of Vancouver Supplemental General Conditions* and the *City of Vancouver Construction Specifications*.
1.2	**Preparation of Shop Drawings**	Add 1.2.1	Refer to *General Condition 5.1 Preparation of Shop Drawings*
1.3	**Submissions**	Add 1.3.1	Refer to *General Condition 5.2 Submission of Shop Drawings*.
1.4	**Format**	Add 1.4.1	Identify details by reference to sheet and detail numbers shown on *Drawings*.
		Add 1.4.2	The maximum sheet size is 1,000mm x 707mm.
		Add 1.4.3	Accompany submissions with transmittal letter, in duplicate, containing: .1 Data. .2 Project title and number. .3 *Contractor's* name and address. .4 Number of each *Shop Drawing*, product data and sample submitted. .5 Other pertinent data.
		Add 1.4.4	Submissions shall include: .1 Data and revision dates. .2 Project title and number. .3 Name of: .1 *Contractor*. .2 *Subcontractor*. .3 Supplier. .4 Manufacturer. .5 Separate detailer, when pertinent. .4 Identification of product or material. .5 Relation to adjacent structure or material. .6 Field dimensions, clearly identified as such. .7 Specification Section number. .8 Applicable standards, such as CSA or CGSB numbers. .9 *Contractor's* stamp, initialed or signed, certifying

review of submission, verification of field measurements and compliance with the *Contract Documents*.

1.5 Review by City Add 1.5.1 Refer to *General Condition 5.3 Review by Contract Administrator.*

1.6 Purpose of the City Review Add 1.6.1 The *Contractor* is responsible for any errors or omissions in the *Shop Drawings* and the *City*'s review shall not relieve the *Contractor* of that responsibility. The *Contract Administrator* and *City Engineer's* review of the *Shop Drawings* will normally be to see if they are in general conformance with City specifications and the level of review is completely at the discretion of the *City*.

Add 1.6.2 The *City's* authority to review the *Shop Drawings*, product data and samples shall be for the benefit of the *City* and such authority shall not give rise to any duty or responsibility on the *City* to the *Contractor*, *Subcontractors*, or their agents, employees or other persons performing any of the *Work*.

Add 1.6.3 The *City's* review shall not relieve the *Contractor* of the responsibility for errors or omissions in the *Shop Drawings* and products incorporated into the *Work*, or of the responsibility for meeting all applicable specifications and bylaws, unless a deviation has been specifically approved in writing by the *City Engineer*.

1.7 Payment Add 1.7.1 Payment for all *Work* performed under this *Section* will be incidental to payment for *Work* described in other *Sections* unless shown otherwise in the *Schedule of Quantities and Prices*.

2.0 PRODUCTS NOT USED

3.0 EXECUTION NOT USED

END OF SECTION 01 33 00S

Section 01 33 01 Project Record Documents

1.3	**Submission**	Add 1.3.6	Submit one complete set of *Record Drawings* of the *Work*, as constructed, within 15 *Days* of *Total Performance*.
		Add 1.3.7	Revise content of *Record Drawings* as required by the *Contract Administrator* prior to issuance of *Certificate of Total Performance*.
1.6	**Record Documents and Samples**	Append to 1.6.1.5	and other modifications to the *Contract*.
		Add 1.6.6	All *Record Drawings* must be referenced to the UTM coordinate system with a minimum of two reference points.
1.7	**Recording Actual Site Conditions**	Append to 1.7.2.1	For sewer installations, the locations and details (such as grade of sewer; trench conditions; type and class of pipe material used; all locations for capped pre-served service connections, wyes and risers, relative to nearest downstream *Maintenance Hole*; and all inverts at *Maintenance Holes* and catchbasins) of all pipes, connections, and other sewer appurtenances shall be recorded, as specified by the *Contract Administrator*, by the *Contractor*'s surveyor as construction proceeds. For water main installations, reference all horizontal locations of underground utilities and appurtenances from property lines and permanent surface improvements. For water main installations, reference all vertical locations of underground utilities and appurtenances from the *City*'s geodetic datum.
		Add 1.7.2.6	The type of soil conditions encountered during trench excavation at least once per *Block* and the location of any changes in soil conditions.
		Add 1.7.2.7	Locations of *Maintenance Holes* and catchbasins (using UTM coordinates) including all connecting pipe alignments.

END OF SECTION 01 33 01

Section 01 35 29.06S Health and Safety Requirements

1.0	**GENERAL**	Add 1.0.1	*Section 01 35 29.06S* addresses health and safety requirements, in addition to the General Conditions and *City of Vancouver Supplemental General Conditions*, to be followed by any *Contractor* working within a City *Street* or right-of-way. This section must be referenced to and interpreted simultaneously with all other sections pertinent to the *Work* described herein.
1.1	**Related Work**	Add 1.1.1	*Section 01 14 00S Control of Work within Municipal Right-of-Way.*
1.2	**References**	Add 1.2.1	Workers Compensation Act
		Add 1.2.2	*Occupational Health and Safety Regulation (OHSR)*
		Add 1.2.3	*Hazardous Products Act*
		Add 1.2.4	*Hazardous Products Regulations*
1.3	**Site Specific HSE Plan**	Add 1.3.1	The *Contractor* shall establish, implement, and provide for the review and approval by the *Contract Administrator*, prior to the start of construction and allowing review time, a detailed Site-Specific Health, Safety & Environmental Management Plan (“Safety Plan”).
		Add 1.3.2	The Safety Plan shall be prepared in accordance with all applicable WorkSafeBC requirements and addresses, without limitation, *Site* layout, hazard identification, risk management, change management, objectives and targets, incident reporting, training requirements, record keeping, project specific safe work procedures and includes a job hazard assessment template and a safety/toolbox meeting schedule.
		Add 1.3.3	The Safety Plan shall: .1 meet all applicable requirements of this document. .2 meet minimum industry-standard requirements. .3 meet the requirements of all applicable laws.
		Add 1.3.4	The *Contractor* shall maintain and comply with the Safety Plan in all material respects during execution of the *Work*. The *Contract Administrator* may audit the Safety Plan and the *Contractor’s* adherence to the Safety Plan at any time.
		Add 1.3.5	Prior to any person accessing the *Site*, the *Contractor* shall provide health and safety orientations and information to such person in accordance with its Safety Plan.

		Add 1.3.6	Where the accessing person is from the general public, the *Contractor* shall be responsible for safely escorting them through the *Site*. Further, and with special attention paid to non-working periods, the *Contractor* shall, at its own expense and risk provide full, proper and safe access to, from and past buildings and properties, both for vehicles, cyclists, and pedestrians, and for this purpose construct and maintain, in good order and serviceable condition, suitable and convenient platforms, approaches, structures, bridges, crossings or similar work.
		Add 1.3.7	The *Contractor* shall comply, and the *Contractor* shall enforce compliance by all its agents, employees, *Subcontractors* and suppliers, with any and all fire regulations which have been or may be established from time to time by the *City Engineer* and anybody having jurisdiction over such matters. The *Contractor* shall at all times ensure that the fire hydrants are not obstructed. The *Contractor* shall maintain fire exits from existing buildings as required by the applicable law and Vancouver fire and rescue authorities.
1.4	**Work around Railways**	Add 1.4.1	Federal legislation governs railway companies operations within railway company facilities including the *Railway Safety Act (Canada)* and the *Canada Labour Code (Canada)*, and the *Contractor* acting as "Prime Contractor" must ensure that it manages health and safety activities during the *Work* in conformity with the legislative safety requirements governing railway companies operations.
		Add 1.4.2	The *Contractor* shall ensure that all persons for whom it is responsible shall attend any railway safety orientations required by railway companies, as a condition to the persons' access to the *Site*.
1.5	**Third-Party Utilities**	Add 1.5.1	The *Contractor* will be responsible for complying with the safe-work requirements of all *Third-Party Utilities*, for construction in proximity to any overhead or underground *Third-Party Utility* infrastructure.
1.6	**Payment**	Add 1.6.1	Payment for all *Work* performed under this *Section* will be incidental to payment for *Work* described in other *Sections* unless shown otherwise in the *Schedule of Quantities and Prices*.
2.0	**PRODUCTS**		NOT USED
3.0	**EXECUTION**		NOT USED

END OF SECTION 01 35 29.06S

Section 01 41 00S Municipal Permits

1.0	**GENERAL**	Add 1.0.1	*Section 01 41 00S* provides guidance on permits issued by the *City* which are required for construction within City *Streets* or Right-Of-Way. This section must be referenced to and interpreted simultaneously with all other sections pertinent to the *Work* described herein.
		Add 1.0.2	The *Contractor* is responsible for all coordination, timely application and receipt of permits.
		Add 1.0.3	Fees are generally required for all permits. Deposits may also be required.
		Add 1.0.4	All work shall be carried out and completed within the stated terms and conditions of any applicable permit.
		Add 1.0.5	The summary list of generally applicable permits is provided for convenient reference. Every effort is taken to ensure the list is up to date; however, the *City* does not guarantee that the list is complete or accurate. The *Contractor* must contact the *City* to confirm and receive the required permits prior to commencing work.
		Add 1.0.6	Additional permits may be required from other government organizations, other authorities within the *City* and/or *Third-Party Utilities* not owned by the *City*.
1.1	**Related Work**	Add 1.1.1	All Sections of the *MMCD Specifications* and the *City of Vancouver's Supplemental Specifications*.
1.2	**References**	Add 1.2.1	*Street and Traffic By-Law No. 2849*
		Add 1.2.2	*Noise Control By-Law No. 6555*
		Add 1.2.3	*Street Tree By-Law No. 5985*
1.3	**Street Use Permit**	Add 1.3.1	Required for: Any construction work on City *Street* or right-of-way.
		Add 1.3.2	Issuer: Engineering Development and Major Projects Branch.
		Add 1.3.3	Estimated Lead Time: Same *Day*.
		Add 1.3.4	Note: Street Occupancy and Temporary Special Zone Permits may also be required.
1.4	**Street Occupancy Permit**	Add 1.4.1	Required for: Structures temporarily stored on *City* property, including hoarding, fencing, cranes, bins and other similar items.
		Add 1.4.2	Issuer: Engineering Development and Major Projects Branch.

		Add 1.4.3	Estimated Lead Time: Same *Day*.
		Add 1.4.4	Note: A Temporary Special Zone Permit may also be required.
1.5	**Temporary Special Zone Permit**	Add 1.5.1	Required for: Reserving parking spaces and parking meters and other changes to curbside requirements for construction, moving, deliveries, service work or other similar activities.
		Add 1.5.2	Issuer: Engineering Development and Major Projects Branch and Engineering Traffic and Data Management Branch (Reviewer).
		Add 1.5.3	Estimated Lead Time: 7 *Days*.
		Add 1.5.4	Note: These permits are not issued for crew parking purposes.
1.6	**Temporary No Stopping Permit**	Add 1.6.1	Required for: Similar to Temporary Special Zone, but for *Third-Party Utility* work
		Add 1.6.2	Issuer: Engineering Utilities Management Branch.
		Add 1.6.3	Estimated Lead Time: 4 *Days*.
1.7	**Traffic Management Plan (TMP) (Review and Approval)**	Add 1.7.1	Required for: Any work in travel lanes on arterials, any sidewalk closure or lane closure request on a local street bikeway.
		Add 1.7.2	Issuer: Engineering Traffic and Data Management Branch.
		Add 1.7.3	Estimated Lead Time: 5 *Days* min (for typical sized project).
		Add 1.7.4	Note: Day and time restrictions are typically imposed, to coordinate with other competing street use (other construction projects, special events and filming activities) and to maintain overall transportation network capacity.
1.8	**Granville Mall Permit (Commercial Parking)**	Add 1.8.1	Required for: Street use on Granville Street between Hastings Street and Smithe Street.
		Add 1.8.2	Issuer: Engineering Traffic and Data Management Branch.
		Add 1.8.3	Estimated Lead Time: 10 *Days*.
		Add 1.8.4	Note: Street use requests on Granville mall are typically sent to Coast Mountain Bus Company for further comment after the Traffic Management Plan has been reviewed by the *City*, who will likely impose time restrictions due to transit impacts.

1.9	**Street Utilities Permit**	Add 1.9.1	Required for: *Third-Party Utility* work on City *Streets*.
		Add 1.9.2	Issuer: Engineering Services Utilities Management Branch.
		Add 1.9.3	Estimated Lead Time: 10 *Days*.
		Add 1.9.4	Note: This permit is issued for work under the *Street Utilities Bylaw*.
1.10	**Test Hole Permit**	Add 1.10.1	Required for: Drilling test holes on City *Streets* for soil sampling or ground monitoring.
		Add 1.10.2	Issuer: Engineering Services Utilities Management Branch.
		Add 1.10.3	Estimated Lead Time: 10 *Days*.
1.11	**Fire Hydrant Use Permit**	Add 1.11.1	Required for: Use of up to five specific fire hydrants in a four-month period.
		Add 1.11.2	Issuer: Waterworks Design Branch.
		Add 1.11.3	Estimated Lead Time: Same *Day*.
		Add 1.11.4	Note: Water Usage Fees Apply. Tested Backflow Preventer Required.
1.12	**Water Exemption Permit**	Add 1.12.1	Required for: Watering landscape during summer watering restrictions.
		Add 1.12.2	Issuer: Waterworks Design Branch.
		Add 1.12.3	Estimated Lead Time: Same *Day*.
		Add 1.12.4	Note: Applies only to Grass/Lawns.
1.13	**Wastewater Discharge Permit**	Add 1.13.1	Required for: Discharging contaminated water to sanitary sewer during construction.
		Add 1.13.2	Issuer: Sewers and Drainage Design Branch.
		Add 1.13.3	Estimated Lead Time: 3 Months.
		Add 1.13.4	Note: Site profile and plan and proof of registry is required.
1.14	**Oversized Truck Permit**	Add 1.14.1	Required for: Driving oversized trucks in the *City*.
		Add 1.14.2	Issuer: Engineering Development and Major Projects Branch.
		Add 1.14.3	Estimated Lead Time: 24 hours.
		Add 1.14.4	Note: Bond of indemnity or a copy of an insurance policy may be required.

1.15	**Anchor Rod Permit**	Add 1.15.1	Required for: Excavation of a basement, underground parkade, or other large area next to a *Street* or lane which requires the installation of anchor rods which temporarily encroach onto City *Street* to prevent collapse of the excavation.
		Add 1.15.2	Issuer: Engineering Development and Major Projects Branch.
		Add 1.15.3	Estimated Lead Time: 10 – 15 *Days*.
		Add 1.15.4	Note: Detailed shoring plan required; plan must be signed and sealed by a Professional Engineer.
1.16	**Tree Removal Permit**	Add 1.16.1	Required for: Removal of private property trees that: • Could cause serious damage to property. • Located within building envelope. • Dead, dying, diseased or presents a hazard.
		Add 1.16.2	Issuer: Development and Building Services.
		Add 1.16.3	Note: See *Protection of Trees Bylaw*.
1.17	**Noise Bylaw Exception Permit**	Add 1.17.1	Required for: Construction during hours outside of the noise bylaw requirements.
		Add 1.17.2	Issuer: Noise Exception Group.
		Add 1.17.3	Estimated Lead Time: 5 *Days*.
		Add 1.17.4	Note: Permit fee is based on how many *Days* before a proposed activity applies.
1.18	**Electrical Permit**	Add 1.18.1	Required for: Construction on or modifications to City electrical assets.
		Add 1.18.2	Issuer: Development Services.
		Add 1.18.3	Estimated Lead Time: 14 *Days*.
2.0	**PRODUCTS**		NOT USED
3.0	**EXECUTION**		NOT USED

END OF SECTION 01 41 00S

Section 01 42 00 Reference Specifications – Site and Infrastructure

1.0 GENERAL

1.2 Referenced Specifications

Add 1.2.2.1	*Asphalt Institute, Paving Manual Series 22*
Add 1.2.5.46	*ANSI / AWWA C209, Cold-Applied Tape Coatings for Steel Water Pipe, Special Sections, Connections and Fittings*
Add 1.2.5.47	*ANSI / AWWA C214, Tape Coatings for Steel Water Pipe*
Add 1.2.5.48	*ANSI / AWWA C217, Microcrystalline Wax and Petrolatum Tape Coating Systems for Steel Water Pipe and Fittings*
Add 1.2.5.49	*ANSI / AWWA C700, Cold-Water Meters- Displacement Type Bronze Main Case*
Add 1.2.5.50	*ANSI / AWWA C701, Cold-Water Meters-Turbine Type*
Add 1.2.5.51	*ANSI / AWWA C702, Cold-Water Meters-Compound Type*
Add 1.2.5.52	*ANSI / AWWA C703, Cold Water Meters-Fire-Service Type*
Add 1.2.5.53	*ANSI / AWWA C707, Encoder-Type Remote-Registration Systems for Cold-Water Meters*
Add 1.2.5.54	*ANSI / AWWA C909, Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe*
Add 1.2.5.55	*ANSI / AWWA M6, Water Meters-Selection, Installation, Testing and Maintenance*
Add 1.2.5.56	*ANSI / AWWA M22, Sizing Water Service Lines and Meters*
Add 1.2.6.20	*ASTM A167, Standard Specification For Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip*
Add 1.2.8.25	*ASTM C33.1, Standard Specification for Concrete Aggregates*
Add 1.2.8.26	*ASTM C67, Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile*
Add 1.2.8.27	*ASTM C140, Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units*
Add 1.2.8.28	*ASTM C142, Standard Test Method for Clay Lumps and Friable Particles in Aggregates*
Add 1.2.8.29	*ASTM C144, Standard Specification for Aggregate for Masonry Mortar*
Add 1.2.8.30	*ASTM C418, Standard Test Method for Abrasion Resistance of Concrete by Sandblasting*
Add 1.2.8.31	*ASTM C425, Standard Specification for Compression Joints for Vitrified Clay Pipe and Fittings*

Add 1.2.8.32 *ASTM C535, Standard Test Method for Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in Los Angeles Machine*

Add 1.2.8.33 *ASTM C700, Standard Specification for Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated*

Add 1.2.8.34 *ASTM C936, Standard Specification for Solid Concrete Interlocking Paving Units*

Add 1.2.8.35 *ASTM C979, Pigments for Integrally Coloured Concrete*

Add 1.2.9.46 *ASTM D1785, Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Schedules 40, 80, and 120*

Add 1.2.9.47 *ASTM D2041, Standard Test Method for Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures*

Add 1.2.9.48 *ASTM D2216, Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock*

Add 1.2.9.49 *ASTM D2564, Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems*

Add 1.2.9.50 *ASTM D3786, Mullen Burst*

Add 1.2.9.51 *ASTM D4353, Sampling of Geotextiles for Testing*

Add 1.2.9.52 *ASTM D4355, Ultraviolet Stability*

Add 1.2.9.53 *ASTM D4491, Permittivity*

Add 1.2.9.54 *ASTM D4533, Trapezoidal Tear*

Add 1.2.9.55 *ASTM D4632, Grab tensile Strength*

Add 1.2.9.56 *ASTM D4751, Apparent Opening Size*

Add 1.2.9.57 *ASTM D4791, Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate*

Add 1.2.9.58 *ASTM D4833, Puncture Resistance*

Add 1.2.9.59 *ASTM D4873, Guide for Identification, Storage, and handling of Geosynthetics*

Add 1.2.9.60 *ASTM D5821, Standard Testing Method for Determining the Percentage of Fractured Particles in Coarse Aggregate*

Add 1.2.9.61 *ASTM D6241, Standard Test Method for Static Puncture Strength of Geotextiles and Geotextile- Related Products Using a 50-mm Probe*

Add 1.2.10 *ASTM E2177, Standard Test Method for Measuring the Coefficient of Retroreflected Luminance (R_L) of Pavement Markings in Standard Condition of Wetness*

Add 1.2.15.15	*CAN / CSA-A179, Mortar and Grout for Unit masonry*
Add 1.2.15.16	*CAN / CSA-B602, Mechanical Couplings for Drain, Waste, and Vent Pipe and Sewer Pipe*
Append to 1.2.18.22	*CSA-C22.2 No. 248.4, Low Voltage Fuses- Part 4: Class CC Fuses*
Add 1.2.23.3	*Traffic Control Manual for Work on Roadways*
Add 1.2.25.1	*AASHTO M36, Standard Specification for Corrugated Steel Pipe, Metallic-Coated, for Sewers and Drains*
Add 1.2.25.2	*AASHTO M247, Standard Specification for Glass Beads Used in Pavement Markings*
Add 1.2.25.3	*AASHTO M288, Geotextile Specifications for Highway Applications*
Add 1.2.25.4	*AASHTO M323, Standard Specification for Superpave Volumetric Mix Design*
Add 1.2.25.5	*AASHTO R30, Standard Practice for Mixture Conditioning of Hot Mix Asphalt*
Add 1.2.25.6	*AASHTO R35, Standard Practice for Superpave Volumetric Design for Asphalt Mixtures*
Add 1.2.25.7	*AASHTO T304, Uncompacted Void Content of Fine Aggregate*
Add 1.2.25.8	*AASHTO T176, Plastic Fines in Graded Aggregates and Soils by the Use of the Sand Equivalent Test*
Add 1.2.25.9	*AASHTO T209, Theoretical Maximum Specific Gravity and Density of Hot Mix Asphalt*
Add 1.2.25.10	*AASHTO T312, Standard Method of Test for Preparing and Determining the Density of Asphalt Mixtures Specimens by Means of the Superpave Gyratory Compactor*
Add 1.2.26.1	*ANSI / NSF Standard 14, Plastic Piping*
Add 1.2.26.2	*ANSI / NSF Standard 61, Drinking Water System Components- Health Effects*
Add 1.2.27.1	*Canadian Nursery Landscape Association Canadian Standards for Nursery Stock*
Add 1.2.28.1	*CEC C22.1, Safety Standard for Electrical Installations*
Add 1.2.28.2	*CEC C22.2, General Requirements*
Add 1.2.29.1	*Council of Tree and Landscape Appraisers Guide for Plant Appraisal*
Add 1.2.30.1	*Federal Fisheries Act*
Add 1.2.31.1	*Groundwater Protection Regulation (GWPR)*

Add 1.2.32.1 *Interlocking Concrete Pavement Institute Technical Specifications*

Add 1.2.33.1 *International Society of Arboriculture (PNW) Species Ratings for Landscape Tree Appraisal*

Add 1.2.34.1 *Manual on Uniform Traffic Control Devices (MUTCD)*

Add 1.2.35.1 *Canadian System of Soil Classification*

Add 1.2.36.1 *Heritage Conservation Act (British Columbia)*

Add 1.2.37.1 *City of Vancouver Archaeology / Heritage Resource Protection Policies and Procedures (E-009)*

Add 1.2.38.1 *General City of Vancouver Guidelines for Archaeological Chance Find Management*

END OF SECTION 01 42 00

Section 01 45 00S Quality Management

1.0 GENERAL

Add 1.0.1 *Section 01 45 00S* addresses general requirements for *Quality Management*, including inspections, *Quality Control* testing and *Quality Assurance* to be completed by the Contractor. This section must be referenced to and interpreted simultaneously with all other sections pertinent to the *Work* described herein.

1.1 Related Work

Add 1.1.1 All Sections of the *MMCD Specifications,* General Conditions, *City of Vancouver Supplemental General Conditions*, and the *City of Vancouver's Supplemental Specifications*.

1.2 References

Add 1.2.1 *Canadian Standards Association (CSA)*

Add 1.2.2 *American Society for Testing and Materials (ASTM)*

Add 1.2.3 *American Water Works Association (AWWA)*

1.3 Site-Specific Quality Management Plan

Add 1.3.1 Any *Contractor* retained by the *City* to construct civil infrastructure on a City *Street* or right-of-way, must:

.1 Submit a Site-Specific Quality Management Plan ("Quality Management Plan"), including an Inspection and Test Plan ("ITP") to the *Contract Administrator* for *City Engineer's* review and approval, within 15 *Days* of *Notice of Award* and prior to starting the *Work*.

.2 Revise, update and resubmit plans for approval on an ongoing basis to remain current.

.3 Submit a weekly report outlining previous inspection and test results, status of any remedial action required, and upcoming inspection and tests.

.4 Submit a final *Quality Management* Report within 15 *Days* of the final inspection to the *Contract Administrator* for the *City Engineer*.

Add 1.3.2 For all *Other Work* on City *Streets* or right-of-way, a Site-Specific Quality Management Plan, including an Inspection and Test Plan should be readily available for review by the *Contract Administrator* or *City Engineer*.

Add 1.3.3 If the plans are not available when requested, or the *City Engineer* is of the opinion that the plans submitted are not suitable for work within the street right-of-way, the *City Engineer* may suspend such work until Plans are provided to their satisfaction.

Add 1.3.4 The *Contractor* shall perform the *Work* in accordance with the Quality Management Plan.

Add 1.3.5 The Inspection and Test Plans included in the Site-Specific Quality Management Plan shall be prepared and updated as the *Work* progresses and be in an approved format and shall

encompass, as appropriate, all fabrication, construction, inspection and test activities to be implemented during production, construction, installation and commissioning in accordance with the *Contract* and *Contract Documents* including City standards. If the *Contractor* submits ITPs using their own internal documents, they must meet as a minimum the requirements of the *Owner's* ITP proforma as outlined in the Site-Specific Quality Management Plan. If the *Contractor's* ITP fails to meet these requirements, the *Contractor* shall submit an amended ITP addressing any issues raised by the *City Engineer*. The *Contractor's* ITP shall not be considered accepted until approved in writing by the *City Engineer*.

Add 1.3.6 As part of the Quality Management Plan, the *Contractor* must retain and pay for the services of an independent qualified testing agency or agencies, acceptable to the *City Engineer*, to provide testing during construction. Third-party testing laboratories must be certified to CSA, ASTM, and any other relevant bodies as required by the test methods. Testing requirements must meet the minimum(s) specified in applicable contracts, laws, regulations, standards and codes.

Add 1.3.7 A qualified *Quality Management* representative shall be appointed to verify the work is in conformance with the Quality Management Plan, Inspection and Test Plans, and applicable contracts, laws, regulations, standards and codes.

Add 1.3.8 The *Contractor* shall prepare and maintain a lot register for the *Work* (2010 Microsoft Excel format), as the primary means of tracking all test results and inspections; the lot register will be updated on a weekly basis and be submitted to the *City Engineer* as part of the weekly report.

Add 1.3.9 The Quality Management Plan shall include the following:

- Inspection and Test Plan.
- Procedures for fabrication, inspection and testing.
- Detailed *Quality Control* and test schedules.
- Procedures for repair or rework.
- Quality responsibility chart.
- List of approved *Subcontractors*, suppliers, inspectors, testers, and trade specialists.
- List of testing equipment with calibration records.
- Procedures for document control.
- Procedures for remediation and non-conformance tracking.
- Audit plan.
- Templates, forms, tables, and checklists to be used by the *Contractor* during the work.

The Quality Management Plan must cover the complete

scope of the *Work* in detail from procurement to final testing and commissioning and shall also outline the inspection and testing of *Subcontractor's* work.

Add 1.3.10 *Quality Assurance* inspections and audits by the *City Engineer* or their representatives do not remove the responsibility of the *Contractor* to complete quality work in accordance with the approved Quality Management Plan, applicable contracts, laws, regulations, standards and codes.

Add 1.3.11 The *Quality Management* Report must include the following:

- Inspection and Test Plan with all inspection and testing documentation.
- Material acceptance and receiving records.
- Progress *Quality Management* Reports.
- *Subcontractor's* inspection reports.
- Non-conformance reports.
- *Quality Audit* reports.
- Issues list.
- Progress photo documentation.

All applicable documents must be completed and closed.

1.4 Payment Add 1.4.1 Payment for all *Work* performed under this *Section* will be incidental to payment for *Work* described in other *Sections* unless shown otherwise in the *Schedule of Quantities and Prices*.

2.0 PRODUCTS NOT USED

3.0 EXECUTION NOT USED

END OF SECTION 01 45 00S

Section 01 51 01 Temporary Utilities and Lighting

1.0 GENERAL

1.5 Temporary Water

Add 1.5.3 Disinfect temporary water mains and test water quality, as outlined in *3.17* and *3.21 of Section 33 11 01 Waterworks*, in advance of connecting any services to temporary main. The *Contractor* shall pay all costs for disinfection and testing.

Add 1.5.4 The *Contractor* will be responsible for making any arrangements necessary and paying the permit costs for the use of City water from City fire hydrants and complying with all backflow requirements outlined in the Hydrant Use Permit.

Add 1.5.5 The *Contractor* shall provide a *Temporary Water Servicing Work Plan* to the *Contract Administrator* prior to commencement of the *Work*, a minimum of 5 *Days* in advance, for acceptance by the and *City Engineer* (Water Design Branch). The *Temporary Water Servicing Strategy* must be explicitly accepted in writing.

END OF SECTION 01 51 01

Section 01 53 01 Temporary Facilities

1.0 GENERAL

1.11 Building Excavations Adjacent to or Encroaching on the Street

Add 1.11.1

The *Contractor* shall, in addition to obtaining permission from the Building Inspector under applicable building Bylaw, ensure that the method of supporting the *Street* and appurtenances thereon is in accordance with applicable Bylaws and to the satisfaction of the *City Engineer*.

END OF SECTION 01 53 01

Section 01 55 00 Traffic Control, Vehicle Access and Parking

1.0	**GENERAL**	Add 1.0.6	To remove parked vehicles from the *Site*, the *Contractor* shall contact the *Contract Administrator*, following receipt of a Temporary Special Zone Permit as per *Supplemental General Condition 20.2*. Licence plate numbers of vehicles legally parked at the time of placement of Temporary Special Zone signs shall be recorded by the *Contractor* and made available for the *Contract Administrator*. If these vehicles are still parked when *Work* commences, the *Contract Administrator* shall be contacted by the *Contractor* for further instructions.
		Add 1.0.7	During certain periods, *Streets* serving special events or being used for traffic diversions may need to be repaired and / or managed under set Traffic Management Plan to the satisfaction of the *City Engineer* (Traffic and Data Management Branch). Such periods of time will be outlined in the *Contract Documents*.
		Add 1.0.8	In the event the *Owner* at any time finds it necessary to correct any problem with or deficiency in the traffic control equipment used by the *Contractor* in the performance of the *Work*, the *Contractor* will reimburse the *Owner* for all costs the *Owner* reasonably incurs in carrying out such corrections and the *Owner* may set-off such amounts against payments owing to the *Contractor* hereunder.
		Add 1.0.9	Where the *Contractor* obstructs more of any *Street*, roadway or place than is ordered or sanctioned by the *City Engineer* in writing, then the *City Engineer* may cause such obstructions to be removed at the expense of the *Contractor*.
1.3	**Temporary Parking Areas**	Delete 1.3.1 and replace with	To limit impact to adjacent residents and businesses, restrict the *Contractor*'s employee parking to designated areas outside of any Temporary Special Zones, as directed by the *Contract Administrator*. Temporary Special Zones are provided for construction activities, not the *Contractor*'s employee parking. The *Contractor* shall apply for a Temporary Special Zone Permit and pay fees for no public parking zones.
1.4	**Traffic Control**	Add 1.4.0	The *Contractor* shall provide a Traffic Management Plan to the *Contract Administrator*, the *City Engineer* (Traffic and Data Management Branch), and the *City Road Authority* representative prior to commencement of the *Work* for acceptance. The Traffic Management Plan must be explicitly accepted in writing. The *Contractor* shall carry out the *Work* in accordance with the accepted Traffic Management Plan. A Traffic Management Plan is valid for six months following acceptance unless otherwise noted or if conditions change.

Append to 1.4.2 The *Contractor* shall also abide by any instructions issued by the *Contract Administrator* regarding traffic control and abide by all Ministry of Transportation and WorkSafeBC regulations.

Append to 1.4.3 For all *Work* on City *Streets*, lanes, or sidewalks, all traffic control shall be provided by the *Contractor*, at the *Contractor*'s expense, except where otherwise specifically provided for in the *Contract Documents*. The *Contractor* shall adhere to the standard procedures and practices prescribed in the *BC Ministry of Transportation and Highways Traffic Control Manual for Work on Roadways* as required by the *City Engineer* (Traffic and Data Management Branch).

Append to 1.4.5 Construction shall be scheduled not to interfere with the rush hours of the predominant direction of traffic. Certain arterial *Streets* are heavily loaded in both directions and construction shall be completed between rush hours. The final decision on the duration and extent of closure permissible will be at the discretion of the *City Engineer* (Traffic and Data Management Branch).

Append to 1.4.8 If approved by the *Contract Administrator*, where it is necessary to limit vehicular access to private property, the *Contractor* shall provide written notice a minimum of 48 hours prior to such work occurring, for each and every instance.

The *Contractor* shall at all times maintain satisfactory pedestrian access to buildings and private property.

Append to 1.4.9.3 The *Contractor* shall at the *Contractor*'s expense provide, erect and maintain all requisite barriers, fences or other proper protection and must provide and maintain such flag-persons, watchpersons and lights as may be necessary or as may be ordered by the *Contract Administrator*, in order to ensure safety to the public as well as to those engaged about the *Site*.

Append to 1.4.9.5.1 The *Contractor* is responsible for all signs, barricades, fencing and equipment at all times, including during and after *Work Hours*.

The *Contractor* shall, from the date of commencement to the date of *Total Performance*, assume responsibility for the barricading and signing of hazards resulting from such *Work* as utility trenches, out-of-grade utility-access covers, or any other obstruction or impediment to pedestrian, cyclist, or vehicular traffic, be these *Work* in-progress prior to or subsequent to the *Work* date of commencement.

Append to 1.4.12 The following pedestrian requirements also apply:

.1 Pedestrian behaviour (a person on foot or in a wheelchair) shall be monitored and addressed

appropriately and promptly whenever their movements are impacted.

.2 A clear 1.8m minimum pedestrian provision must be in place whenever a sidewalk is closed for *Work* purposes, or a reasonable alternate solution to the satisfaction of the *City Engineer* (Traffic and Data Management Branch).

.3 When observations reveal a condition that requires additional measures be taken to ensure the public's safety, the *Contractor* must make all efforts to correct the situation in a timely manner, and provide these measures to the *City Engineer* (Traffic and Data Management Branch) for review and acceptance.

.4 No two parallel or adjacent sidewalks are to be under construction concurrently.

.5 Where *Work* directly impacts sidewalk accessibility, "fixed-in-place" ramps with a tactile surface shall be provided at either end of the *Site* allowing pedestrians to safely negotiate the grade change between the roadway surface and drop ramps, curbs and boulevards. Ramps must be of solid / sound construction, a minimum of 1.8m wide, less than 8% grade, and fixed in place with a traction surface.

.6 When a sidewalk closure is unavoidable due to limiting circumstances such as road width or traffic volumes, appropriate signage must be installed to provide direction to pedestrians guiding them to an accessible alternative. A traffic control person should be available to hold traffic should a pedestrian choose to ignore signage and walk in the travel lane.

.7 A safe pedestrian provision should be provided after hours when sidewalks cannot be reopened after hours, and personnel are not available to facilitate safe passage of pedestrians.

Add 1.4.14 The following cyclist requirements apply:

.1 Specific care and attention shall be provided for construction on bike routes or within bike lanes. Refer to *City* documentation and *BC Ministry of Transportation and Highways Traffic Management Manual for Work on Roadways* for further information.

.2 A Traffic Management Plan with clear directions of how cyclists are to be managed shall be provided to the *City Engineer* (Traffic and Data Management Branch).

.3 Different measures for managing cyclists shall be used for the varying type of *Work* impact: emergency, long term and short term. The *Contractor* shall coordinate with the *Contract Administrator* to ensure the appropriate measures are identified and included in the Traffic Management Plan.

.4 Accommodations shall be made to allow cyclists through

the *Site* safely, or to provide an equivalent provision on an alternate route as accepted by the *City Engineer* (Traffic and Data Management Branch).

Add 1.4.15 The following trucking requirements apply:

.1 All truck operators must operate the vehicle in a safe and courteous manner and in full compliance with Provincial and Federal motor vehicle and trucking regulations.

.2 All truck operators must comply with *City* Bylaws regulating truck use including truck route, engine brake noise, idling, weight and load securement (tarping) provisions. There will be a zero tolerance on overloading trucks and un-tarped loads.

.3 All vehicles must be inspected prior to leaving the *Site* to ensure no debris is on the vehicle and that no debris or rocks are between tires.

.4 Development *Sites* must submit and have accepted a *Truck Plan* to be used during construction for deliveries and excavation.

END OF SECTION 01 55 00

Section 01 57 01 Environmental Protection

1.0 GENERAL

1.2 Temporary Erosion and Sediment Controls

Append to 1.2.1.2

Do not dispose of anything but water into watercourses, storm systems, or sanitary systems. Other waste liquids and *Hazardous Materials* must be directed for treatment and disposal at a permitted facility.

Add 1.2.1.4

All wastes and wastewater resulting from construction and its related activities on *City* property must be strictly treated in accordance with all related *City* Bylaws such as the *Sewer and Watercourse Bylaw No. 8093*. Failure to do so could result in immediate stoppage of *Work* and penalty.

Add 1.2.1.5

Do not discharge water with a pH less than 6.0 or greater than 9.0.

Add 1.2.1.6

Best Management Practices must be implemented to mitigate discharge of sediments into the storm sewer system. An *Erosion and Sediment Control Plan* subjected to the approval of the *Contract Administrator* may be required prior to the *Work* being done. The *Erosion and Sediment Control Plan* shall include, but not limited to, the following:

.1 A phased construction schedule that limits the extent of tree or vegetation removal and soil disturbance to those areas immediately required for site construction.

.2 Details showing site access and measures to address soil tracking.

.3 Plans and specifications to describe the work required to control and treat Total Suspended Solids and pH in run-off water from the construction site and the location of the discharge to the *City* sewer system. The discharge location must be easily accessible.

.4 Measures to reduce sediment run-off from the *Site*.

.5 A program to remove mud, dirt, and debris from *City* property.

.6 Storm drain inlet protection (i.e., sediment sacks).

.7 Sampling and analyses required to demonstrate compliance with applicable Bylaws.

Add 1.2.1.7

Storm drain inlet protection is required adjacent to the *Work*.

Append to 1.2.2.5

No temporary stream crossings will be allowed without the approval of the federal, provincial, or municipal authorities.

Add 1.2.2.9

Prevent sand blasting and other extraneous materials from entering watercourses.

Add 1.2.3.2

A truck wheel wash system is required, if necessary, to keep mud, dirt and debris from being tracked onto roads and into

the storm sewers system.

Add 1.2.5 Protection of Stormwater Infiltration Areas:

.1 Do not allow construction stormwater runoff to drain on or through areas planned for stormwater infiltration practices.

.2 Avoid construction material storage and construction traffic in areas planned for stormwater infiltration practices.

.3 If use of the infiltration areas is unavoidable during construction, then the infiltration capacity of the area must be restored by removing clogged soils and decompacting the soils.

.4 The stormwater infiltration practices, such as permeable pavement, bioretention, and infiltration trenches, shall be constructed last to avoid clogging and damage from construction activity.

END OF SECTION 01 57 01

Section 01 58 01 Project Identification

1.0 GENERAL

1.2 Temporary Project Signage

Delete 1.2.1.2 and replace with

The *Contract Administrator* shall supply the *Contractor* with all project notification signage to be installed. This may include pedestrian, cyclist and vehicle operator specific signage. The *Contractor* shall return all signage upon *Total Performance*, or otherwise as directed by the *Contract Administrator*.

Add 1.2.1.6

All project signage shall be posted in locations owned by or leased to the *City*, including *Streets*, sidewalks and other public rights-of-way. Under specific circumstances, signage may be posted outside of locations owned by or leased to the *City* with the approval of other *Road Authorities*. Signs shall be posted at a location, height and orientation specified by the *Contract Administrator*.

Add 1.2.1.7

The *Contractor* shall move, remove or adjust signage at any time as directed by the *Contract Administrator*.

END OF SECTION 01 58 01

Section 03 30 20 Concrete Walks, Curbs and Gutters

1.0 GENERAL

1.1	**Related Work**	Add 1.1.8	*Section 31 32 19 Geosynthetics*
		Add 1.1.9	*Section 33 40 01 Storm Sewers*
1.4	**Measurement and Payment**	Delete 1.4.6 and replace with	Payment for driveway crossings including granular base as shown on *Standard Detail Drawings C7.1* to *C7.3* will be made on a unit basis (each crossing) for each specified thickness.

2.0 PRODUCTS

2.1	**Materials**	Delete 2.1.5 and replace with	Concrete mixes and materials to *Section 03 30 53 Cast-in-Place Concrete*.
		Add 2.1.7	Polyvinyl Chloride (PVC) or Acrylonitrile Butadiene-Styrene (ABS) plastics shall meet the requirements of the latest revision of *CAN / CSA 182.1*. Pipe shall be available in 3m lengths with nominal diameter of 100mm and perforations as detailed in *Section 4.1.4 of CAN / CSA 182.1* for leach field pipe. The pipe will include bell and spigot design suitable for solvent welding, where required. The pipe shall have an SDR of 28 or lower and 700kPa at 5% deflection.
		Add 2.1.8	Perforated Corrugated Metal Pipe (PCMP) shall conform to the latest revision of *AASHTO M36*. PCMP shall consist of 18-gauge (minimum 1.214mm) metal with 6.35mm minimum diameter rivets or the seam may be formed by welding. Helical corrugated pipe will be acceptable if it has corrugations 6.35mm deep by 38mm wide. Perforations shall consist of two groups of two lines each. The holes shall be not less than 6.35mm nor more than 11.1mm in diameter and shall be located in the inside ridges of all corrugations. The lines of holes shall be approximately 25mm apart and the outer rows of holes shall be not more than 67.5˚ from the centre line of the non-perforated segment.
		Add 2.1.9	Filter fabric geotextile shall meet the requirements described in *AASHTO M288* for Class 2.

3.0 EXECUTION

3.3	**Formwork**	Add 3.3.9	At lanes, crossings and other similar locations, formwork shall be left in place until the concrete has attained sufficient strength to bear traffic loads without edge damage. Sufficient strength generally means minimum 20MPa in concrete strength unless otherwise allowed by the *City Engineer*.

3.7	**Driveway Crossings and Wheel Chair Ramps**	Add 3.7.2	Wheel Chair Ramps: .1 Ramps shall land wheelchair and other users safely in the crosswalk and in the desired direction of travel. .2 The ramp and the directional score lines shall lead into the crosswalk, lining up with the ramp across the *Street* and be parallel with the crossing or marked crosswalk. The directional score lines are intended to aid the visually impaired pedestrian across the *Street* and shall be constructed for maximum detection.
		Add 3.7.3	Double Curb Ramp: Minimum 1.0m full curb is required between the two ramps as per *Standard Detail Drawing C8.1*. Double curb ramps are preferred, and shall be implemented whenever possible, over large single curb ramps as described in *3.7.4 of this Section*.
		Add 3.7.4	Large Single Curb Ramp: The ramp must adequately land a pedestrian in both crosswalks as per *Standard Detail Drawing C8.2*.
		Add 3.7.5	Lane Curb Ramp: The ramp and the directional score lines shall line up with the ramp across the lane and be parallel with the crossing as per *Standard Detail Drawing C9.1*.
		Add 3.7.6	The minimum thickness of all residential concrete driveway crossings shall be 200mm as per *Standard Detail Drawing C7.1*. The minimum thickness for commercial crossings is 300mm as per *Standard Detail Drawing C7.2*.
		Add 3.7.7	The minimum thickness of all curb ramps shall taper from 100mm at the back of ramp (matching the sidewalk thickness) to 200mm at the back of curb as per *Standard Detail Drawings C8.1* to *C8.4* and *C9.1*.
3.9	**Expansion Joints**	Delete 3.9.3	Delete 3.9.3
		Delete 3.9.4	Delete 3.9.4
3.10	**Control Joints**	Delete 3.10.1 and replace with	Walks 1.5m, 1.8m, and 2.0m in width shall be marked off in panels 1.5m, 1.8m, or 2.0m long respectively unless otherwise directed by the *City Engineer*. Control joints to control and minimize cracking shall be installed to the satisfaction of the *City Engineer*. The scoring pattern of the sidewalk is governed by the distance between features such as tree pits and water valve boxes. Keep the scoring pattern as square as possible for the sidewalk panels.
		Add 3.10.5	Whenever there is a sidewalk feature, such as a tree pit or water valve box, presented, the scoring pattern must follow through from the main sidewalk scoring pattern. A cut is generally spaced between two adjacent sidewalk panels as

			long as it provides balanced scoring pattern between features.
3.11	**Isolation Joints**	Append to 3.11.1	Carefully fit, cut, and mark the sidewalk around all features such as water valve boxes, lamp standards, poles, and hydrants to prevent cracking of the slabs, to the satisfaction of the *City Engineer*.
3.12	**Finishing**	Append to 3.12.5	Cutting and marking tools shall have a cutting edge not less than 25mm in depth and the edge of the panel shall be rounded to a 6mm radius. Trowel edge to be as close to flush as possible with broom finish. The broom finish shall extend to the edge of the panel.
		Add 3.12.9	Finished curb and gutter shall have a smooth and uniform surface, true to line, grade, and section and shall be free from voids, sags, bumps, or other irregularities to the satisfaction of the *City Engineer*.
		Add 3.12.10	All control joints are to be sawcut only (no trowel marks) and shall be done 24 hours after the pour to avoid any cracking.
		Add 3.12.11	All score lines are to be trowelled only.
3.13	**Special Effects**	Add 3.13.3	At *Street* intersections, the cast year shall be stamped in the surface of the sidewalk as directed by the *City Engineer*. The necessary template figures will be available from the *Contract Administrator*.
		Add 3.13.4	Old historical sidewalk stamp markings 1950 or older have special value to the *City* and are required to be saved and kept in place. The *Contract Administrator* must be contacted and consulted prior to the demolition and removal of the sidewalk containing the markings.
3.14	**Protection**	Delete 3.14.1 and replace with	Protect freshly finished concrete from dust, rain or frost by using tarpaulins or other suitable protective coverings after final set. Keep clear of finished surface.
3.16	**Perforated Drain Pipe**	Append to 3.16.1	Perforated drain pipe installed adjacent to sidewalk or curb and gutter shall have a minimum of 400mm of cover.
		Add 3.16.2	Connect to catchbasins and stamp letter “D” in walk where drain crosses under.
		Add 3.16.3	Drain pipe placed across lane entrances shall be either corrugated metal pipe or non-perforated PVC pipe.
		Add 3.16.4	Geotextile (filter fabric) shall be installed between drain gravel and overlying soil.
3.17	**Acceptance**	Append to 3.17.1	Any portion marked or damaged by vandalism, rain, frost, equipment, traffic, or other, to be replaced at the *Contractor*’s cost.

Add 3.17.3 The *Contractor* shall be responsible for any damage to existing concrete walks, curbs, and gutters at their *Site* or any damages at adjacent sites, and shall make all necessary repairs, at their cost, to any damage caused from their construction activities to the satisfaction of the *City Engineer*.

END OF SECTION 03 30 20

Section 03 30 53 Cast-in-Place Concrete

1.0 GENERAL

1.1 Related Work — Add 1.1.10 — *Section 03 30 20 Concrete Walks, Curbs and Gutters*

2.0 PRODUCTS

2.1 Materials — Add 2.1.10 — All concrete used under this specification shall be ready-mixed concrete, proportioned and mixed in an approved mixing plant.

2.2 Concrete Mixes — Delete 2.2.1 and replace with — All concrete supplied shall meet the requirements of *CAN / CSA-A23.1* and *City*-specified mix requirements unless otherwise allowed by the *City Engineer*. Concrete shall be normal weight, and the *Contractor* and its supplier shall assume responsibility for the quality and performance of the concrete as per *CAN / CSA-A23.1 Table 5 Alternative 1*. Submit mix designs to the *Contract Administrator* for review and record upon request.

Add 2.2.2 — City of Vancouver Roller Compacted Concrete Mix 1500A:

Property	Specification
Typical Use	Pavements, No-slump concrete applications
Cement Type	GUL (HE if required)
Maximum Aggregate Size	20mm
Optimum Moisture Content	To be determined as per *CAN / CSA A23.2-12C*
Compacted Density	±2% of the design concrete density
Strength Accelerator	As needed
Hot Water	When required
Exposure Class	F1
Compressive Strength	Min. 20MPa for traffic loading unless otherwise allowed by the *City Engineer* and 30MPa at 28-day
Aggregates	*CAN / CSA A23.1 Clauses 4.2.3.3, 4.2.3.4, 4.2.3.5, 4.2.3.6 and 4.2.3.7*
Mix Proportions	*CAN / CSA A23.1 Clause 4.3*

Add 2.2.3 City of Vancouver Mix 1503:

Property	Specification
Typical Use	Pavements, Crossings, Curb and Gutter, and Sidewalks
Cement Type	GUL (HE if required)
Maximum Aggregate Size	20mm
Slump	80mm ± 30mm
Air Content	5%-8%
Strength Accelerator	As needed
Hot Water	When required
Exposure Class	C2
Compressive Strength	Min. 20MPa for traffic loading unless otherwise allowed by the *City Engineer* and 32MPa at 28-day

Add 2.2.4 City of Vancouver Mix 1528A:

Property	Specification
Typical Use	Protective concrete over pipes or around *Maintenance Holes* and pipe cradling, bedding for vertical separation
Cement Type	GUL (HE if required)
Maximum Aggregate Size	28mm, 20mm, or 10mm
Slump	Max. 50mm
Air Content	3% to 6% for 28mm aggregate 4% to 7% for 20mm aggregate 5% to 8% for 10mm aggregate
Exposure Class	F2
Compressive Strength	Min. 25MPa at 28-day

Add 2.2.5 City of Vancouver Mix 1528B:

Property	Specification
Typical Use	Thrust blocks and other non-structural mass concrete needs
Cement Type	GUL (HE if required)
Maximum Aggregate Size	20mm
Slump	80mm ± 30mm
Air Content	4%-7%
Exposure Class	F2
Compressive Strength	25MPa at 28-day

Add 2.2.6 City of Vancouver Mix 2828A:

Property	Specification
Typical Use	Machine-Formed Curbs
Cement Type	GUL (HE if required)
Maximum Aggregate Size	10mm
Slump	Max. 50mm
Air Content	6%-9%
Strength Accelerator	As needed
Hot Water	When required
Exposure Class	C2
Compressive Strength	Min. 15MPa at 3-day and 32MPa at 28-day

Add 2.2.7 City of Vancouver Mix 2828B:

Property	Specification
Typical Use	Hand-Formed Curbs and Sidewalks
Cement Type	GUL (HE if required)
Maximum Aggregate Size	20mm
Slump	80mm ± 30mm
Air Content	5%-8%
Strength Accelerator	As needed
Hot Water	When required
Exposure Class	C2
Compressive Strength	Min. 20MPa for traffic loading unless otherwise allowed by the *City Engineer* and 32MPa at 28-day

Add 2.2.8 City of Vancouver Mix 2828C:

Property	Specification
Typical Use	Structural concrete used for *Maintenance Holes*, catchbasins, or other underground chambers
Cement Type	GUL (HE if required)
Maximum Aggregate Size	20mm
Slump	80mm ± 30mm
Air Content	5%-8%
Calcium Chloride (% by Weight of Concrete)	Maximum 1% From Nov. 1 to March 31 (No Calcium Chloride in concrete for any components that have contact with any metal)
Hot Water	When Required
Exposure Class	F1
Compressive Strength	Min. 20MPa for traffic loading unless otherwise allowed by the *City Engineer* and 30MPa at 28-day

3.0 EXECUTION

3.5 Cold Weather Placement

Add 3.5.1 Cold weather requirements apply when the air temperature is at or below 5˚C, or is forecast to fall below 5˚C within 24 hours of placing.

Do not schedule or place concrete during periods that have a high probability of rain or snow. Protect concrete against potential rain and frost until it has cured sufficiently to the satisfaction of the *City Engineer*.

Add 3.5.2 When concrete is to be placed in cold weather, have all materials and equipment needed for adequate protection and curing on hand and ready for use before concrete placement is started. Obtain prior authorization from the *City Engineer* for the proposed enclosures, equipment, and procedures for cold weather concreting.

Add 3.5.3 Do not place concrete against any surface that has a temperature of less than 5˚C. Remove all snow and ice. Preheat such surfaces for 24 hours or as required to obtain surface temperatures of 5˚C minimum, whichever is longer, prior to placing concrete.

Add 3.5.4 Design and construct heating and hoarding protection measures including heated enclosures, coverings, insulation, or a suitable combination of these methods in accordance with *CAN / CSA-A23.1*.

Add 3.5.5 Inspect heating and hoarding measures at least every four hours and verify that enclosures, coverings, and insulation are in place, there is adequate heater fuel, and the specified temperatures are being maintained.

Add 3.5.6 Provide a sufficient number of adequately sized and properly vented heaters. Do not place heaters at locations that may cause rapid drying of freshly placed concrete. Use fans to constantly circulate warm air within the enclosure. Do not use tiger torches or other open flame burners as heaters.

3.6 Hot Weather Placement

Add 3.6.1 Hot weather requirements apply when the air temperature is at or above 25˚C, or is forecast to rise to 25˚C within 24 hours of placement.

Add 3.6.2 Protect formwork, reinforcement, and concrete equipment from the direct rays of the sun, or cool by fogging and evaporation. Dampen subgrade surfaces prior to concrete placement.

Add 3.6.3 Provide adequate personnel and equipment to transport, place, consolidate, and finish the concrete at the fastest possible rate. Obtain prior authorization from the *City Engineer* for the proposed equipment and procedures for hot weather concreting.

Add 3.6.4 Provide protection from drying in accordance with *CAN / CSA-A23.1*.

END OF SECTION 03 30 53

Section 03 40 01 Precast Concrete

2.0 PRODUCTS

2.1 Materials

Add 2.1.2 All concrete used under this specification shall be proportioned and mixed in an approved mixing plant.

Add 2.1.3 All precast concrete shall meet the requirements of *CAN / CSA-A23.1* and *City*-specified mix requirements outlined in *Section 03 30 53 Cast-in-Place Concrete* unless otherwise allowed by the *City Engineer*. Concrete shall be normal weight, and the *Contractor* and its supplier shall assume responsibility for the quality and performance of the concrete as per *CAN / CSA-A23.1 Table 5 Alternative 1*. Submit mix design to the *Contract Administrator* for review and record upon request.

END OF SECTION 03 40 01

Section 26 42 13 Cathodic Protection

1.0	**GENERAL**		
1.8	**Measurement and Payment**	Delete 1.8.1 and replace with	Unless otherwise noted in the *Contract Documents*, payment for all *Work* under this Section will be incidental to payment for *Work* described in other Sections.
2.0	**PRODUCTS**		
2.2	**Thermite Welds**	Delete 2.2.1 and replace with	Thermite welders and weld metal to be of an appropriate size for the pipe and cable and manufactured by Cadweld as shown on *Standard Detail Drawing W106.4*.
2.8	**Test Station Terminal**	Delete 2.8.1 and replace with	Test station terminal to be as per *Standard Detail Drawing W105.1* or *Approved Equal*.
		Delete 2.8.2 and replace with	Test Station cover to be as per *Standard Detail Drawing W104.1*.
3.0	**EXECUTION**		
3.4	**Joint Continuity**	Add 3.4.5	Joint continuity (cables or straps) to be as per *Standard Detail Drawings W106.1* to *W106.3*.

END OF SECTION 26 42 13

Section 26 56 01 Roadway Lighting

1.0 GENERAL

1.4 Electrical Energy Supply

Add 1.4.4

The *Contractor* shall coil and install wire markers indicating signal phase on conductors out of the weather head. Utility company shall complete electrical service connections.

1.10 Inspection

Add 1.10.2

Required field tests are to be confirmed with the *City Engineer*, including, but not limited to:

- Concrete testing.
- Flashing out of traffic signal wiring.
- Arc flash test results.
- Pole fabrication test reports.
- Powder coat test reports.

Set-up testing and commissioning reports may also be required for, but not limited to:

- Traffic controllers.
- Cameras.
- UPS.

2.0 PRODUCTS

2.1 General

Delete 2.1.2 and replace with

All products supplied to be new, and in accordance with the *Contract Documents*. All products must bear evidence of either a mark or a label of a certification agency accredited by CSA or have an approval label issued by the BC Safety Authority.

Delete 2.1.3 and replace with

All products shall be in accordance with the Approved Materials and Products List which may be shown on the *Drawings*, as well as the current volume of the *BCMOT Electrical and Signing Materials Standard (E&SMS)*. Where the list is not on the *Drawings*, contact the *Contract Administrator* for a current list.

2.2 Conduits

Add 2.2.6

Any 53mm diameter conduit used for street lighting and traffic signal purposes shall be terminated to a junction box as shown on the *Drawings*.

Any 103mm diameter conduit used for communication purposes shall be terminated to a junction box as shown on the *Drawings*.

Add 2.2.7

Street lighting / traffic signal conduits and communications conduits cannot be terminated or passed through the same junction box. Separate boxes are required.

Add 2.2.8

Any conduit which is not used shall be stubbed out and capped off by CSA-CEC approved means.

2.4	**Plastic Junction Boxes**	Add 2.4.2	Unless otherwise directed in the *Contract Documents*, plastic boxes are not allowed unless approved in advance by the *City Engineer*.
2.5	**Concrete Junction Boxes**	Delete 2.5.1 and replace with	The *City* utilizes polymer concrete (Synertech or *Approved Equal*) junction boxes in varying standard box sizes. Refer to *Standard Detail Drawings E2.3* and *E2.4* for junction box details. Refer to the *Drawings* for type and size. Boxes shall: • be Tier 22 load rated. • have 64mm long (with 18 thread) stainless steel hex head bolts and washer lid hold bolts. • be labelled with the "COV" logo.
2.6	**Concrete Bases**	Delete 2.6.1 and replace with	All concrete bases shall be poured-in-place type. Refer to *Standard Detail Drawings CE1.1* to *CE1.7* for concrete base details. Refer to the *Drawings* for type.
2.7	**Poles and Anchor Bolts**	Delete 2.7.5.5 and replace with	Poles shall have powder coat finish with RAL colour number defined on the *Drawings*.
		Add 2.7.9	Davit poles shall not have a flange connecting the 2A arm.
		Add 2.7.11	Pole bottom hand hole rings shall be 305mm (H) x 127mm (W) with a cover of 346mm (H) x 171mm (W).
2.8	**Conductors and Cables**	Delete 2.8.1 and replace with	Single Conductors: 600V, conductor size (AWG) as noted on the *Drawings*, stranded copper type with RWU90 polyethylene insulation, to conform to *CAN / CSA C22.2 No. 38*, 90˚C, and colour coded as per *CAN / CSA C22.2*.
2.10	**Conductor Connectors**	Add 2.10.1.3	Wire connectors in underground boxes shall be silicon-filled wire nuts or approved waterproof method of split bolts for bigger wire sizes.
2.11	**Fuses and Fuse Holders**	Delete 2.11.1 and replace with	Fuse: 5amp standard midget fuse (10mm x 38mm), Class CC to *CAN / CSA C22.2 No. 248.4* and rated for up to 600V.
2.14	**Luminaires**	Delete 2.14.1 and replace with	All luminaires shall be LED, and only products and manufacturer(s) listed on the *Drawings* shall be used, unless approved by the *City Engineer*.
		Delete 2.14.2	Delete 2.14.2
		Delete 2.14.3	Delete 2.14.3
		Delete 2.14.4	Delete 2.14.4
		Delete 2.14.5	Delete 2.14.5
2.18	**Powder Coat Finish**	Add 2.18.5	Powder coat colours (RAL number) shall be as specified on the *Drawings*, or as directed by the *City Engineer*.

2.19	**Service Panels and Cabinets**	Add 2.19.1	Typical service panels, kiosks and cabinets are defined on *Standard Detail Drawings E1.3* and *E7.7* to *E7.9*. Kiosks and cabinets shall be fabricated in accordance with *Section 26 56 02S Service Kiosks and Cabinets*. The specific panel, kiosk or cabinet and internal breakers, contactors, transformer and metering shall be as described on the *Drawings*.
		Add 2.19.2	Kiosk and cabinets shall have a powder coat finish in accordance with requirements of *2.18 of this Section* and *Section 26 56 02S Service Kiosks and Cabinets*.
3.0	**EXECUTION**		
3.1	**General**	Add 3.1.5	When tying into or upgrading an existing installation, maintain the existing lighting system in operation or provide temporary lighting to ensure illumination of the *Street* meets requirements for safe passage by pedestrians, cyclists and motor vehicles at all hours.
3.3	**Concrete Bases**	Delete 3.3.1 and replace with	Install concrete bases in accordance with *Section 03 30 53 Cast-in-Place Concrete* and as shown on *Standard Detail Drawings CE1.1* to *CE1.7* for poured-in-place concrete base details.
3.4	**Junction Boxes and Vaults**	Delete 3.4.1 and replace with	Refer to *Standard Detail Drawings E2.3* and *E2.4* for junction box and vault details. Refer to the *Drawings* for box type.
3.5	**Underground Conduit**	Delete 3.5.2 and replace with	Minimum cover over conduits shall be 600mm for all street lighting and signal conduits and 900mm for communications conduits. The number of bends in a conduit run shall not exceed 360˚. Main run (backbone) communications conduit shall be concrete-encased in road crossings.
3.6	**Poles and Related Equipment**	Add 3.6.11	The *Contractor* shall place specific pole number labels on poles after installation as per the *Drawings*. The *Contract Administrator* will supply number labels. Pole numbers shall be placed 45˚ on the pole shaft facing traffic flow for arterial and collector roads and on the front face of pole shafts for residential areas at 1.8m minimum above grade.
3.7	**Electrical**	Delete 3.7.2 and replace with	Refer to *Standard Detail Drawing E1.4* for service cabinet concrete base details. Refer to *Standard Detail Drawings E1.3* and *E7.7* to *E7.9* for service panel and cabinet details.
3.8	**Wiring**	Add 3.8.12	Prior to capping or pulling conductors, conduits shall be blown out with compressed air, from both ends, then swabbed out to remove stones, dirt, water and other material which may have entered during installation. All cut ends of conduits shall be trimmed to remove rough edges.
		Add 3.8.13	Cables and wires shall have 1.0m of spare length in all junction boxes and 0.3m minimum of spare length out from pole hand hole cover.

		Add 3.8.14	All field wire shall be RWU90, stranded copper.
3.10	**Luminaires and Photocells**	Append to 3.10.1	Luminaires shall be securely fastened with appropriate torque recommended by the luminaire installation instructions to the luminaire arm, leveled and cleaned after pole erection and plumbing is complete.
		Delete 3.10.3 and replace with	Photocell shall be installed at the luminaire close to the kiosk, cabinet or panel. Photocell eye to face north direction. Photocell shall be installed away from tree branches or other obstructions that may impede its function.
		Add 3.10.4	NEMA wattage labels shall be visible at the bottom of the luminaire on all fixtures. Place label on the underside of the luminaire for Cobra heads and on the neck or top of pole for post tops.
3.11	**Grounding & Bonding**	Add 3.11.5	Additional to common bonding conductor, all poles shall be connected to a ground plate. Refer to *Standard Detail Drawing E7.10* for details; however, plate shall be located 300mm on the side of the concrete base with native soil separating the base and the ground plate.
3.13	**Pole Finish Application**	Add 3.13.5	Pole refinishing (touch-up): The *Contractor* shall clean and wire brush galvanized surfaces, touch up scratches and abrasions with prime coat (General Paint META Prime (vinyl wash)), and apply finish coat of non-alkyds color base paint. Poles must be free from moisture (rain, dew, frost, fog). No pole refinishing shall be undertaken if frost is predicted within 24 hours of the *Work*.
3.14	**Bus Shelter Lighting**	Add 3.14.1	Bus shelters shall be connected to the City street lighting system where noted. The bus shelter shall tie into the City street lighting system via Type 3 junction box with 5A in-line fuse, and the *Contractor* shall install conduit and pull wire to the City junction box. The *City Engineer* shall inspect the bus shelter wiring installation prior to the final connections.

END OF SECTION 26 56 01

Section 26 56 02S Service Kiosks and Cabinets

1.0 GENERAL

Add 1.0.1 *Section 26 56 02S* refers to those portions of *Work* that are unique to the requirements for the design and supply of electrical service kiosks and cabinets. This section must be referenced to and interpreted simultaneously with all other sections pertinent to the *Work* described herein.

For clarity, a cabinet has no internal transformer whereas a kiosk has an internal transformer.

Add 1.0.2 Kiosks and cabinets shall include all required equipment including, but not limited to, the main breaker, metering equipment (if required), pull box, distribution panel(s), transformer (kiosks only), contactors, lighting controls and other components as shown on the *Drawings* including *Standard Detail Drawings E7.7* to *E7.9C*. Cabinets and kiosks shall have a climate control system (heater and fan) to maintain the operating temperature of the internal equipment. Electrical kiosks / cabinets shall be required to have surge protection devices.

Add 1.0.3 The supplier shall have the necessary certifications and approvals to manufacture CSA listed products.

Add 1.0.4 Where metering is required, the kiosk / cabinet and internal components shall be designed to meet the approval of BC Hydro and shall be designed for ease of maintenance.

Add 1.0.5 All equipment produced shall meet the requirements of the *Canadian Electrical Code, CAN / CSA C22.1 - Safety Standard for Electrical Installations* and *CAN / CSA C22.2 – General Requirements*.

Add 1.0.6 The lighting control and power distribution system (single line diagram) for a standard 120 / 240V, 240 / 480V and 120 / 208V service is noted on *Standard Detail Drawings E7.7* to *E7.9C*. Other non-standard cabinets may also be required as noted on the *Contract Drawings*.

Add 1.0.7 The kiosk / cabinet size shall be as specified on the *Contract Drawings*, or the smallest of the three standards as defined on *Standard Detail Drawing E7.9A* as approved by the *City Engineer*. The *Contract Drawings* shall show a general single line and equipment layout; however, the size, rating and number of contactors and breakers will vary and are defined on *Standard Detail Drawings E7.7* to *E7.9C*. Where equipment varies beyond breaker standard sizes, quantity and rating, a custom single line diagram may be required. In this case, the equipment shall be arranged to fit the defined kiosk / cabinet or a custom cabinet maybe required.

Use of custom-size kiosks / cabinets must be approved in advance by the *City Engineer,* and the *Contractor* must be

able to demonstrate that the kiosk / cabinet has been designed to be as compact as possible.

1.1 Related Work

Add 1.1.1 *Section 26 56 01 Roadway Lighting*

Add 1.1.2 *Section 34 41 13 Traffic Signals*

1.2 Abbreviations

Add 1.2.1 The following abbreviations are used in this section:

- CEC Canadian Electrical Code (Parts 1 and 3).
- CSA Canadian Standards Association.
- IESNA Illuminating Engineering Society of North America.
- LED Light Emitting Diode.
- NEMA National Electrical Manufacturers Association.

1.3 Material Certification

Add 1.3.1 The final kiosk / cabinet complete with all electrical components shall bear CSA and Arc Flash labels.

1.4 Inspection and Testing

Add 1.4.1 The supplier shall have and maintain a suitable *Quality Management* program. The purpose of the *Quality Management* program is to ensure that the product meets the quality requirements of these specifications, is delivered on time, and is produced in a cost-effective manner. The supplier's *Quality Management* program shall apply to all stages of the design, procurement, manufacturing, testing and delivery of the product.

Add 1.4.2 The supplier shall test the operation of the kiosk / cabinet in their shop. The *Contractor* shall undertake all required field testing and commissioning of any controls required. Powder coat adhesion test results shall be provided by the manufacturer.

Add 1.4.3 Inspect each installed unit for damage. Replace damaged components.

Add 1.4.4 Provide a minimum of 5 *Days* advanced notice of dates and times for field tests. Field tests shall include a complete demonstration of operation of the kiosk / cabinet.

Add 1.4.5 Provide instruments to make and record test results.

Add 1.4.6 Tests and Observations: Supplier shall test all circuits and controls prior to shipping.

Add 1.4.7 Replace or repair damaged and malfunctioning units, make necessary adjustments, and retest. Repeat procedure until all units operate properly.

Add 1.4.8 Required field tests are to be confirmed with the *City Engineer* including, but not limited to:

- Concrete testing.
- Flashing out of traffic signal wiring.
- Arc flash test results.

- Pole fabrication test reports.
- Powder coat test reports.

Set-up testing and commissioning reports may also be required for, but not limited to:

- Traffic controllers.
- Cameras.
- UPS.

1.5 Measurement for Payment

Add 1.5.1 Unless otherwise directed in the *Contract Documents*, payment for the supply and installation of service kiosks and cabinets shall be at the lump-sum price as indicated in the *Schedule of Quantities and Prices*.

1.6 Warranty

Add 1.6.1 The *Contractor* shall provide a two-year parts and labour warranty on all materials, components, products and systems from the date of *Substantial Performance*.

2.0 PRODUCTS

2.1 Manufacturers

Add 2.1.1 Available products: Those approved to manufacture products are listed in the Approved Materials and Products List in the *Contract Documents*. Only manufacturers listed may supply kiosk and cabinets.

2.2 General Material Requirements

Add 2.2.1 All materials shall be new.

Add 2.2.2 Unless otherwise noted, the kiosk / cabinet shall be fabricated from 12-gauge stainless steel.

Add 2.2.3 All materials shall be corrosion resistant for extended life.

2.3 Fabrication Process

Add 2.3.1 The kiosk / cabinet and doors shall be fabricated to plus or minus 1mm tolerance for proper fit.

Add 2.3.2 All bending shall be done using a break press specifically designed for bending the gauge, size and designation of steel required.

2.4 Connecting Hardware

Add 2.4.1 All screws, bolts, washers, nuts and other similar hardware shall be stainless steel.

Add 2.4.2 All screws shall be stainless steel pan-head machine screw type.

Add 2.4.3 Any bolts that are 1/4-20 or larger shall be stainless steel hex head type.

Add 2.4.4 No sheet metal or self-tapping screws shall be used.

2.5 Welding

Add 2.5.1 All exterior seams shall be of continuously welded construction. All welds shall be free of slag and spatter. All exterior welds shall be ground smooth.

Add 2.5.2 The supplier shall have suitable credentials to weld stainless steel and shall adhere to all applicable ANSI standards.

2.6 Doors and Hinges

Add 2.6.1 Doors shall be designed and installed to provide a weather-tight seal to the cabinet.

Add 2.6.2 Doors shall be fabricated out of a single sheet of stainless steel and have wrap-around return for strength and fit.

Add 2.6.3 Doors shall have an inner skin for additional strength. The bottom of each door shall have ventilation holes.

Add 2.6.4 Doors shall be fully gasketed against the cabinet.

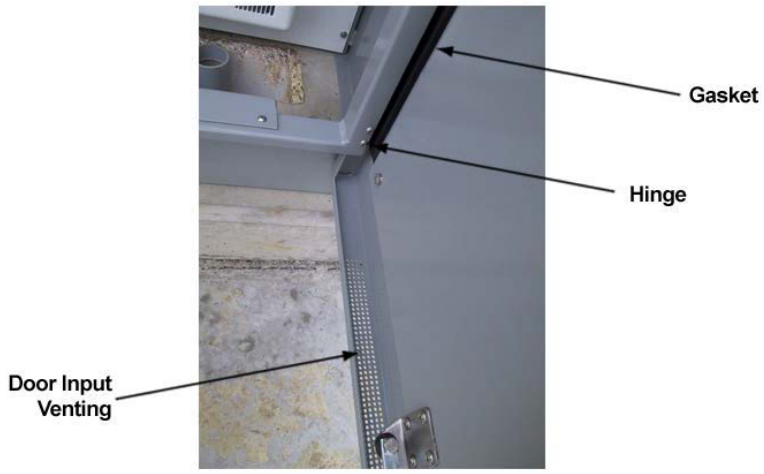
Add 2.6.5 Door hinges shall be positioned so they are hidden behind the door and cannot be accessed with the door closed. A minimum of two hinges are required per door.

Add 2.6.6 Each door shall have a pneumatic return device to control the rate of door open and close and prevent opening beyond 90˚ (Faucher Series 777 or *Approved Equal*). The door shall be bonded to the cabinet with a bare ribbon type conductor.

Add 2.6.7 Door handles shall be recessed and of three-point contact stainless steel construction. The handles shall be designed to be vandal proof and accommodate a City padlock and shall latch to the cabinet 16-gauge stainless steel rails and rollers which shall be fabricated to provide a secure and well-sealed attachment to the cabinet.

Add 2.6.8 The exterior of the doors shall have continuous welds.

Add 2.6.9 All exterior corners shall be rounded to a minimum radius of 3mm. All sharp edges shall be de-burred to reduce hazards to service personnel.



2.7 Cabinet and Kiosk

Add 2.7.1 The cabinet / kiosk shall be constructed to meet NEMA 3R standards using 12-gauge stainless steel. They shall be made up of the main body, roof section and inner wall. These components shall be welded together and fit plumb and square.

Add 2.7.2 The cabinet / kiosk shall have a peaked roof with a 20˚ slope.

Add 2.7.3 The cabinet / kiosk shall be designed to attach to concrete pad via an anchoring system specifically designed for exterior locations, such as Hilti Drop-In Anchor HDI or *Approved Equal*. The manufacturer shall supply anchors with the cabinet.

Add 2.7.4 The exterior of the cabinet / kiosk shall have continuous welds.

Add 2.7.5 The cabinet / kiosk main body shall have a suitable return to seal the door as shown below.

Add 2.7.6 The cabinet / kiosk shall contain two LED Strip Lights (RAB UC-LED300-NW or *Approved Equal*) controlled with door switch, two thermostatically controlled fans (EBM4600 or *Approved Equal*), a thermostatically controlled 500W heater

(applicable to cabinet only) (Oulette OVS0502BL or *Approved Equal*), and 120V spec grade ground fault duplex receptacle.

Add 2.7.7 The cabinet / kiosk shall be equipped with lifting brackets, which shall be removed after the installation.

Add 2.7.8 All exterior corners of the cabinet / kiosk shall be rounded to a minimum radius of 3mm. All sharp edges shall be de-burred to reduce hazards to service personnel.

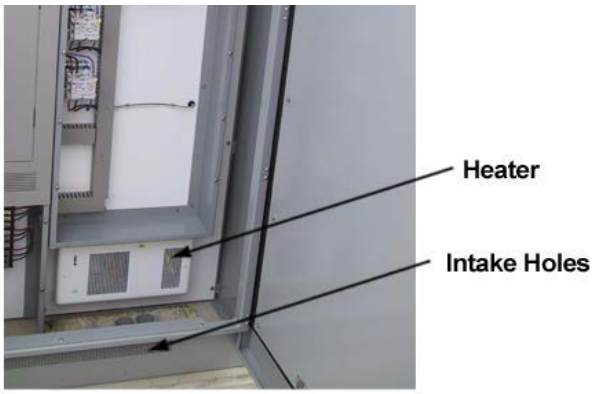
2.8 Ventilation

Add 2.8.1 The cabinet / kiosk along with the doors shall be provided with an engineered ventilation system designed to move filtered air in through the bottom of the cabinet / kiosk and out through the top. The internal air temperature shall be thermostatically controlled to allow the internal equipment to operate within their recommended operation temperatures and to reduce condensation. The supplier shall produce details of the ventilation system, how it works, and evidence that the system has been engineered.

The cabinet / kiosk shall have intake vents in the lower portion of each door and exhaust vents on the cabinet / kiosk above the door that are protected with finger safe anti-vandalism protection when the door is closed.

Ventilation holes shall not be larger than 3mm diameter to prevent the entry of foreign particles into the cabinet / kiosk.

Both intake and exhaust vent shall be filtered.



2.9 Equipment Mounting Inner Wall

Add 2.9.1 Equipment shall be mounted on an inner panel.

Add 2.9.2 Equipment mounting panels shall be constructed from minimum 14-gauge galvanized steel.

2.10 Finish

Add 2.10.1 Upon completion of fabrication, the cabinet / kiosk, door and inner wall shall be finished as follows:

- The surface shall be thoroughly cleaned and degreased using alkaline cleaner and then rinsed.
- The surfaces shall be brush blasted to a 1.5 to 2mil profile.

- The surfaces shall then be pre-baked and a prime coat shall be electrostatically applied (zinc epoxy powder primer) 2 to 3mils in thickness.
- After the prime coat has set, the top coat shall be electrostatically applied (polyester urethane anti-graffiti type resin for cabinet and doors) 3 to 5mils in thickness. Color shall be as defined by the RAL number listed on the *Drawings* for the cabinet / kiosk and door and white for the internal back plane.

Add 2.10.2 An independent testing agency shall test and verify the final powder adhesion via scratch tests.

Add 2.10.4 The final product shall be free of dents, scratches, weld burns and abrasions harmful to its strength and general appearance.

2.11 General Electrical

Add 2.11.1 An inner mask shall be installed to protect personnel from electrical hazard. The mask shall have cut-outs for circuit breaker toggle mechanisms. Knock-outs in the mask shall be provided for all spare breaker spaces.

Add 2.11.2 All equipment shall be mounted on stand-off back panels and shall be secured using 8-32 inserts.

2.12 Metering

Add 2.12.1 Where required, metering shall meet the approval of the local utility (BC Hydro). All metering shall be mounted inside the cabinet with a Lexan window to read the meter or use an antenna.

Add 2.12.2 Current transformers shall be to local utility standards. Current transformers and metering cabinets shall be sized and laid out to meet utility standards.

2.13 Panel Boards

Add 2.13.1 The main panel boards shall have a copper bus and shall be supplied based on the panel schedule on the *Contract Drawings*.

Add 2.13.2 All panels shall be supplied with the breakers installed.

Add 2.13.3 For cabinets and kiosks, a load center shall also be supplied to feed internal lighting, heater (for cabinets only), fan, receptacle and thermostat. This panel may also feed some external devices noted on the *Contract Drawings*.

Add 2.13.4 The panel boards and load centers shall be Schneider Square D, or *Approved Equal*.

Add 2.13.5 Panel boards and load centers shall be securely attached to the kiosk / cabinet back plane and shall be located for ease of access and servicing.

Add 2.13.6 Panels shall have breaker covers over signal breakers where signals and lighting are in the kiosk / cabinet. This is to protect accidental turn-off of traffic signal breakers. See the following photos:

2.14 Circuit Breakers

Add 2.14.1 The main breaker (reverse breaker not allowed) shall be thermal magnetic trip, molded-case, and bolt-on type (Schneider Square D, or *Approved Equal*).

Add 2.14.2 Branch circuit breakers shall be thermal magnetic trip, molded-case, bolt-on type (Schneider Square D, or *Approved Equal*) to suit the main panel board.

Add 2.14.3 The minimum fault current shall be as noted on the *Contract Drawings*. Series rating of breakers may be allowed at the discretion of the *City Engineer*, panel supplier shall provide

calculations for review.

Add 2.14.4 Breaker terminals shall be rated for a minimum of 75˚C.

2.15 Transformers

Add 2.15.1 Transformers shall be dry type, VPI style (Hammond epoxy type, or *Approved Equal*).

Add 2.15.2 Transformer size and voltage shall be as noted on the *Contract Drawings*.

Add 2.15.3 Transformers shall be mounted and attached in a suitable location for ease of access.

Add 2.15.4 All transformer windings shall be copper.

2.16 Grounding and Surge Protection

Add 2.16.1 The grounding system shall be designed to meet all CSA standards and any codes and local utility standards.

Add 2.16.2 The grounding system shall be designed as part of the power distribution system.

Add 2.16.3 Surge protection shall be provided. For cabinets on the main panel bus and for kiosks on the secondary side of the transformer, surge protection shall be Advanced Protection Technology or *Approved Equal*.

2.17 Lighting Controls

Add 2.17.1 Lighting controls shall be as noted on the *Drawings*.

Add 2.17.2 Contactors (an electrically controlled switch or relay) shall be rated for lighting loads.

2.18 Pull Boxes and Wireways

Add 2.18.1 Pull boxes and wire ways shall be provided for ease of field wiring and trouble shooting. Pull box size and locations shall meet BC Hydro and other applicable utility standards.

Add 2.18.2 All wire ways and pull boxes shall have removable covers.

2.19 Wiring

Add 2.19.1 All wiring shall be neatly grouped, bundled and ty-rapped as shown in in *2.19.5 of this Section*.

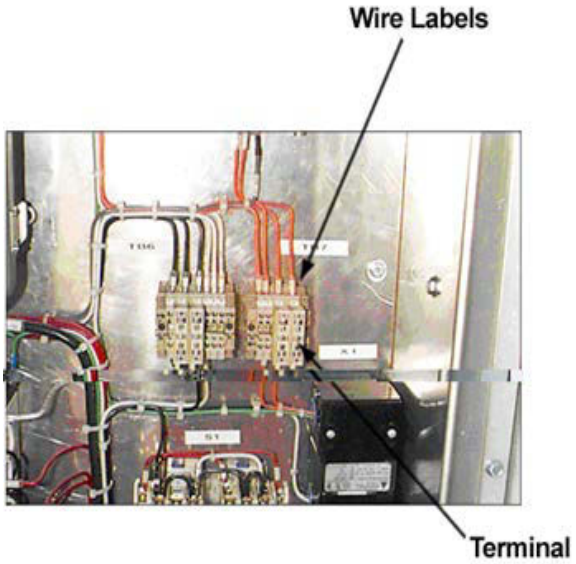
Add 2.19.2 All conductors shall be stranded copper RW90 insulation.

Add 2.19.3 Provide 8-32 inserts and ty-rap mounts for the attachment of

wiring.

Add 2.19.4 Wiring and terminal blocks shall be labeled.

Add 2.19.5 All wiring shall meet CEC standards.



Add 2.19.6 All field wire shall be RWU90, stranded copper.

2.20 Terminal Blocks

Add 2.20.1 Terminal blocks in the contactor cabinet shall be mounted using DIN Rail or *Approved Equal* for stranded copper wiring.

Add 2.20.2 Output wiring shall be connected via terminal blocks to accept field wiring from #2 AWG to #14 AWG.

Add 2.20.3 Terminals for bonding conductors will also be required.

2.21 Labelling

Add 2.21.1 All products shall be labeled (inside) with the supplier's company name, model number, panel rating and the date of manufacture. Kiosks / cabinets shall have a waterproof label on the outside of the kiosk / cabinet which lists the weight of the cabinet. A waterproof decal (with kiosk or cabinet number) shall be supplied with the kiosk or cabinet and installed by the *City*.

Add 2.21.2 The supplier shall provide adhesive Lamicoid or vinyl labels on the inside of each kiosk / cabinet for each component. Each contactor and output circuit shall also be labeled in accordance with the supplier's lighting design.

Add 2.21.3 All ID labels shall have 6mm to 12mm high white characters on a red background as shown in *2.21.5 of this Section*.

Add 2.21.4 All wiring shall be labeled with computer generated sleeve type wire markers.

Add 2.21.5 The inner mask shall be supplied with a panel directory and holder for the single line diagram and manuals.

Arc flash labels shall be placed on the cover (in visible locations) of all exposed live equipment.

2.22 Packaging Add 2.22.1 Each kiosk / cabinet shall be lag bolted to two 100mm x 100mm posts along the shorter sides of the cabinet to be used for support when kiosk / cabinet is being lifted or moved.

3.0 EXECUTION

3.1 Installation Add 3.1.1 The cabinet / kiosk shall be designed to attach to the concrete pad via Hilti or *Approved Equal* anchors, which are supplied with the kiosk / cabinet. The kiosk / cabinet supplier shall supply a bolt layout template with the cabinet.

Add 3.1.2 Seal kiosk / cabinet to concrete with exterior rated, premium silicone sealant or *Approved Equal*, to provide a weather-tight seal.

Add 3.1.3 For standard kiosk / cabinets, the conduit layout shall be as shown on *Standard Detail Drawing E1.4*. For non-standard (custom) cabinets or kiosks, the conduit layout shall be provided by the supplier along with a conduit layout template.

Add 3.1.4 Concrete Foundations:

- Size as noted on *Standard Detail Drawing E1.4*. The intent is to select the size of the kiosk / cabinet and foundation to minimize the footprint.
- Concrete shall have a minimum compressive strength of 32MPa at 28 days.
- Comply with details on *Standard Detail Drawing E1.4* for reinforcing, attachment and other requirements.
- Trowel finish and rub smooth parts exposed to view. Top of concrete shall be level. Chamfer all exposed edges. Standing pad required.
- Conduits shall be as noted on *Standard Detail Drawing E1.4*. Supplier to provide template locating conduits to suit the kiosk or cabinet.

3.2	**Grounding**	Add 3.2.1	Install all grounding and bonding in accordance with *CEC* and the *Drawings*. Install a minimum of two ground plates per cabinet or kiosk and place a minimum of 1.5m apart.
3.3	**Bonding**	Add 3.3.1	For all new installations, a continuous bonding conductor shall run from service panel or kiosk to the street light pole. If bonding conductor is impossible to pull via existing conduit, bonding mitigation solution shall apply. Refer to *Standard Detail Drawing E7.19*.

END OF SECTION 26 56 02S

Section 31 05 17 Aggregates and Granular Materials

1.0 GENERAL

1.3 Approvals

Append to 1.3.1

The *Contractor* shall be responsible to provide samples to the *Contract Administrator*.

2.0 PRODUCTS

2.1 General

Add 2.1.3

Approved Granulars, as referenced in the *Standard Detail Drawings*, refers to *2.2*, *2.3*, *2.5*, *2.6*, *2.7*, *2.9*, *2.10*, *2.11*, and *2.13 of this Section*.

2.2 Native Material

Append to 2.2.1

Granular native material may be used only with the express written permission of the *City Engineer*, and provided it can be compacted to the requirement stated in *Section 31 23 01 Excavating, Trenching and Backfilling*. All costs for *Quality Control* testing of granular native materials shall be covered by the *Contractor*.

The *City Engineer* may require analytical laboratory confirmation that the native materials meet the applicable BC Ministry of Environment land use standards (residential or industrial).

Add 2.2.2

Granular native materials must also meet the following requirements:

Property	Specification
% Passing the 600µm (#30) Sieve	<55%
% Passing the 75µm (#200) Sieve	<20%
Liquid Limit (LL)	<25
Plasticity Index (PI)	<10
Coefficient of Uniformity (Cu)	Well-Graded (>10)
Moisture Content	±2% of the Optimum
Organic Content	<0.5% by Mass
Maximum Loose Lift Thickness	200mm

Add 2.2.3

Prior to any granular native material being approved for use, the grain size and in-situ moisture content of the proposed material must be verified by washed sieve and moisture content test as per *ASTM C117*, *ASTM C136*, and *ASTM D2216*.

Add 2.2.4 A Modified Proctor Test, as per *ASTM D1557*, shall be conducted to determine the moisture-density relationship of the proposed soil. The in-situ moisture content shall be compared against the optimum moisture content determined from the Modified Proctor Test to give an indication as to the viability of using the material. If the in-situ moisture content is found to be within the range of moisture levels that will yield the desired minimum compaction levels, it may be considered for approval. The moisture content and grain sizes shall be closely monitored thereafter to ensure that material properties are consistent and minimum compaction levels can be achieved. Every effort shall be made to maintain the favourable moisture of a suitable granular native material.

Add 2.2.5 Only native granular materials with properties within above limits, as verified by Sieve Analysis, Proctor Tests and in-situ Moisture Tests can be used as backfill materials. Any deviation in materials as the *Work* progresses or any changes in soils strata throughout the depth must meet the same criteria as outlined above; testing confirming continuous compliance and the frequency of that testing shall be to the satisfaction of the *City Engineer*.

Add 2.2.6 Compaction shall be done in equal lifts not exceeding 200mm in loose thickness, as necessary throughout the entire depth of the backfill to ensure even and adequate compaction to the specified levels of compaction. Thicker lifts may be considered if it can be demonstrated that specified densities are achievable for a given combination of material, equipment, and conditions. Before the *City Engineer* gives their approval, the *Contractor* may be called upon to demonstrate that their compaction method and machinery are feasible and adequate to meet the specified requirements.

Add 2.2.7 The granular native material must be able to provide good stability and acceptable load bearing capacity with minimum settlement to the satisfaction of the *City Engineer*. The *City Engineer* may require the *Contractor* to provide an independent third-party certification and or additional testing to verify the specified properties of the granular native backfill at the *Contractor*'s cost.

Add 2.2.8 The re-use of soils containing silts and clays, outside of the parameters set above, is typically not allowed because of the difficulty in achieving consistent compaction levels. Where, in the opinion of the *City Engineer*, native material is unsuitable for re-use, it shall be removed from the job and approved granular material shall be substituted and no claim for extra payment shall be made.

Add 2.2.9 If granular native materials are acceptable for use, they are only to be used up to 1.2m below finished grade.

Add 2.2.10 Granular native materials shall not be used in inclement weather.

2.3 Pit Run Gravel

Delete 2.3 and replace with

Pit Run - City of Vancouver Aggregate #12:

This granular material may be considered for deep fills only if the regular used items, City of Vancouver Aggregate #17 and #9 are not available from the suppliers. It shall be well-graded and free-draining with clay lumps, organic matter and other extraneous material totalling not more than 0.5% by mass, and screened to remove all stones larger than 75mm. The material shall compact readily to the density specified for its use. The *City Engineer* may specify additional requirements as part of the conditions of accepting the material for backfill purpose. The final acceptance of the material will be solely at the discretion of the *City Engineer*. The grading limits shall be:

Sieve Designation	Percent Passing
75.0mm	100
12.5mm	56 - 100
4.75mm (No. 4)	32 – 83
2.36mm (No. 8)	17 – 70
75µm (No. 200)	2 - 10

2.5 River Sand

Delete 2.5 and replace with

Sand Fill - City of Vancouver Aggregate #17:

This granular material is used for deep fills, to a maximum upper limit of 0.6m below the base of pavement. This material shall be sand with uniform quality. Clean sand containing less than 0.5% organic materials is generally acceptable. This material is used for deep fills where a granular fill material is required. This material is also used for waterworks pipe bedding. The grading limits shall be:

Sieve Designation	Percent Passing
12.5mm	100
9.5mm	91 – 100
4.75mm (No. 4)	83 – 100
2.36mm (No. 8)	73 – 94
1.18mm (No. 16)	57 – 80
600µm (No. 30)	33 – 60
300µm (No. 50)	10 – 37
150µm (No. 100)	4 - 17
75µm (No. 200)	0 - 5

2.6 Drain Rock

Delete 2.6.1 and replace with

19mm Clear Drain Rock - City of Vancouver Aggregate #7:

Drain rock shall be of uniform quality, thoroughly washed free of sand, silt, and clay, and shall not contain more than 15% in crushed particles. It shall consist of durable particles capable of withstanding the effects of handling and spreading without degradation or production of deleterious fines. The grading limits shall be:

Sieve Designation	Percent Passing
37.5mm	100
25.0mm	0 - 100
19.0mm	0 – 100
12.5mm	0 – 30
4.75mm (No. 4)	0 - 3

Add 2.6.3

An alternate partially crushed rock with proven physical properties against degradation meeting the above gradation limits may be allowed for use as drain rock with the *City Engineer*'s approval. Final acceptance of the material will be at the discretion of the *City Engineer*.

2.7 Granular Pipe Bedding and Surround Material

Delete 2.7.1 and replace with

20mm Clear Crushed Aggregate - City of Vancouver Aggregate #15:

This material shall be of uniform quality, crushed to size as necessary, and shall consist of sound, tough, durable, highly angular, 100% mechanically crushed fragments with two or more fractured faces having a rough surface texture. It shall be free from an excess of flat or elongated particles, wood, shells, coatings of clay, or any other deleterious material. Aggregates with objectionable polishing characteristics are not acceptable. This material is typically used for sewer pipe bedding. The grading limits shall be:

Sieve Designation	Percent Passing
19.0mm	100
12.5mm	28 - 46
9.5mm	8 - 21
4.75mm (No. 4)	3 - 11
2.36mm (No. 8)	0 - 6
1.18mm (No. 16)	0 - 2

2.9 Crushed Granular Sub-Base

Delete 2.9 and replace with

75mm Minus Crushed Tailings - City of Vancouver Aggregate #13:

This material shall be a well-graded, 75mm minus, 100% crushed-quarried material of uniform quality suitable for use in fills and road subbase lifts. It shall consist of durable particles capable of withstanding the effects of handling, spreading and compacting without degrading, resulting in the production of deleterious fines. The grading limits shall be:

Sieve Designation	Percent Passing
75.0mm	100
19.0mm	40 – 50
4.75mm (No. 4)	20 – 35
75µm (No. 200)	2 - 8

2.10 Granular Base

Delete 2.10 and replace with

19mm Minus Combined Crushed Aggregate Fill (Mulch) - City of Vancouver Aggregate #9:

This material shall be of uniform quality, crushed to size as necessary, and consisting of sound, tough, durable, mechanically crushed fragments. A minimum 60% of particles by mass of the portion retained on a 9.5mm sieve shall have at least one freshly fractured face. The grading limits shall be:

Sieve Designation	Percent Passing
19.0mm	100
12.5mm	61 – 95
9.5mm	45 – 85
4.75mm (No. 4)	35 – 60
2.36mm (No. 8)	26 – 47
1.18mm (No. 16)	20 – 39
600µm (No. 30)	13 – 29
300µm (No. 50)	8 – 21
150µm (No. 100)	5 – 15
75µm (No. 200)	2 - 8

This is a high quality granular fill and may be used up to the bottom of the asphalt or concrete surface.

2.11 Recycled Aggregate Material

Delete 2.11.1 and replace with

25mm Minus Combined Crushed Recycled Aggregate – City of Vancouver Aggregate #30:

This material shall be of uniform quality, crushed to size as necessary and consisting of sound, tough, durable, mechanically crushed mixture of concrete, asphalt slab, gravel and natural sands. This crushed product shall meet the gradation and other specified requirements as indicated below. Final acceptance and usage of this material will be at the sole discretion of the *City Engineer*. The grading limits shall be:

Sieve Designation	Percent Passing
25.0mm	100
19.0mm	94 - 100
12.5mm	62 - 95
9.5mm	49 - 85
4.75mm (No. 4)	35 - 63
2.36mm (No. 8)	26 - 47
1.18mm (No. 16)	19 – 37
600µm (No. 30)	13 – 29
300µm (No. 50)	8 - 21
150µm (No. 100)	5 - 15
75µm (No. 200)	3 - 9

Other properties:

Property	Specification
% Asphalt Coated Aggregate Particles	Max. 40
% Total Asphalt Cement	Max. 3.0
% Loss in LA Abrasion – Coarse Aggregate	Max. 30
% Loss in Micro-Deval – Coarse Aggregate	Max. 25
% Loss in Micro-Deval – Fine Aggregate	Max. 30
% Loss in MgSO4 Soundness – Coarse Aggregate	Max. 20
% Loss in MgSO4 Soundness – Fine Aggregate	Max. 25
% Organics Matter	Max. 0.5
% 1-Face Fracture Particles	Min. 60
pH Level	Max. 11 (Reference Only)
Environmental	BC Ministry of Environment's CSR - Minimum RL standards for top 1m of boulevards and street medians, minimum IL standards in all remaining areas

Properties of the final product must satisfy the specified requirements unless otherwise allowed by the *City Engineer*.

Add 2.11.2

The *Contractor* shall only source recycled aggregate material from a supplier who undertakes a minimum of one set of industry standard material testing per year and which confirm that the materials supplied meet the gradation and other property requirements of *2.11.1 of this Section*. In addition, any product changes shall have a minimum population sample of 30 test results to confirm properties. All test results are subject to review by the *City Engineer*. All sources for recycled material must be pre-approved by the *City Engineer*.

2.13 Pea Gravel

Add 2.13.1 9.5mm Minus Rounded Granular Aggregate (Pea-Gravel):

The material may be used only in backfill operations adjacent to foundation walls. The material shall be of uniform quality, thoroughly washed free of sand, silt and clay and shall contain no more than 5% non-rounded (having one or more fractured faces) particles by mass on material retained on the 4.75mm sieve size or larger. The particles shall be durable, capable of withstanding the effects of handling, placement and compaction without the production of deleterious fines. The grading limits shall be:

Sieve Designation	Percent Passing
9.5mm	100
6.3mm	60 – 85
4.75mm (No. 4)	40 – 75
2.36mm (No. 8)	0 – 13
1.18mm (No. 16)	0 - 1

Add 2.13.2 Any proposed alternative materials for the specified pea gravel must be approved by the *City Engineer* prior to its use. The *City Engineer* may also require additional qualification requirements for the replacement product.

END OF SECTION 31 05 17

Section 31 11 01 Clearing and Grubbing

1.0 GENERAL

1.4 Measurement and Payment

Append to 1.4.1 Unless otherwise noted in the *Contract Documents*, payment for all *Work* under this Section will be incidental to payment for *Work* described in other Sections.

Append to 1.4.2 Unless otherwise noted in the *Contract Documents*, payment for all *Work* under this Section will be incidental to payment for *Work* described in other Sections.

END OF SECTION 31 11 01

Section 31 11 41 Shrub and Tree Preservation

1.0 GENERAL

1.2	**References**	Add 1.2.4	*International Society of Arboriculture (PNW) Species Ratings for Landscape Tree Appraisal*
1.3	**Measurement and Payment**	Append to 1.3.1	Unless otherwise noted in the *Contract Documents*, payment for all *Work* under this Section will be incidental to payment for *Work* described in other Sections.
		Add 1.3.2	The *Contractor* shall, at their own expense, remove, dispose of and replace, any trees which die or are deemed by a suitably qualified arborist to have a low probability of survival, as a result of the *Contractor*'s activities.
1.5	**Protection of Trees Bylaw**	Add 1.5.1	All *Work* around trees, including protection barriers, must be in accordance with the *Protection of Trees Bylaw No. 9958*.

3.0 EXECUTION

3.1	**Existing Trees**	Append to 3.1.2	Temporary storage sites of construction material or soil excavate shall be as far from neighbouring trees as possible.
		Add 3.1.7	Street trees may not be removed, moved, or otherwise impaired, interfered with, or injured without prior approval from the *City Engineer*. Only *City Arborists*, or arborists authorized by the *Contract Administrator*, may prune or remove street trees.
3.2	**Raising Grade Around**	Add 3.2.7	The *Contractor* may not alter the existing grade within the drip line of a street tree, except to raise the grade by no more than: • 5cm within a 1m radius around the trunk. • 10cm between the 1m radius and the drip line of the tree.
3.4	**Pruning**	Append to 3.4.1	No tree branches or roots may be pruned or cut without prior approval by the *City Engineer*. Branches and roots are to be cut with a sharp axe or saw with the *Contract Administrator* present. Cutting roots with excavating equipment such as a backhoe, excavator, or Gradall bucket is not acceptable.
		Add 3.4.2	If branches unavoidably obstruct *Work* activities, or if they are in such proximity that they are likely to be damaged, the *Contractor* shall request an inspection by the *Contract Administrator* to determine the course of action.

3.5	**Clean-up**	Append to 3.5.2	Replacement tree species, size and location to be approved by the *City Engineer*.
3.6	**Work Adjacent to Trees**	Add 3.6.1	*Site* access shall be planned with consideration for avoiding conflicts with street trees. Alternate access routes may be required to protect street trees.
		Add 3.6.2	Where required by the *City Engineer* or *City Arborist*, alternative root preserving techniques such as hydro-vacuum excavation or hand digging is to be used.
		Add 3.6.3	Soil compaction reducing techniques such as weight displacement plates or thick wood mulch (20 – 30cm) may be required by the *City Engineer* if street tree rooting area is likely to be affected by vehicular movement.

END OF SECTION 31 11 41

Section 31 15 60 Dust Control

3.0 EXECUTION

3.1 Application Append to 3.1.1 The intention of this specification is to apply water when necessary to control dust at all times. It is the *Contractor*'s option to use the other methods described in this section.

3.3 Haul Routes Add 3.3.1 *Haul Routes* along and across any public traveled way shall be kept free and clean of all rubbish and debris, including spillage, resulting from construction operations. Water or dust palliative, or both, shall be supplied as necessary to prevent dust nuisance, to the satisfaction of the *Contract Administrator*.

Add 3.3.2 Any vehicle exiting the *Site* that is handling loose material or travelling over loose material shall be inspected to ensure no debris is on the vehicle or between the tires.

Add 3.3.3 If the *Site* is not adequately controlled for dust, or kept clean to the satisfaction of the *Contract Administrator*, the *City* may do the *Work* at the *Contractor*'s expense. Flushing of debris into City catchbasins is not permitted without the express written consent of the *City Engineer*.

Add 3.3.4 A truck wheel wash station may be required to be installed at the *Contractor*'s expense as per *Section 01 57 01 Environmental Protection* if tracking occurs.

END OF SECTION 31 15 60

Section 31 22 01 Site Grading

1.0 GENERAL

1.3	**Site Conditions**	Add 1.3.3	Size, depth and location of existing utilities and structures shown on the *Contract Drawings* are for guidance only. Completeness and accuracy are not guaranteed.
		Add 1.3.4	Prevent damage to all adjacent natural growth, landscaping, buildings, structures and underground and overhead utilities. Make-good all damage to the satisfaction of the *City Engineer*.
1.4	**Measurement and Payment**	Delete 1.4.1 to 1.4.8 and replace with	Unless otherwise noted in the *Contract Documents*, payment for all *Work* under this Section will be incidental to payment for *Work* described in other Sections.

3.0 EXECUTION

3.1	**Stripping of Topsoil**	Add 3.1.3	When excavating the soil trench, care must be taken to avoid disruption to the granular base structure of the curb and sidewalk.
3.2	**Grading**	Delete 3.2.3 and replace with	Excavate soft and unstable areas below subgrade that cannot be compacted to this standard and fill with approved backfill material, except in locations where special environmental conditions have been identified. In such cases, appropriate alternative solutions to be approved by the *City Engineer* and carried out.
		Delete 3.2.6 and replace with	Scarify areas showing excessive compaction to minimum depth of 100 mm and compact as directed by the *City Engineer* immediately before placing topsoil.

END OF SECTION 31 22 01

Section 31 23 01 Excavating, Trenching and Backfilling

1.0 GENERAL

1.8	**Limitations of Open Trench**	Append to 1.8.1	All backfilling procedures shall be carried out as promptly as possible behind pipe laying. Under no circumstances shall an inactive open trench be open for more than 5 *Days* unless otherwise approved by the *Contract Administrator*. In addition, no more than one *Block* may remain un-backfilled at any given time, unless approved in advance by the *Contract Administrator*.
		Add 1.8.2	The use of road plates to cover excavations and restore travel lanes is generally not permitted. Where construction necessitates their use, a letter signed by an *Engineer* must be submitted ensuring the installation is safe and that the plate will support H-20 traffic loading. Plates need to be properly secured (either pinned or recessed into the pavement) and feathered a minimum 300mm with existing road asphalt. Plates need to extend a minimum 300mm beyond the trench, and any pavement damage related to the plate installation will need to be repaired.
1.9	**Permits and Approvals**	Add 1.9.2	Conduct a *Condition Survey* with the *Contract Administrator* prior to commencing any excavation unless otherwise directed by the *City Engineer*.
1.10	**Measurement and Payment**	Delete 1.10.2 and replace with	Unless otherwise noted in the *Contract Documents*, payment for trench excavation by hand (hand dig) or hydro-vacuum excavation will be incidental to payment for *Work* described in other Sections.
		Add 1.10.9	Payment for rock excavation will be made in accordance with *Section 31 23 17 Rock Removal*.
		Add 1.10.10	Unless otherwise noted in the *Contract Documents*, payment for all charges or fees related to inspection from third-party utility companies and / or external authorities / agencies will be incidental to payment for *Work* described in other Sections.
		Add 1.10.11	Payment for additional paving, including saw-cutting, removal of existing asphalt and base, and preparation of new base shall be made as per the relevant unit price item as indicated in the *Schedule of Quantities and Prices*. Payment for additional paving connected to mainline trench pavement repair shall be paid using the lowest unit rate in the *Schedule of Quantities and Prices*.
		Add 1.10.12	Unless otherwise noted in the *Contract Documents*, payment for all costs incurred to obtain professional geotechnical services will be incidental to payment for *Work* described in

			other Sections.
		Add 1.10.13	Where extended trench width is required and approved by the *City Engineer* due to an unstable soil condition beyond the *Contractor*'s control, the cost of such upgrading shall be borne by the *Owner*. However, where extended trench width has occurred due to unapproved over-excavation, the cost of such upgrading shall be borne by the *Contractor*.
		Add 1.10.14	Unless otherwise noted in the *Contract Documents*, payment for all costs of vertical trench timbering or sheeting protection will be incidental to payment for *Work* described in other Sections.
1.11	**Inspection and Testing**	Add 1.11.2	Sources and gradation curves for backfill materials must be submitted to the *Contract Administrator* at least two weeks prior to construction. Material samples are required if requested by the *City Engineer*.
		Add 1.11.3	Compaction tests will be performed as outlined in the *Contract Documents* and approved by the *City Engineer*. Separate compaction tests at each depth are not required at the same station if storm and sanitary sewers are in a common trench.
		Add 1.11.4	The *Contractor* shall ensure all compaction test results (for all failed and passed tests) and test certificates are submitted to the *Contract Administrator* within 48 hours. Compaction test results shall be submitted by third parties to the *Contract Administrator*.
2.0	**PRODUCTS**		
2.1	**General**	Add 2.1.2	Refer to *Section 31 05 17 Aggregates and Granular Materials* and discipline-specific sections, such as *Section 33 11 01 Waterworks*, *Section 33 40 01 Storm Sewers* and *Section 33 30 01 Sanitary Sewers* for additional requirements.
2.2	**Use of Specified Materials**	Delete 2.2.1 and replace with	Backfill for over-excavated trench to be one of the following, as indicated in the *Contract Documents* or as directed by the *City Engineer*: .1 75mm Minus Crushed Tailings (City of Vancouver Aggregate #13). .2 19mm Minus Combined Crushed Aggregate Fill (Mulch) (City of Vancouver Aggregate #9). .3 19mm Clear Drain Rock (City of Vancouver Aggregate #7) (for waterworks only – only where approved by the *City Engineer*). .4 20mm Clear Crushed Aggregate (City of Vancouver Aggregate #15) (for waterworks only – only where approved by the *City Engineer*). .5 25mm Minus Combined Crushed Recycled Aggregate (City of Vancouver Aggregate #30) (for sewers only).

Delete 2.2.3 and replace with

Backfill for trenches and excavations to be one of the following, as indicated in the *Contract Documents* or as directed by the *City Engineer*:

.1 Approved granular native material:

.1 Native silts and / or clay materials shall not be used, as clarified in *Section 31 05 17 Aggregates and Granular Materials*.

.2 Native granular materials (primarily sand) are permissible for backfilling up to 1.2m below the finished grade provided that they meet the requirements set forth in *Section 31 05 17 Aggregates and Granular Materials* and have been approved by the *City Engineer*. All approved native granular materials shall be compacted to the minimum densities in *3.5.4 of this Section*. In addition to the compaction requirements, the granular native material must be proven to be stable enough to provide a good foundation for the lifts of granular base on top. The acceptance of certain native granular materials will be at the sole discretion of the *City Engineer*. The *City Engineer* may also impose additional acceptance requirements as deemed necessary for the use of approved native granular material. See *2.2 of Section 31 05 17 Aggregates and Granular Materials* for further details.

.2 Granular or Sand Backfill:

.1 Use imported granular fill materials as per *Section 31 05 17 Aggregates and Granular Materials* unless otherwise specified or approved by the *City Engineer*.

.3 Controlled Density Fill:

.1 Controlled density fill shall meet the requirements in *Section 31 23 23 Controlled Density Fill*.

.2 Backfill material shall be free of large stones and / or frozen material.

3.0 EXECUTION

3.1 Site Preparation

Delete 3.1.2 and replace with

The *Contractor* shall continuously cut existing pavement to its full depth along neat straight lines with a cutting tool to confine the width of the pavement to be disturbed. The *Contractor* shall not disturb the pavement beyond the maximum trench width defined on the *Drawings* or contained herein, or unless approved otherwise by the *City Engineer*.

3.2 Stockpiling

Append to 3.2.1

Do not block curb and gutter drainage with granular materials. Stockpiling must be in accordance with *Section 01 57 01 Environmental Protection*.

3.3 Excavation

Append to 3.3.3 Excavations shall be to the alignment and grades shown on the *Drawings* and as set in the field by the construction survey. Vertical walls on all trenches shall be maintained. If, in the opinion of the *Contract Administrator*, it is impossible or impractical to maintain vertical walls for certain sewer trenches, a "Y" type of excavation will be permitted to a point 300mm above the top of the pipe; trench walls below this point shall be maintained vertical using appropriate shoring methods.

For pipe bedding, the *Contractor* shall over excavate the trench as per *Standard Detail Drawing G4.2, G4.3* and *G4.4* or as specified herein or on the *Drawings*. If the bottom of the excavation extends beyond the required depth, the over-excavation shall be refilled at the *Contractor*'s expense with approved compacted granular material. The use of trench digging machinery will be permitted except where its operations will cause damage to trees, buildings, existing utilities, or existing structures above or below ground. At such locations, hand methods shall be employed to avoid such damage.

Delete 3.3.6 and replace with Hand and hydro-vacuum excavation: excavate by hand if necessary to preserve or minimize damage to existing trees, shrubs, buildings, and all similar existing features or facilities. Where, in the opinion of the *City Engineer*, mechanical excavation presents a high risk of damage to existing underground utilities, the *City Engineer* can require either hand or hydro-vacuum excavation to be done to expose those underground utilities. The cost of hand or hydro-vacuum excavation shall be borne by the *Contractor*.

Append to 3.3.8.1 All water pumped or drained from the *Work* shall be disposed of in a suitable manner satisfactory to the *City Engineer*.

Add 3.3.8.3 Do not discharge silt or sand laden water into sewers. Water discharged into sewers must meet the requirements of *Section 01 57 01 Environmental Protection* and the *Sewer and Watercourse Bylaw No. 8093*.

Add 3.3.8.4 Material that becomes unsuitable, in the opinion of the *City Engineer*, through the *Contractor*'s failure to divert surface water or control water in the trench must be excavated and disposed of at the *Contractor*'s expense.

Add 3.3.8.5 Existing storm service connections shall be permitted to discharge into the trench excavation during new sewer installation through the existing pipe network; however, in no case shall urban runoff be allowed to directly enter the excavation via overland flow during construction, unless approved by the *City Engineer*.

Add 3.3.8.6 Written permission from the *City Engineer* is required before any liquid waste (excluding liquid waste from existing sewer services and / or clean groundwater) may be disposed of through existing *City* sewers.

Append to 3.3.11 Where trench excavation involves the removal of solid bedrock, consolidated glacial till or hardpan, boulders, loose rock, buried concrete pavements, concrete rubble and foundations, or suspected contaminated soils, the *Contractor* must contact the *Contract Administrator* immediately.

Append to 3.3.12 Any materials dropped or spilled during the hauling operations shall be promptly cleaned up by and at the expense of the *Contractor*, to the satisfaction of the *Contract Administrator*.

Refer to *3.3 of Section 31 15 60 Dust Control* for additional hauling requirements.

Add 3.3.13 Vertical trench timbering or sheeting shall be placed in accordance with the requirements of WorkSafeBC or as may be necessary to protect life and property adjacent to or on the *Site*. The *Contractor* shall be responsible for the adequacy of such bracing and shoring. Unless otherwise accepted by the *Contract Administrator*, or as WorkSafeBC Rules and Regulations dictate, vertical trench timbering or sheeting shall be placed so as not to extend below the springline of the largest pipe. No timbering or sheeting shall be left in without the written approval of the *City Engineer*, and when removed, the void left by the raised sheeting shall be backfilled and thoroughly compacted.

Add 3.3.14 All bracing, shoring, and cribbing shall be removed from the trench as backfilling proceeds unless ordered to be left in place by the *City Engineer*.

Installation and removal of bracing, shoring and cribbing shall ensure that the integrity of bedding and initial backfill is maintained during removal operations.

Add 3.3.15 If the *Work* is stopped on the whole or at any part of the trench, and the trench is left open for an unreasonable length of time, as determined by the *Contract Administrator*, in advance of the installation of the pipe, the *Contractor* shall, when directed by the *Contract Administrator*, refill such trench or part thereof until they are ready to proceed with the installation of the pipe.

3.5	**Backfill and Compaction**	Append to 3.5.1	Care must be exercised in selecting compaction equipment. In City *Streets*, there are many utilities with service connections that are susceptible to damage. The use of drop hammer type compactors and large vibrating rollers shall not be allowed, except under special conditions approved by the *City Engineer*. The *Contractor* shall assume all responsibility for costs / damages caused to any existing utility.
		Add 3.5.3.6	All backfilling shall be controlled. The final acceptance to use the backfill method shall be at the sole discretion of the *City Engineer*. No claim shall be made for the proposed backfill method being unaccepted.
		Add 3.5.4.4	Backfill materials shall be placed in uniform lifts not exceeding 300mm in loose thickness, 200mm for approved granular native material, and compacted to specified densities unless otherwise specified or allowed by the *City Engineer*.
3.6	**Surface Restoration**	Add 3.6.1.4	Restorations to be completed in accordance with the requirements of *Section 32 15 01S Surface Restoration*.
		Add 3.6.2.7	Refer to the following sections: • *Section 32 91 21 Topsoil and Finish Grading*. • *Section 32 92 20 Seeding*. • *Section 32 92 19 Hydraulic Seeding*. • *Section 32 92 23 Sodding*. • *Section 32 93 01 Planting of Trees, Shrubs and Ground Covers*.
		Delete 3.6.6 and replace with	Temporary pavement patching to be completed in accordance with the requirements of *Section 32 15 01S Surface Restoration*.
		Delete 3.6.7 and replace with	Permanent pavement restoration to be completed in accordance with the requirements of *Section 32 15 01S Surface Restoration*.
3.7	**Trenching in Peat Areas**	Add 3.7.1	Street *Cut* repairs in peat areas must be restored strictly in accordance with the *Standard Detail Drawing R2.5*.

END OF SECTION 31 23 01

Section 31 23 17 Rock Removal

1.0 GENERAL

1.3	**Definitions**	Delete 1.3.1 and replace with	Rock is defined as all solid rock in the form of bedrock, consolidated glacial till and hardpan that requires breaking by continuous drilling and blasting before excavation. Rock also includes rocks, boulders, buried concrete and foundations having individual volumes in excess of $1.0m^3$, that require breaking by continuous drilling and blasting, or other means, before excavation.
		Add 1.3.5	Concrete forming part of the road pavement structure is not classified as rock.
1.6	**Measurement and Payment**	Delete 1.6.1 and replace with	All units of measurement for payment will be as specified herein unless shown otherwise in the *Schedule of Quantities and Prices*.
		Delete 1.6.2 and replace with	Rock removal shall be measured per project as identified in the *Form of Tender*. Measurement for payment will not be based on individual occurrence.
		Delete 1.6.3 and replace with	Rock removed prior to the examination and measurement by the *Contract Administrator* will not be classified as rock excavation and no payment will be made for rock removal, backfilling and surface restoration.
		Delete 1.6.4 and replace with	Rock will be measured in cubic meters.
		Delete 1.6.5 and replace with	Payment for rock removal by blasting, including any additional material required to backfill the excavated rock, and restore damaged surfaces will be made at the unit price as indicated in the *Schedule of Quantities and Prices*.
		Add 1.6.6	Payment for rock removal where blasting is specifically prohibited will be measured in cubic meters.
		Add 1.6.7	No payment will be made for bedrock or consolidated glacial till or hardpan excavated beyond the limits of the maximum trench width and depth specified.
		Add 1.6.8	No payment will be made for repairing damage to existing pipelines or utilities caused by rock removal.
1.7	**Seismic Survey and Monitoring**	Delete 1.7.1 and replace with	The *Contractor* and the *Contract Administrator* will visit owners of buildings and structures to determine existing conditions and describe blasting and seismic recording operations.

		Delete 1.7.2 and replace with	Cost of seismic survey and monitoring reports will be paid by the *Contractor*.
1.9	**Protection of Work, Property and Public**	Add 1.9.2	Prevent damage to surroundings and injury to persons. Post guards, sound warnings and display signs when blasting is to take place.
3.0	**EXECUTION**		
3.1	**Blasting and Vibration Control**	Add 3.1.5	Exercise care and limit use of explosives to such charges that do not cause damage to existing pipelines and other utilities.
3.2	**Rock Removal**	Delete 3.2.3 and replace with	Blasting operations shall be in accordance with *City* Bylaws.
		Delete 3.2.5 and replace with	Locations where explosive blasting is not permitted will be determined by the *City Engineer*.
		Delete 3.2.7 and replace with	Excavate trenches in accordance with *Section 31 23 01 Excavating, Trenching and Backfilling* and to sections shown on applicable *Drawings*.
3.3	**Rock Disposal**	Delete 3.3.1 and replace with	As directed by the *Contract Administrator*, dispose of surplus removed rock at an approved location.

END OF SECTION 31 23 17

Section 31 23 23 Controlled Density Fill

1.0 GENERAL

1.5	**Inspection and Testing**	Add 1.5.2	Submit an *Engineer*-certified mix design and *Quality Control* test certificate to the *Contract Administrator* for record upon request. *Quality Control* testing must be performed by an independent CSA-certified inspection agency at least once per pour placed on any one day.

2.0 PRODUCTS

2.1	**Materials**	Add 2.1.7	Controlled density fill supplied shall satisfy the requirements of *CAN / CSA A23.1 Table 5 Alternative 1* and requirements in *Section 03 30 53 Cast-in-Place Concrete*.

3.0 EXECUTION

3.4	**Placing**	Add 3.4.9	Before backfilling proceeds, the excavation shall be free from water, debris or sloughed soil unless considered impractical by the *City Engineer*.
		Add 3.4.10	Timbering and shoring shall be removed as backfilling with control density fill progresses unless specifically authorized by the *City Engineer* to do otherwise

END OF SECTION 31 23 23

Section 31 24 13 Roadway Excavation, Embankment and Compaction

2.0 PRODUCTS

2.2 Specified Materials

Delete 2.2.1 and replace with

Backfill for embankment fill (subgrade fill) to be:

.1 Approved granular native material as per *2.2 of Section 31 05 17 Aggregates and Granular Materials*.

.2 Pit Run - City of Vancouver Aggregate #12 as per *2.3 of Section 31 05 17 Aggregates and Granular Materials*.

.3 Sand Fill - City of Vancouver Aggregate #17 as per *2.5 of Section 31 05 17 Aggregates and Granular Materials*.

.4 75mm Minus Crushed Tailings - City of Vancouver Aggregate #13 as per *2.9 of Section 31 05 17 Aggregates and Granular Materials*.

Add 2.2.3

The final acceptance to use the above materials or other proposed materials shall be at the sole discretion of the *City Engineer*.

3.0 EXECUTION

3.4 Placing

Delete 3.4.4 and replace with

Place backfill material in uniform full-width lifts not exceeding 300mm in loose thickness, 200mm for approved granular native material, and compact to specified densities.

END OF SECTION 31 24 13

Section 31 32 19 Geosynthetics

1.0	**GENERAL**	Delete 1.0.3 and replace with	This section currently provides minimum specifications for geotextiles only. The use of geogrids, geocomposites and geomembranes is permitted providing the *Contractor* has submitted advanced notice of the use of the proposed material to the *Contract Administrator*, and that the proposed material has been reviewed and approved by the *City Engineer*.
		Add 1.0.4	Any damage to existing geogrids, geocomposites, and geomembranes must be repaired or replaced to the satisfaction of the *City Engineer* at the *Contractor*'s expense.
1.1	**Related Work**	Add 1.1.5	*Section 31 23 01 Excavating, Trenching and Backfilling*
1.5	**Delivery and Storage**	Append to 1.5.1	At no time shall the geotextile be exposed to ultraviolet light for a period exceeding 14 calendar days. Geotextile rolls shall be stored in a manner which protects them from the elements. If stored outdoors, they shall be elevated and protected with a waterproof cover.
2.0	**PRODUCTS**		
2.1	**Geosynthetic**	Add 2.1.6	The geotextile shall be labelled as per *ASTM D4873*.
3.0	**EXECUTION**		
3.1	**Installation**	Append to 3.1.1	When geotextile is overlapped, the upstream geotextile shall overlap over the downstream.
		Add 3.1.5	The geotextile shall be placed loosely (not taut) with no wrinkles or fold. Care will be taken to place the geotextile in intimate contact with the soil so that no void spaces occur between the geotextile and the underlying soil.
		Add 3.1.6	Care shall be taken during construction to avoid contamination of the geotextile with soil or other material. Contaminated geotextile shall be removed and replaced at the *Contractor*'s expense.
3.3	**Repairs**	Append to 3.3.1	The geotextile shall have no tears or defects which adversely alter its physical properties.

END OF SECTION 31 32 19

Section 32 11 16.1 Granular Subbase

2.0 PRODUCTS

2.1 Specified Materials

Delete 2.1.1.1	Delete 2.1.1.1
Delete 2.1.1.2 and replace with	Pit Run Gravel (City of Vancouver Aggregate #12) as per *Section 31 05 17 Aggregates and Granular Materials.*
Delete 2.1.1.3 and replace with	75mm Minus Crushed Tailings (City of Vancouver Aggregate #13) as per *Section 31 05 17 Aggregates and Granular Materials.*
Delete 2.1.1.5 and replace with	Granular Native Material as per *Section 31 05 17 Aggregates and Granular Materials.*
Delete 2.1.1.7 and replace with	Sand Fill (City of Vancouver Aggregate #17) as per *Section 31 05 17 Aggregates and Granular Materials.*

END OF SECTION 32 11 16.1

Section 32 11 23 Granular Base

2.0 PRODUCTS

2.1 Granular Base Delete 2.1.1.1 and Replace with 19mm Minus Combined Crushed Aggregate Fill (Mulch) (City of Vancouver Aggregate #9) as per *Section 31 05 17 Aggregates and Granular Materials.*

END OF SECTION 32 11 23

Section 32 12 17 Superpave Hot-Mix Asphalt Concrete Paving

1.0 GENERAL

Append to 1.0.2

The selection, application and approval of each Superpave mix is entirely at the discretion of the *City Engineer*.

1.6 Inspection and Testing

Add 1.6.4

Pavement deflections shall be measured with a Benkelman Beam or a Falling Weight Deflectometer (FWD) (See *TAC Pavement Design and Management Guide*). Maximum Benkelman Beam deflections (mean plus two standard deviations) are set as an upper limit for the design of new roads and overlays, and for confirming acceptability of complete roads, are as follows:

- Residential - Streets and Lanes: 1.5
- Higher Zoned - Streets / Lanes: 1.0 / 1.2
- Industrial / Arterial - Streets: 0.6
- Bus Routes - Streets: 0.5”

2.0 PRODUCTS

2.1 Materials

Delete 2.1.1 and replace with

Asphalt Cement: The Performance Grade (PG) grading of asphalt binder selected shall meet the temperature setting for the region, appropriate for the paving location such as Light-Duty Asphalt pavements and Heavy-Duty Asphalt pavements. Final selection shall be approved by the *City Engineer*.

Delete 2.1.2 and replace with

Mineral Aggregates: Aggregates shall meet the latest established Superpave standards for aggregate characteristics. The requirement for each of these properties is based on traffic level and position within the pavement structure. Specifications shall be based on the traffic level of 3 to 30 million ESALs and mat thickness of 100mm or less unless otherwise specified by the *City Engineer*.

Delete 2.1.3 and replace with

Consensus Aggregate Requirements:

.1 *Coarse Aggregate Angularity ASTM D5821*. The minimum value shall be 95/90, meaning 95% of the coarse aggregate shall have one or more freshly fractured face and at least 90% shall have two or more freshly fractured faces for pavement less than 100mm thickness.

.2 *Fine Aggregate Angularity AASHTO T304*. The minimum value shall be 45% for pavement less than 100mm thickness and 40% for pavement greater than 100mm thickness.

.3 *Flat and Elongated Particles ASTM D4791*. Test is performed on coarse aggregate larger than 4.75mm. The maximum value allowed shall be 10% based on a 5:1 maximum length-to-minimum thickness ratio.

.4 *Clay Content ASTM D2419* or *AASHTO T176*. The minimum sand equivalent value for fine aggregate shall be 45%.

Delete 2.1.4 (including tables) and replace with

Source Aggregate Requirements:

.1 *Toughness ASTM C131* or *ASTM C535*. The loss shall not be more than 35% for Wearing Course and 25% for Base Course.

.2 *Soundness ASTM C88*. The loss shall not be more than 15% for coarse aggregate and 18% for fine aggregate.

.3 *Deleterious Materials ASTM C142*. The loss shall not be more than 1%.

Add 2.1.5

Design Aggregate Gradation Requirements:

The design aggregate structure shall meet the Superpave gradation requirements. A design structure must pass between gradation control points while avoiding gradation restricted zones as indicated below. It is recommended that the design gradation pass below the restricted zone. Exception can be made on individual cases with documented success history and test results. The supplier must provide proof documentation on such mix design to the *City Engineer* upon request.

.1 9.5mm Nominal Maximum Aggregate Size Mix:

Sieve	**Control Points**		**Restricted Zone Boundary**	
(mm)	**Min.**	**Max.**	**Min.**	**Max.**
12.5	100			
9.5	90	100		
4.75		90		
2.36	32	67	47.2	47.2
1.18			31.6	37.6
0.600			23.5	27.5
0.300			18.7	18.7
0.075	2	10		

.2 12.5mm Nominal Maximum Aggregate Size Mix:

Sieve	Control Points		Restricted Zone Boundary	
(mm)	Min.	Max.	Min.	Max.
19	100			
12.5	90	100		
9.5		90		
4.75				
2.36	28	58	39.1	39.1
1.18			25.6	31.6
0.600			19.1	23.1
0.300			15.5	15.5
0.075	2	10		

.3 19mm Nominal Maximum Aggregate Size Mix:

The *City Engineer* will consider the use of this mix for base or surface course only on an individual project basis. The *City Engineer's* decision will be final.

Sieve	Control Points		Restricted Zone Boundary	
(mm)	Min.	Max.	Min.	Max.
25	100			
19	90	100		
12.5		90		
9.5				
4.75				
2.36	23	49	34.6	34.6
1.18			22.3	28.3
0.600			16.7	20.7
0.300			13.7	13.7
0.075	2	8		

Superpave uses these aggregate size definitions:

- Maximum Size: one sieve size larger than the nominal maximum size.
- Nominal Maximum Size: one sieve size larger than the first sieve to retain more than 10% of combined aggregate.

- Control Points: Function as master range between which gradation must pass.
- Restricted Zone: Resides along the maximum density gradation. It forms a band through which the combined gradation shall not pass.

2.2 Mix Design

Delete 2.2.1 and replace with

Submit job mix formula to the *City Engineer* for review and approval. Mix designs older than two years will not be accepted.

Delete 2.2.2 (including tables) and replace with

Mix Designs shall be based on the following:

- *AASHTO M323*.
- *AASHTO R30*.
- *AASHTO R35*.
- *AASHTO T312*.
- *Superpave Mix Design Superpave series No. 2 (SP-2)*.
- *C-SHRP #17, Superpave 2000 - Improved Standards for a New Millennium*.

Add 2.2.3

Laboratory compaction shall be by means of a Superpave Gyratory Compactor (SGC) and the asphalt content selected based on volumetric design requirements according to the standards shown in *2.2.2 of this Section*.

Mixture Properties	Criteria
Air Voids (%)	4.0
VMA (%) for 9.5mm Nominal Max. Size	15.0 Min.
VMA (%) for 12.5mm Nominal Max. Size	14.0 Min.
VMA (%) for 19mm Nominal Max. Size	13.0 Min.
VFA (%)	65 – 75
Dust Proportion	0.6 – 1.2*
%Gmm at N-Initial	89 Max.
%Gmm at N-Design	96
%Gmm at N-Maximum	98 Max.
TSR (Moisture Sensitivity)	80 Min.
Gmm = Maximum Theoretical Specific Gravity	

* Ratio may increase to 0.8 – 1.6 if the aggregate gradation passes beneath the restricted zone boundaries.

Add 2.2.4 Asphalt mix shall be designed at the following specified design number of gyrations unless otherwise specified by the *City Engineer*:

- N-initial = 8
- N-design = 100
- N-maximum = 160

Add 2.2.5 The air voids of the design mix shall be 4.0%.

Add 2.2.6 Superpave asphalt mix may contain up to a maximum 15% RAP by weight of total mix without a special mix design. The *City Engineer* may approve a higher proportion of RAP if the *Contractor* can demonstrate with proof documentation their ability to produce a mix meeting the requirements of the specification.

Tier	% RAP by wt of Total Mix	Determine RAP AC Content	Measure RAP Gradation	Measure RAP AC Stiffness	Measure Agg. Blend Properties	PG Grade Change
1	≤15%	(a)	Yes	No	Yes	None
2	16% - 25%	Yes	Yes	No (b)	Yes	One Grade Lower (c)
3	>25%	Yes	Yes	Yes	Yes	Use Blend Chart

(a) At the discretion of the *City Engineer*.

(b) Unless blending chart is used.

(c) Or use blending chart.

Add 2.2.7 The job mix formulas, with the mixing variance limits applied, shall not result in a gradation that is outside the recommended Superpave design limits and the applicable design standards. The final gradation of the supplied mix as represented by the test samples must also retain the initial designed nominal maximum aggregate size of the mix.

3.0 EXECUTION

3.1 Plant and Mixing Requirements

Delete 3.1.4.1 and replace with

Permissible variation in aggregate gradation from the job mix (percent of total mass) shall be as follows:

Gradation	Tolerance
Passing 4.75mm and Larger Sieves	±5%
Passing 2.36mm to 0.6mm	±4%
Passing 0.6mm to 0.3mm	±3%
Passing 0.3mm to 0.15mm	±2%
Passing 0.15mm to 0.075mm	±1.5%

Delete 3.1.4.2 and replace with

Permissible variation of asphalt cement from job mix shall be 0.25%

3.2 Equipment

Add 3.2.3.3

Vibratory rollers may only be used with precaution to ensure there will be no damage done to nearby structures and utilities, or cause unreasonable discomfort to nearby residents.

While compaction standards as set forth in *Section 31 23 01 Excavating, Trenching and Backfilling* and *Section 32 12 17 Superpave Hot-Mix Asphalt Concrete Paving* must always be met, extreme care must be taken around cast iron water mains as additional costs may be incurred by the *Contractor* if the repair of leaking / damaged water mains becomes necessary.

3.5 Placing

Add 3.5.3.4

Upon arrival, it shall be immediately put in place in a uniform lift without any segregation. Segregation within asphalt will not be accepted.

Add 3.5.8

The grade and camber shall be smooth and true, and conform to the grade and camber of the existing surface, where applicable. All excess asphalt shall be removed by sweeping.

Add 3.5.9

Provide the best possible seamless joints by raking of finer materials to fill in all the gaps directly adjacent to the joints, leaving a flush finish between old and new asphalt. A non-flush grade between existing and new surface is cause for rejection. Refer to *Standard Detail Drawing G5.6* for compliance requirements.

3.6 Compaction

Delete 3.6.1 and replace with

Roll asphalt continuously to meet the following requirements:

- 9.5mm nominal maximum aggregate size mix: 92 to 96% MTD.
- 12.5mm nominal maximum aggregate size mix: 92 to 96% MTD.

- 19mm nominal maximum aggregate size mix: 93 to 96% MTD.

Maximum Theoretical Density (MTD) of each mix shall be determined in accordance with *AASHTO T209* or *ASTM D2041*. Final compaction level of the finished pavement shall be determined by core samples. The *Contractor* will be required to provide core density verification data upon request by the *City Engineer*.

A minimum of three cores shall be obtained from random locations as selected by the *City Engineer*. No more than one individual test result shall be more than 1.0% below or 2.0% above the specified range as indicated above, and the average test results of the cores must be within the specified range. The *Contractor* may be allowed to extract one additional core near the original failed area with the consent of the *City Engineer*. New average will be calculated with the new core result replacing the original failed data. Failing to comply constitutes immediate rejection.

Add 3.6.6 The *Contractor* shall use smaller approved power compactors or tampers in areas around *Maintenance Holes*, poles, or other structures which are inaccessible to a roller, to the satisfaction of the *City Engineer*.

END OF SECTION 32 12 17

Section 32 13 13 Portland Cement Concrete Paving

3.0 EXECUTION

3.2	**Grade Preparation**	Delete 3.2.2 and replace with	Compact all granular fill to minimum 95% Modified Proctor Density in compliance with *ASTM D1557* (all following references to density imply compliance with *ASTM D1557*).
3.16	**Defective Concrete**	Append to 3.16.1.4	Final acceptance of strength shall be in accordance with *CAN / CSA A23.1 Clause 4.4.6.6.*

END OF SECTION 32 13 13

Section 32 14 01 Unit Paving

1.0 GENERAL

Add 1.0.2

The *City* maintains an inventory of approved concrete paver styles. Contact the *Contract Administrator* for further information prior to any *Work* involving paver stones. Any variation must be approved by the *City Engineer*.

1.1 Related Work

Add 1.1.7

Section 31 32 19 Geosynthetics

1.8 Quality Assurance

Add 1.8.1

The *Contractor* may be required to install a 2m x 2m mock-up.

Add 1.8.2

Upon acceptance by the *City Engineer*, this trial mock-up will be retained as the standard for the project. Surcharge of the bedding sand layer, joint sizes, line, laying pattern(s), colour(s) and texture of the mock-up panel shall be consistent throughout the job.

Add 1.8.3

Subject to acceptance by the *City Engineer*, the mock up may form part of the permanent product. A mock-up that is not part of the final product shall be removed and properly disposed of at the *Contractor*'s expense.

2.0 PRODUCTS

2.1 Materials

Delete 2.1.4 and replace with

Bedding sand (also referred to as granular laying sand or concrete sand) shall consist of clean, hard, durable crushed stone particles, free from clay lumps, cementation, organic material, frozen material and other deleterious materials. Bedding sand shall meet the general requirements for fine aggregate as specified in *CAN / CSA A23.1 Table 12*. Grading of the sand shall be within the following limits (*Interlocking Concrete Pavement Institute (ICPI) Tech Spec No. 9 Table 1 – CAN / CSA A23.1 - FA1*):

Sieve Designation	Percent Passing
10.0mm	100
5.0mm	95 – 100
2.5mm	80 – 100
1.25mm	50 – 90
630µm	25 – 65
315µm	10 – 35
160µm	2 – 10
80µm	0 - 1

Delete 2.1.5 and replace with

Concrete unit pavers shall comply with the latest revision of *ASTM C936* and *Interlocking Concrete Pavement Institute, Tech Specifications* with the following requirements:

- Compressive strength and water absorption to *ASTM C140*.
- Resistance to freezing and thawing to *ASTM C67*.
- Abrasion resistance to *ASTM C418*.
- Concrete pavers shall be free of chips, spalls, cracks and all other manufacturing defects, to the satisfaction of the *City Engineer*. Rejection of more than 10% for these reasons in any one lot shall be ground for rejection of the entire lot.

The supplier shall be prepared to provide independent reports of the producing lot for the above specified tests upon request of the *Contract Administrator*.

The pavers shall be sourced from one manufacturer / supplier to ensure uniformity of product and shall match the size, shape and colour as shown in the *Contract Documents*.

Add 2.1.7

Joint sand shall conform to *Interlocking Concrete Pavement Institute (ICPI) Tech Spec No. 9 Table 2 - CSA A179* within the following grading limits:

Sieve Designation	Percent Passing
5.0mm	100
2.5mm	90 – 100
1.25mm	85 - 100
630µm	65 - 95
315µm	15 - 80
160µm	0 - 35
80µm	0 - 1

Add 2.1.8

Geotextile used to prevent the migration of bedding sand shall meet the requirements as described in *AASHTO M288 Class 2*.

Add 2.1.9

Cement-treated base material shall have a 7-day unconfined compressive strength of at least 4.5MPa.

Add 2.1.10

Unbound granular subbase material shall have a Plasticity Index less than 10 and a Liquid Limit less than 25.

3.0 EXECUTION

3.1 Subgrade Preparation

Add 3.1.3 — Subgrade soils having a California Bearing Ratio (CBR) of 3% or less shall be evaluated for either replacement with a material with higher bearing strength, installation of an aggregate subbase capping layer, improvement by stabilization, or use of geotextiles.

Add 3.1.4 — The excavated *Site* shall be free of organic materials and large rocks.

3.2 Granular Subbase and Base

Delete 3.2.2 and replace with — Compact the top 600mm of base and subbase directly beneath the bedding sand to a minimum of 98% Modified Proctor density as per *ASTM D1557* unless otherwise specified by the *City Engineer* or *Contract Documents*. The remaining 400mm base and subbase will require the normal 95% Modified Proctor density. Special attention shall be given to achieving compaction standards adjacent to curbs, catchbasins, and utility structures.

Delete 3.2.4 and replace with — Ensure that the top of granular base is within the specified tolerances as listed in *Section 32 11 23 Granular Base*.

Add 3.2.5 — Variation in final surface base elevations shall not exceed 10mm when tested with a 3m straightedge. The finished and compacted surface of the aggregate base shall not allow continuous migration of bedding sand into the base layer.

Add 3.2.6 — Road base design elevation is to be equal to the road design elevation, minus the thickness of the pavers and minus the thickness of the compacted sand bedding layer (minimum 25mm to 35mm maximum), plus 3mm to 6mm which is the amount that is desired for the initial height of paver surface above the road design elevation.

Add 3.2.7 — The surface of the base course and its perimeter around the edge restraints shall be inspected for areas that might allow bedding sand to migrate after installation. Such locations may be found around utility structures, or at catchbasins. These areas shall be covered with a geotextile fabric as required by the *City Engineer* to prevent loss of the bedding sand. Geotextile shall also be installed between the bedding sand and curbs, sidewalks, and foundation walls at the discretion of the *City Engineer* to prevent sand migration. Geotextiles shall be in accordance with *Section 31 32 19 Geosynthetics*.

Add 3.2.8 — Geotextile fabric shall be used along edge restraints and concrete utility collars to prevent the loss of bedding sand. A minimum 300mm wide geotextile strip shall be applied along the base and turned up along the sides of the restraints and concrete utility collars. Do not place filter cloth on top of the bedding sand.

		Add 3.2.9	Every joint of the geotextile fabric used must have a minimum 300mm downslope overlap.
3.3	**Edge Restraint**	Add 3.3.2	Edge restraints must be in place prior to laying unit pavers as approved by the *City Engineer*.
		Add 3.3.3	Install temporary bracing with plastic or metal edge restraints around the perimeter of the utility *Cut* opening to secure existing pavers. The restraints are to be pinned to the base using metal spikes.
		Add 3.3.4	If there is a change in slope, a straight edge shall be formed at the top, with the pavers and the pattern resumed down the slope.
		Add 3.3.5	Edge restraints shall not be installed on top of bedding sand.
3.4	**Granular Laying Course**	Delete 3.4.1 and replace with	Screed bedding sand in a uniform layer to give a compacted thickness of 25mm, unless noted otherwise in the *Contract Documents*.
		Add 3.4.2	Bedding sand shall be maintained at a uniform density. Screeded sand left overnight or subject to rain shall be rechecked for level and raked and re-screeded where necessary.
		Add 3.4.3	Bedding sand shall not be used to correct out-of-tolerance granular base.
3.5	**Unit Paving**	Delete 3.5.4.1 and replace with	Set pavers in laying design as shown on the *Drawings* or as specified by the *City Engineer*. Align pavers to maintain correct lines and patterns.
		Delete 3.5.4.2 and replace with	Herringbone 45˚ pattern is required in areas subject to vehicular traffic. This pattern offers the greatest structural capacity and resistance to lateral movements.
		Delete 3.5.4.3 and replace with	A crowned profile is required in areas subject to vehicular traffic.
		Delete 3.5.4.4 and replace with	Existing pavers shall be removed to a minimum 0.8m from the edges of utility *Cuts*. Restoration of pavers must be on undisturbed granular materials and bedding. Retain existing pavers so they can be reinstated upon completion of utility repair. Stack the pavers neatly near the opening, out of the way of excavation equipment.
		Delete 3.5.4.5 and replace with	Set pavers with 3mm ± joints. No more than 5% of the joints shall exceed 6mm wide to achieve straight bond lines.
		Delete 3.5.4.6 and replace with	Joint (bond) lines shall not deviate more than ± 15mm over 15m from string lines.

Add 3.5.4.7 Fill gaps at the edges of the paved area with cut pavers or edge units. Pavers shall be cut using double bladed splitter or masonry saw to achieve a smooth cut. No pieces shall be smaller than 10mm; smaller gaps shall be filled with sand. Adjust bond pattern at pavement edges such that cutting of edge pavers is minimized. All cut pavers exposed to vehicle tires shall be no smaller than 1/3 of a whole paver.

Add 3.5.4.8 Keep skid steer and forklift equipment off newly laid pavers that have not received initial protection and joint sand.

Add 3.5.4.9 Use a low-amplitude plate compactor capable of at least 22kN at a frequency of 75Hz to 100Hz to vibrate the pavers into the sand. Tamp down and level pavers with a minimum of four passes and until joints are filled with sand, unit pavers are true to grade, within design tolerances and free of movement. Remove any cracked or damaged pavers and replace with new units.

Add 3.5.4.10 Simultaneously spread, sweep and compact dry joint sand into joints continuously until full. Tamp down and level pavers with suitable vibratory force for a minimum of four passes and until joints are filled with sand, unit pavers are true to grade, within design tolerances and free of movement. Do not compact within 2m of unrestrained edges of paving units.

Add 3.5.4.11 Ensure paver elevation is approximately 3mm to 6mm above road design grade after compaction.

Add 3.5.4.12 The surface elevation of pavers shall be 3mm to 6mm above adjacent drainage inlets, concrete collars or channels.

Add 3.5.4.13 The elevation of adjacent pavers may not differ by more than 3mm.

Add 3.5.4.14 All pavements within 2m of unfinished edges shall have the joints fully filled with sand and be compacted at the end of each day. The laying face of any incomplete areas must be covered with plastic sheets overnight to prevent exposed bedding sand from becoming saturated from rainfall.

Add 3.5.4.15 For utility installation in *Streets* and walks constructed with concrete pavers, special provisions may be required. Contact the *City Engineer* for further details.

Add 3.5.4.16 All permanent repairs which have been constructed by the *Contractor* shall be maintained by the *Contractor* for a period of two years from *Substantial Performance* unless otherwise noted in the *Contract Documents*. The *Contractor* is also responsible, within this two-year period, for the extra costs the *City* incurs for the repair of damage to the pavement caused by backfill deficiency.

3.6 Acceptance Add 3.6.2 Ensure there are no water ponding areas.

END OF SECTION 32 14 01

Section 32 15 01S Surface Restoration

1.0	**GENERAL**	Add 1.0.1	*Section 32 15 01S* refers to those portions of *Work* that are unique to temporary and permanent surface restorations of light-duty and heavy-duty asphalt roadways, concrete sidewalks, medians, ramps and driveway crossings as a result of trench and utility *Cuts* or drill / test holes. This section must be referenced to and interpreted simultaneously with all other sections pertinent to the *Work* described herein.
		Add 1.0.2	For surface restoration of unit pavement surfaces, the permanent restoration shall be carried out in accordance with *Section 32 14 01 Unit Paving* unless otherwise directed by the *City Engineer*.
1.1	**Related Work**	Add 1.1.1	*Section 03 30 20 Concrete Walks, Curbs and Gutters*
		Add 1.1.2	*Section 03 30 53 Cast-in-Place Concrete*
		Add 1.1.3	*Section 31 05 17 Aggregates and Granular Materials*
		Add 1.1.4	*Section 31 23 01 Excavating, Trenching and Backfilling*
		Add 1.1.5	*Section 31 23 23 Controlled Density Fill*
		Add 1.1.6	*Section 32 11 16.1 Granular Subbase*
		Add 1.1.7	*Section 32 11 23 Granular Base*
		Add 1.1.8	*Section 32 12 13.1 Asphalt Tack Coat*
		Add 1.1.9	*Section 32 12 13.2 Asphalt Prime*
		Add 1.1.10	*Section 32 12 17 Superpave Hot-Mix Asphalt Concrete Paving*
		Add 1.1.11	*Section 32 13 13 Portland Cement Concrete Paving*
		Add 1.1.12	*Section 32 13 16.1 Roller Compacted Concrete Paving*
1.2	**References**	Add 1.2.1	The abbreviated standard specifications for testing, materials, fabrication, and supply, referred to herein, are fully described in *Section 01 42 00 Reference Specifications – Site and Infrastructure*.
1.3	**Surface Classifications**	Add 1.3.1	"Light Duty Asphalt (LDA) pavement" refers to road surfaces on low volume residential *Streets* and lanes where the existing road surface consists of approximately 75mm or less of asphaltic material. This classification also includes existing gravel spray-cap and Macadam pavements. Restoration of LDA pavement structure shall be in accordance with *Standard Detail Drawing G5.1*.

		Add 1.3.2	"Heavy Duty Asphalt (HDA) pavement" refers to heavier duty pavements over 75mm thick and / or having an asphaltic concrete wearing surface overtop of asphaltic concrete and / or P.C.C. bases. HDA pavement is utilized on arterial, collector and industrial *Streets*, *Streets* which are designated as truck routes or bus routes and on Higher-Zoned Routes. Higher-Zoned Routes are defined as those routes with any abutting properties zoned RM or above as defined by the *Zoning and Development Bylaw No. 3575*. Restoration of HDA pavement structure shall be in accordance with *Standard Detail Drawings G5.2* to *G5.4*.
		Add 1.3.3	"Portland Cement Concrete (P.C.C.) pavement" refers to Portland cement concrete pavement for road surfaces. Restoration of P.C.C. pavement structure shall be in accordance with *Standard Detail Drawing G5.5*.
		Add 1.3.4	"Portland Cement Concrete (P.C.C.) flatwork" refers to sidewalks, ramps, curbs, driveway crossings and other surfaces constructed of cast-in-place Portland cement concrete. Restoration of P.C.C. walk structures shall be in accordance with *Standard Detail Drawings C1.1*, *C2.1*, *C2.2*, *C7.1*, *C7.2*, *C7.3*, *C8.1*, *C8.2*, *C8.3*, *C8.4*, *C9.1*, *C9.2*, and *C9.3*.
		Add 1.3.5	"Medians" refers to medians and islands constructed of cast-in-place Portland cement concrete. Restoration of P.C.C. Medians shall be in accordance with *Standard Detail Drawings C15.1* and *C15.2*.
1.4	**Access During Construction**	Add 1.4.1	Traffic shall not be permitted on un-protected restorations during curing until the concrete has reached 70% of the 28-day specified strength. Where alternate access cannot be provided and temporary access across a restoration is required during the curing period, the *Contractor* shall protect such crossings or portions of the restored pavement to ensure the restored *Work* is not damaged. Protection measures, including the use of steel plates, must be approved by the *City Engineer* in advance. See *Section 01 55 00 Traffic Control, Vehicle Access and Parking* for additional access during construction requirements.
1.5	**Temporary Repairs of trench & utility cuts**	Add 1.5.1	The *Contractor* shall construct and maintain a temporary asphaltic repair (50mm or 75mm minimum thickness) as shown on *Standard Detail Drawing G5.1* to *G5.5*, on any roadway or lane (including sidewalks and boulevard crossings) until permanent repairs have been made, to the satisfaction of the *City Engineer*. On residential roads and lanes, the temporary asphaltic

repair shall be constructed and established continuously as the *Work* progresses and at no time shall a gravel road surface remain unpaved for a period greater than 10 calendar days.

On arterial roads and intersections, the temporary asphaltic repair shall be constructed and established continuously as the *Work* progresses and at no time shall a gravel surface remain unpaved for a period greater than 2 calendar days.

Add 1.5.2 Good workmanship and surface smoothness is critical and will be monitored closely. A non-flush grade between existing and *Cut* repair surfaces is cause for rejection.

Add 1.5.3 Proceeding with permanent repairs immediately following backfill is preferred. If permanent restoration cannot proceed immediately, the *Contractor* shall follow temporary restoration measures.

Add 1.5.4 The *Contractor* shall regularly maintain the temporary asphaltic repair to the satisfaction of the *City Engineer* until the permanent repair has been completed.

1.6 Permanent Repairs of trench & utility cuts

Add 1.6.1 Permanent / final surface restoration shall be completed within two weeks of trench backfill and compaction or as required by the *City Engineer*.

Add 1.6.2 Good workmanship and surface smoothness is critical and will be monitored closely. A non-flush grade between existing and *Cut* repair surfaces is cause for rejection.

Add 1.6.3 Street *Cut* repairs in peat area(s) must be restored strictly in accordance with *Standard Detail Drawing R2.5*.

Add 1.6.4 Whenever a part of a panel, square or section of concrete sidewalk, curb, median, or crossing is broken, damaged or undermined, the entire panel, square or section shall be removed and replaced neatly to the nearest score, groove or joint. No partial repairs are allowed unless approved by the *City Engineer*.

Add 1.6.5 Rebuild the entire aggregate pavement structure within the *Cut* in accordance with *Standard Detail Drawings G5.1* to *G5.5*.

Add 1.6.6 For P.C.C. walks, the concrete shall be finished to match the surrounding walk unless otherwise directed by the *City Engineer*. All sidewalk joints are to be saw-cut.

For LDA and HDA pavement, the thickness and properties of the repairing asphalt pavement must match the adjacent pavement structure. The pavement must meet or exceed the minimum thickness of the existing pavement structure or as specified on *Standard Detail Drawing G5.1* to *G5.5*.

		Add 1.6.7	Longitudinal joint for successive lifts of asphalt must be overlapping by at least 200mm except at the curb edge.
		Add 1.6.8	For permanent repair of *Cuts* in pavement that is less than five years old, the area of permanent restoration shall be expanded as follows, depending on the age at issuance of the *Contractor Permit*: .1 Pavements less than two years old: Grind and overlay or repave the full width of the pavement from curb to curb. .2 Pavements between two and five years old: Partially damaged lane(s) must be removed to its / their full lane width and restored. Grind and overlay or repave the full lane width of the *Cut* lane(s).
1.7	**Repair of Drill / Test holes**	Add 1.7.1	If there are extensive test holes to be drilled within a small area, in the opinion of the *City Engineer*, a written detailed restoration plan from the *Contractor* may be required prior to the commencing of the drilling. Such extensive damage to the pavement could be treated as a trench or utility *Cut* and the restoration shall be in accordance with the applicable *City* Bylaws and *1.5* and *1.6 of this Section*.
		Add 1.7.2	At the end of service (if applicable), the drill holes shall be decommissioned in compliance with the *Groundwater Protection Regulation (GWPR)* of the *Water Sustainability Act*. As the intent of the *GWPR* is to ensure that activities related to wells and groundwater are completed in an environmentally safe manner, any conflict between the *GWPR* and the street restoration requirements in this manual will default to the requirements of the *GWPR*.
1.8	**Measurement and Payment**	Add 1.8.1	Unless otherwise noted in the *Contract Documents*, payment for all *Work* under this Section will be incidental to payment for *Work* described in other Sections.
1.9	**Inspection and Testing**	Add 1.9.1	Inspection and testing must meet the requirements of General Condition*, Clause 4.12, Tests and Inspections*.
1.10	**Maintenance**	Add 1.10.1	The *Contractor* shall maintain the surfaces which they have permanently restored in a state of good and complete repair for two years from the date of *Substantial Performance* unless otherwise noted in the *Contract Documents*. This obligation extends to any required maintenance as a result of backfill or compaction deficiency.
2.0	**PRODUCTS**		
2.1	**General**	Add 2.1.1	Materials utilized in the *Work* shall conform to specifications set out herein and to noted sections of the latest edition of the ASTM and CSA specifications. All material used and the method of measuring and mixing shall be to the satisfaction

of the *City Engineer*.

Add 2.1.2 Materials not specifically covered herein shall be of a quality acceptable to the *City Engineer*. Equivalent materials of a quality acceptable to the *City Engineer* may be substituted for materials specified.

Add 2.1.3 Where samples are required, a 10 *Day* period shall be allowed for examination of samples by the *City Engineer*.

2.2 Asphaltic Concrete

Add 2.2.1 Asphaltic Concrete used as surfacing material in *Cut* restoration shall be Superpave mix and supplied by an approved mixing plant. The *Contractor* shall obtain the *City Engineer's* approval of the proposed mixing plant prior to the beginning of the *Work*. The asphalt mixes shall meet the requirements of the latest asphalt paving specifications (refer to *Section 32 12 17 Superpave Hot-Mix Asphalt Concrete Paving*).

Add 2.2.2 In some situations, an alternative engineered pavement structure or methods may be considered, upon prior written approval of the *City Engineer*.

2.3 Portland Cement Concrete (P.C.C.)

Add 2.3.1 Portland Cement shall conform to specifications under the latest revision of *CAN / CSA A5* within *CAN / CSA A3000*.

Add 2.3.2 Concrete shall conform to the requirements of *Section 03 30 53 Cast-in-Place Concrete*. The following mix-designs are approved for use on City *Streets*:

Application	Mix
Base Course	City of Vancouver Roller Compacted Concrete Mix 1500A
Roadway	City of Vancouver Mix 1503
Sidewalks	City of Vancouver Mix 2828B
Driveway crossings	City of Vancouver Mix 1503

Use of alternate mix designs are not permitted unless approved in advance by the *City Engineer*.

2.4 Aggregate and Granular Materials

Add 2.4.1 Granular materials shall conform to the requirements of *Section 31 05 17 Aggregates and Granular Materials*.

2.5 Curing Compounds

Add 2.5.1 A membrane curing compound containing a fugitive dye and complying with the latest revision of *ASTM C309* may be used. It shall be applied within the temperature range recommended by the manufacturer and using the rates and methods recommended by the manufacturer

2.6	**Roller Compacted Concrete Paving**	Add 2.6.1	Roller Compacted Concrete shall conform to *Section 03 30 53 Cast-in-Place Concrete* and *Section 32 13 16.1 Roller Compacted Concrete Paving*.
3.0	**EXECUTION**		
3.0	**General**	Add 3.0.1	Finished compacted pavements must be flush with the adjacent road. The practice of mounding up a repair to rely on passing traffic to complete consolidation and compaction of the backfill will be cause for immediate rejection by the *City Engineer* and for immediate satisfactory repairs to be performed by the *City*. The expense of such corrective *Work* shall be borne by the *Contractor* who constructed the mounded repair.
		Add 3.0.2	The *Contractor* is responsible for any and all peripheral damage to the road which has been caused by the trench and utility *Cut* or drill / test hole activity. This includes all damage to the surrounding pavement structure which includes cracking or deterioration or instability as compared to the condition prior to the *Contractor*'s activity. In such cases, unless the *Contractor* can clearly demonstrate such damage was present in advance of the *Contractor*'s activities, the *Contractor* is responsible for, and must ensure that the entire damaged area of pavement, plus the standard minimum 200mm lap joint, is repaired to the full applicable road standard.
		Add 3.0.3	For backfilled excavations not subject to vehicular, cyclist or pedestrian traffic (e.g. architectural or landscaped boulevards), the surface shall be returned to a condition equal to, or better than, the condition existing before the excavation was made.
3.1	**Weather**	Add 3.1.1	Comply with all additional and special weather-related requirements including, but not limited to, cold weather, hot weather or rain requirements for supply, placement, finishing, curing and protection of materials contained within the applicable reference specification listed in *1.1 of this Section*.
3.2	**Cutting**	Add 3.2.1	Vertical, straight *Cuts* shall be made along the outline using equipment such as diamond saws or road milling machines, as approved by the *City Engineer*.
		Add 3.2.2	Longitudinal *Cuts* shall be repaired at the surface such that the final longitudinal asphalt joint is not in line with the traffic wheel path. Final longitudinal joints shall be at lane lines or in the center of the lane. This requirement applies only to the top surface lift of asphalt, and not the underlying trench walls.

3.3	**Removals and Excavation**	Add 3.3.1	When removing sidewalk against a building or structure, the sidewalk must be totally *Cut* and removed as per the requirements of *3.2 of this Section* (if workable), to provide a clean, straight edge.
		Add 3.3.2	Any materials within the area for repair, including any temporary repair or fill material, shall be removed to the required depth to yield a pavement thickness as indicated on *Standard Detail Drawings G5.1* to *G5.5*, and then re-compacted prior to the final repair. All existing materials removed must be transported and disposed off-*Site*.
3.4	**Grade Preparation**	Add 3.4.1	The granular materials shall consist of the minimum thicknesses as indicated on *Standard Detail Drawings G5.1* to *G5.5*. Aggregates shall be in accordance with approved aggregates as set forth in *Section 31 05 17 Aggregates and Granular Materials*. All aggregates shall be compacted as per *Section 31 23 01 Excavating, Trenching and Backfilling*.
		Add 3.4.2	Excavation to subgrade elevation shall be completed with a straight edged bucket to expose undisturbed subgrade soil. All loose or organic materials at subgrade elevations shall be removed to the approval of the *City Engineer* or Geotechnical *Engineer* prior to backfilling with approved aggregates as set forth in *Section 31 05 17 Aggregates and Granular Materials*. Suitable subgrade shall conform to the requirements of *Section 31 22 16 Reshaping Granular Roadbeds* and *Section 31 22 16.1 Reshaping Existing Subgrade*.
3.5	**Asphalt Placement**	Add 3.5.1	Asphalt placement shall meet the requirements of *Section 32 12 17 Superpave Hot-Mix Asphalt Concrete Paving* or as approved by the *City Engineer*.
3.6	**Concrete Placement**	Add 3.6.1	Concrete placement shall meet the requirements of *Section 03 30 53 Cast-in-Place Concrete*.
3.7	**Light Duty Asphalt (LDA) Pavement Repair**	Add 3.7.1	Refer to *Standard Detail Drawing G5.1* for compliance requirements.
		Add 3.7.2	For <u>asphaltic pavement</u>: Pavement thickness shall match existing, provided the minimum thickness is at least 50mm. The procedure shall be: • Saw-cut and remove all areas disturbed by the trenching operation. • Trim vertically and square up the edges to permit good even compaction along the edges of the repair. • Place and compact backfill and subgrade in accordance with *3.4 of this Section*. • Clean, dry and paint the edges along the top of the trench wall as well as the adjoining surface area for about ±125mm with asphalt emulsion, or approved PG

binder.

- Place and compact asphalt in accordance with *3.5 of this Section*.

Add 3.7.3 For gravel surfaces on roads, lanes and driveways, including shoulders of strip pavements:

The surface shall be restored by backfilling with approved granular material to a depth corresponding to the depth of the existing granular material on both sides of the excavation and the backfilled material shall be compacted to minimum 95% modified proctor density. The grade and camber of all repairs shall conform to the grade and camber of the existing surface. Asphalt grindings may be considered as backfill materials, but their use will be only at the express written consent of the *City Engineer*.

Add 3.7.4 For spray-capped surfaces and macadam pavements:

Particular attention shall be given to the excavation before constructing the repair. The procedure shall be:

- Saw-cut and remove all areas which have been broken up or disturbed by the trenching operation.
- Trim vertically and square up the edges to permit good even compaction along the edges of the repair.
- Place and compact backfill and subgrade in accordance with *3.4 of this Section* (Note: Asphalt grindings may be considered as backfill materials, but their use will be only at the express written consent of the *City Engineer*).
- Finish in accordance with final procedural steps as approved in advance by the *City Engineer*.

3.8 Heavy Duty Asphalt (HDA) Pavement Repair

Add 3.8.1 Refer to *Standard Detail Drawings G5.2* to *G5.4* for compliance requirements

Add 3.8.2 The outline of the final repair shall be rectangular and shall provide for a minimum shoulder of 200mm in each direction from the excavation. Thus, the width and length of the final repair shall be at least 400mm oversized from the temporary repair.

Add 3.8.3 All *Cut* sides that are 500mm or less from a pavement edge, joint or crack after providing a 200mm lap joint, shall be removed.

Add 3.8.4 The edges of the *Cut* shall be chipped, brushed and thoroughly cleaned to remove all loose material. Chipping will not be necessary for the roughened surfaces provided by asphalt milling machines.

Add 3.8.5 The top 75mm of the existing asphalt edge must be dry. If heating is required, take special care to not overheat the existing asphaltic pavement (i.e. no discoloration of the asphalt from heating). Any discoloured asphalt must be

removed.

Add 3.8.6 The backfill and shoulder shall be thoroughly compacted in accordance with *3.4 of this Section*.

Add 3.8.7 City of Vancouver Roller Compacted Concrete Mix 1500A shall be used as P.C.C. base as per *Section 03 30 53 Cast-in-Place Concrete* and *Section 32 13 16.1 Roller Compacted Concrete Paving* and placed in the *Cut* to the levels indicated on *Standard Detail Drawing G5.4*.

Add 3.8.8 City of Vancouver Roller Compacted Concrete Mix 1500A shall be compacted with a vibratory mechanical compactor to within ±2% of the design mix density (to be provided by the supplier to the *Contract Administrator* upon request). Hand tamping is not adequate and is not permitted as a substitute.

Add 3.8.9 Prior to placing asphalt pavement overtop of the P.C.C. base, the edges along the top of the trench wall as well as the adjoining surface area for about ±100mm of the *Cut* shall be painted with approved PG binder or asphalt emulsion.

Rake the hot mix asphalt immediately into place to a level that will provide a flush surface after compaction, and complete placement in accordance with *3.5 of this Section*.

3.9 P.C.C. Pavement Repair

Add 3.9.1 Refer to *Standard Detail Drawing G5.5* for compliance requirements.

Add 3.9.2 The outline of the final repair shall be rectangular and shall provide for a minimum shoulder of 200mm in each direction from the excavation. Thus, the width and length of the final repair shall be at least 400mm oversized from that of the temporary repair.

Add 3.9.3 All *Cut* sides that are 500mm or less from a pavement edge, joint or crack after providing a 200mm lap joint shall be removed.

Add 3.9.4 Materials, including any temporary repairs, within the area for final repair shall be removed to a depth of 250mm, or to the bottom of the existing concrete pavement (whichever is greater).

Add 3.9.5 There must be a minimum of 1/2 of the original slab's total surface area remaining, or the entire slab must be removed and replaced.

Add 3.9.6 Smooth saw-cut surface must be cleaned and free from any deleterious materials for bonding. The exposed surface shall be roughened prior to the placing of the restoration concrete. The *Contract Administrator* may request the use of a bonding agent and / or any other methods to achieve the desired results.

Add 3.9.7 The edges and the exposed surface of the *Cut* shall be brushed and thoroughly cleaned to remove all loose and unsound concrete.

Add 3.9.8 The backfill and shoulder shall be thoroughly tamped and the edges of the *Cut* moistened.

Add 3.9.9 For repair of existing curb integral with the existing concrete road, the *Contractor* shall remove the existing curb, install dowels (sized at 15M rebar) into the existing integral concrete road at 600mm spacing, bend the dowels 90˚ upwards and pour the new concrete curb and gutter. Refer to *Standard Detail Drawing G5.7*.

Add 3.9.10 If side forms are required, forms shall be of steel, lumber, or an *Approved Equal* in good condition, and of a depth equal to or greater than the thickness of the existing pavement. The forms shall be placed accurately to line and grade of the existing pavement and held rigidly in place, and driven down flush with or below the top surface of the form.

Add 3.9.11 Internal vibrators shall be used wherever practicable to consolidate the concrete. Any other consolidation method must be approved by the *City Engineer* prior to the pour; hand tamping is not an acceptable method.

Add 3.9.12 Joint construction shall be as outlined in *Section 32 13 13 Portland Cement Concrete Paving*.

Add 3.9.13 Curing shall commence as soon as possible with two coats of a curing compound as specified in the materials section of this specification after final finishing and continue for a period necessary to attain 70% of the 28-day specified strength. No forms shall be removed until after the concrete is sufficiently cured, or as directed by the *City Engineer*. Traffic shall not be permitted on the repairs during this time unless otherwise directed by the *City Engineer*.

3.10 P.C.C. Walk Repair

Add 3.10.1 Refer to *Standard Detail Drawings C1.1* to *C2.2* and *C7.1* to *C9.3* for compliance requirements for P.C.C. sidewalk, ramps, and crossings (standard markings).

Add 3.10.2 For restorations associated with adjacent private property development, restoration shall be done as soon as practicable, within four weeks after *Substantial Performance* of the project or as specified by the *City Engineer*.

Add 3.10.3 Construction shall be as outlined in *Section 32 13 13 Portland Cement Concrete Paving* and *Section 03 30 20 Concrete Walks, Curbs and Gutters* and shall be uniform. Where tree pits are encountered, construction joints shall extend from the corners of tree pits to minimize and control cracking.

Add 3.10.4 When installing tree pits in utility strips or front boulevards, the tree pits must be installed at the front edge of the main sidewalk. The seat for the tree pit surround panels at the main sidewalk edge must be part of the sidewalk construction.

Add 3.10.5 The building strip must be poured separately of the main sidewalk. A cold joint shall be installed between the main sidewalk and the building strip.

3.11 Drill & Test Hole Repair

Add 3.11.1 Repair of all drill holes in sidewalks, driveways, letdowns, medians, islands, and other surfaces constructed of cast-in-place Portland cement concrete shall be in accordance with *3.10 of this Section*.

Add 3.11.2 Drill holes larger than 150mm in diameter in existing asphalt surfaces shall be restored according to the following procedures:

- The outline of the final repair shall be either square or rectangular. The repair dimensions are measured by extending a minimum 200mm shoulder to all sides of the drill holes or drill areas.
- For asphalt pavement, repair in accordance with *3.7* and *3.8 of this Section*.
- For concrete pavement, repair in accordance with *3.9 of this Section*.

Add 3.11.3 Drill holes 150mm or smaller in diameter can be repaired as per drill hole dimensions.

Add 3.11.4 For drill holes 150mm or smaller in diameter in concrete surfaces (excluding sidewalks), Method A restoration shall be implemented. For drill holes in asphalt surfaces, Method B restoration shall be implemented.

Add 3.11.5 All materials and the method of measuring and mixing shall be to the satisfaction of the *City Engineer*.

Add 3.11.6 All foreign and loose material shall be removed from the hole and from the surface of the surrounding pavement. The hole and its surrounding surface shall be free of standing water but in saturated surface dry condition for restoration Method A. For Method B restoration, the hole shall be relatively dry prior to the repair to ensure good bonding to the existing pavement for the pre-mix asphalt patching material.

Add 3.11.7 Clean, washed sand fill to City of Vancouver Aggregate #17 (*Section 31 05 17 Aggregates and Granular Materials*) shall be placed into the hole and thoroughly tamped in maximum 300mm layers with suitable tamping tool up to the underside of the asphalt or concrete surfaces. Materials used for restoration of drill holes shall be in compliance with the *Groundwater Protection Regulation (GWPR)*.

Add 3.11.8 Method A – concrete patching product:

A commercially available fast setting "traffic patch" type concrete patching material shall be used for the concrete restoration *Work*. Prepare the product according to the manufacturer's recommendations. An after-mixing slump value greater than 100mm is generally not recommended for quick set. Consolidate and finish the patching material with conventional concrete practices. The elevation, surface texture and thickness of the concrete patch shall match the adjacent concrete pavement.

Restored holes shall be allowed to cure with conventional curing methods and protected from traffic as long as possible. Avoid concrete repair when ambient temperatures are below -4˚C. Warm mixing water is required for cold weather repair. Always protect repair concrete from freezing weather.

Add 3.11.9 Method B – Sand Cement Mortar Plug and Asphalt Pre-Mix:

Mix one part of cement and two parts of clean coarse sand with a sufficient amount of water until a workable but stiff consistency is obtained. The mixture shall be tamped into the hole up to within 100mm of the surface. A commercially available fast setting concrete fine mix also works well in this application. Allow the concrete mix to cure as much as possible. Pre-mix asphalt shall then be consolidated into the top 100mm with mechanical tamping device and finished to conform to the surface of the adjacent pavement. Pre-mix asphalt may not be accepted as a permanent patching material for larger size repair. Consult the *City Engineer* for further information.

END OF SECTION 32 15 01S

Section 32 15 02S Private Development Site Works

1.0 GENERAL

Add 1.0.1 *Section 32 15 02S* covers temporary *Work* on City *Streets* and permanent restoration of any damaged City street assets, undertaken by duly authorized *Contractors* who are not directly contracted to the *City*, and associated with development of a private building *Site*. Requirements for backfilling private development *Site* excavations are also included. This section must be referenced to and interpreted simultaneously with all other sections pertinent to the *Work* described herein.

Add 1.0.2 Temporary *Work*, includes but is not limited to

- Installation of anchor rods and shotcrete walls associated with private *Site* excavations.
- Hoarding and fencing on City *Streets*.
- Construction waste bins placed on City *Streets*.

Add 1.0.3 Permanent restoration *Work*, includes but is not limited to

- Removal of anchor rods and shotcrete walls.
- Backfilling of excavations adjacent to foundations, walls or other geotechnical elements.
- Removal of *Areaways*.
- Replacement of damaged utilities, Portland cement concrete flatwork, asphalt pavement, landscaping, lamp standards, traffic signals and any other *City* infrastructure.

Add 1.0.4 If the *Contract Administrator* for the *Work* under this Section is not an employee or agent of the *City*, the *Contract Administrator* therefore does not have any delegated authority from the *City Engineer*.

Add 1.0.5 *City Engineer* approval is required for:

- Temporary occupation of any portion of City *Street*.
- Any proposed changes to the *City*-accepted Issued for Construction *Drawings* applicable to *City* assets.
- Any deviation from the *City*'s construction standards.
  - approved products and materials.
  - execution methodology.
  - testing and inspection requirements.
- Means and methods for *Street* support for private site excavations.
- Means and methods for restorations of excavations on private *Sites*, where *Street* support was required.
- Final acceptance of permanent *Work*.

		Add 1.0.6	The *Contractor* is reminded that there are frequently project and location specific special circumstances that result in additional *City* requirements, over and above those contained within this Section. The *Contractor* must receive prior approval of the means and methods for restoration of excavations surrounding building *Sites* from the *City Engineer* in advance of initiating restorations.
1.1	**Related Work**	Add 1.1.1	*Section 31 05 17 Aggregates and Granular Materials*
		Add 1.1.2	*Section 31 23 23 Controlled Density Fill*
		Add 1.1.3	*Section 03 30 53 Cast-in-Place Concrete*
		Add 1.1.4	*Section 32 12 17 Superpave Hot-Mix Asphalt Concrete Paving*
1.2	**References**	Add 1.2.1	*Vancouver Building Bylaw*
		Add 1.2.2	*Vancouver Street and Traffic Bylaw*
		Add 1.2.3	*Vancouver Noise Control Bylaw*
		Add 1.2.4	*Vancouver Encroachment Bylaw*
		Add 1.2.5	*Vancouver Charter*
1.3	**Measurement and Payment**	Add 1.3.1	Payment for all *Work* under this Section will be incidental to *City* permits.
		Add 1.3.2	Any damage to adjacent public infrastructure will be, at the *Contractor*'s expense, repaired to the *City Engineer*'s satisfaction and to these Specifications.
1.4	**Inspection and Testing**	Add 1.4.1	Inspection and testing must meet the requirements of General Conditions *4.12*.
		Add 1.4.2	Dynamic cone penetration testing is an acceptable compaction checking method for pea-gravel, as long as the *Engineer* certifies that the test results are meeting the specified minimum 90% Modified Proctor Density requirement.
1.5	**Permits**	Add 1.5.1	The *Contractor* shall apply for and receive all applicable *Contractor Permits*, as regulated by *City* and other regulators.
1.6	**Letters of Assurance**	Add 1.6.1	The *Contractor* may not undertake any *Work* related to excavation or backfill of an excavation, where such excavation is required to be shored as per applicable *WorkSafeBC Occupational Health and Safety Regulations*, without plans and supporting documentation prepared by the *Engineer*. The *Contractor* shall also confirm that the following Letters of Assurance as required by the *Vancouver Building Bylaw*,

have been submitted to and accepted by the *Contract Administrator*:

- *Schedule B-1 Assurance of Professional Design and Commitment for Field Review*.
- *Schedule B-2 Summary of Design and Field Review Requirements*.
- *Schedule C-B Assurance of Professional Field Review and Compliance*.

Add 1.6.2 During the project, an interim letter may be submitted by the *Engineer* covering a portion of the excavation backfill to facilitate construction of street work such as sidewalks over or adjacent to portions of the backfill.

Add 1.6.3 The interim letter and *Schedule C-B* must be supported by the following materials:

- All daily field review reports.
- Gradation test results on each type of backfill material used.
- Batching slips for all Controlled Density Fill material delivered to the *Site*.
- Density test results on backfill placed on days in which the *Engineer* (or representative) was not in attendance, accompanied by an explanation of why the *Engineer* was not in attendance, and a description of what remedial steps were taken to satisfy the *Engineer* as to the adequacy of the backfill and its compaction where compliance with the job specifications had not been attained.

Add 1.6.4 For *Areaway* removals, the following additional documents will be required:

- Signed and sealed *Contract Drawings* for building cut off wall.
- Copy of building permit related to building cut off wall.

Add 1.6.5 The *Contractor* shall undertake sufficient testing as the *Engineer* deems necessary to be able to provide the Letters of Assurance.

1.7 Anchor Rods

Add 1.7.1 All temporary anchor rods and portions thereof encroaching into *City* property must be removed if within 1.5m of City building grade elevations. Below 1.5m, anchor rods must be fully grouted along their entire length or de-tensioned.

Add 1.7.2 All permanent anchor rods to support private structures must be wholly contained on private property. No portion of a permanent anchor rod is permitted on *City* property.

1.8 Shotcrete

Add 1.8.1 Shotcrete must be removed from excavations within 1.5m of City building grades prior to backfilling. Shotcrete in proximity to any *City* service connections (sewer, water and any other *City* utility services) shall be further removed to

1.5m around the top and sides and just below the lowest point of the connections unless otherwise approved by the *City Engineer*.

Add 1.8.2 Letter of Assurance must be supplemented by:

- Sealed as built survey confirming depth of shotcrete removal.
- Date stamped construction photos showing removal of shotcrete.

1.9 Areaways

Add 1.9.1 All *Areaway* walls and portions thereof encroaching into *City* property must be removed if within 1.5m of City building grade elevations.

1.10 Restoration of Damaged Infrastructure

Add 1.10.1 Damage to any *City* asset, including but not limited to; pavement, sidewalks, driveway crossings, and underground utilities; caused by the *Contractor*'s activities shall be permanently restored to a condition as near as possible to, or better than the original condition unless otherwise approved by the *City Engineer*.

Restoration shall be carried out in accordance with applicable *City* Bylaws and specifications.

1.11 Maintenance

Add 1.11.1 The *Contractor* shall maintain the *City* infrastructure which they have permanently restored, in a state of good and complete repair for two years from the date of *Substantial Performance* unless otherwise approved by the *City Engineer*. This obligation extends to any required maintenance as a result of backfill or compaction deficiency.

2.0 PRODUCTS

2.1 General

Add 2.1.1 Materials utilized in this *Work* shall conform to specifications set out herein and to noted sections of the latest edition of the ASTM and CSA specifications. All material used and the method of measuring and mixing shall be to the satisfaction of the *City Engineer*.

Add 2.1.2 Materials not specifically covered herein shall be of a quality acceptable to the *City Engineer*. Equivalent materials of a quality acceptable to the *City Engineer* may be substituted for materials specified.

Add 2.1.3 Where samples are required, a 10 *Day* period shall be allowed for examination of samples by the *City Engineer*.

2.2 Materials

Add 2.2.1 Granular materials shall conform to the requirements of *Section 31 05 17 Aggregates and Granular Materials*.

Add 2.2.2 Pea-gravel shall conform to the requirements of *Section 31 05 17 Aggregates and Granular Materials*.

Add 2.2.3 Controlled Density Fill shall confirm to the requirements of *Section 31 23 23 Controlled Density Fill*.

Add 2.2.4 Cast-In-Place concrete shall conform to the requirements of

Section 03 30 53 Cast-in-Place Concrete.

Add 2.2.5 Asphaltic concrete shall conform to the requirements of *Section 32 12 17 Superpave Hot-Mix Asphalt Concrete Paving*.

3.0 EXECUTION

3.1 General

Add 3.1.1 Execution shall be in accordance with the applicable *City* specifications (e.g. for surface restorations, *Section 32 15 01S Surface Restoration*).

Add 3.1.2 *Work* not specified by *City* specifications shall be executed to the satisfaction of the *City Engineer*.

3.2 Backfilling of Private Development Excavations

Add 3.2.1 In usual practice, excavation widths are 0.6m maximum, with vertical walls. Sloped edges to excavations are generally not acceptable, because of the impact on other uses of the *Street*. Excavations with sloped edges and those which project into *Street* corridors used by trees, underground utilities or surface structures (sidewalks and curbs) may require special backfilling procedures. All such exceptional cases shall be subject to the direction and approval of the *City Engineer*.

Add 3.2.2 Backfilling requirements depend upon the depth of the excavation and its proximity to *City* property.

When the excavation encroaches onto *City* property, or the depth of the excavation below finished grades is greater than or equal to the shortest horizontal distance from the edge of the excavation to the adjacent *City* property line, all backfilling shall conform to one of the *Contract Administrator*-approved options (*Standard Detail Drawing G9.1*):

- Option 1 – Pea-gravel and Controlled Density Fill
- Option 2 – Controlled Density Fill
- Option 3 – Granular Fill

Option 3 shall be used for all excavations wider than 1.2m.

Add 3.2.3 **Option 1 - Pea-gravel and CDF**:

When pea-gravel is to be used as backfill material, the *Contractor* shall ensure that the pea gravel will remain confined to its original area of placement, should subsequent work be undertaken on any adjacent sites. The proposed method of providing such confinement shall be submitted to the *City Engineer* for review prior to the commencement of backfill operations.

Pea-gravel Material shall be placed from the bottom of the excavation to a grade below the finished surface grade, determined as follows:

- 300mm below the finished surface grade, plus an additional depth below this grade determined by 1.5 times the width of the excavation, to a maximum of

1.2m.

- Controlled Density Fill shall be placed above the pea-gravel material to no nearer than 300mm of finished surface grade. The top 300mm of the backfill may be backfilled with granular base material, or may contain landscaping materials subject to the review and approval of the *City Engineer*.

Pea-gravel shall be consolidated in place with an immersion concrete vibrator or other approved methods to a density equivalent to a minimum 90% modified proctor and to the satisfaction of the *City Engineer*. "End dumping" of pea-gravel is not an acceptable method of compaction.

Add 3.2.4 **Option 2 – CDF**:

Controlled Density Fill shall be placed for the full depth of the excavation, to within 300mm of the finished surface grade. The top 300mm of the backfill may be backfilled with granular base material, or may contain landscaping materials subject to the review and approval of the *City Engineer*. Area with landscaping features may require a thicker lift of topsoil as directed by the *City Engineer*.

Add 3.2.5 **Option 3 – Granular Fill:**

Granular fill shall be placed for the full depth of the excavation, to within 1.2m of the finished surface grade. The top 300mm of the backfill may contain landscaping materials subject to the review and approval of the *City Engineer*. All backfill materials shall be compacted to a minimum 95% modified proctor density.

END OF SECTION 32 15 02S

Section 32 17 23 Painted Pavement Markings

1.0 GENERAL

1.2 Scope

Delete 1.2.1 and replace with

The pavement markings which shall be installed with paint, as per *2.1.3.2* and *2.1.3.3 of this Section,* include:

- Directional dividing lines
- Lane lines
- Continuity lines
- Edge lines
- Gore areas
- Merge arrows
- Clearance panels
- Trap parking space panels
- Stop bars at stop signs
- Raised islands

For directional dividing lines and lane lines, a quick-dry paint (no cones needed), with glass beads added, shall be used. All other painted lines shall be coned paint without glass beads. Glass beads shall be as per *2.1.5 of this Section*.

Add 1.2.2

The pavement markings which shall be installed with thermoplastic paint, as per *2.1.3.1 of this Section*, include:

- Crosswalks
- Stop bars at crosswalks
- Bus lane diamonds
- Continuity Lines through an intersection
- Turn arrows
- Stencils and cycling facilities pavement markings

Add 1.2.3

Reflective pavement markers which shall be installed, as per *2.1.7 of this Section*, are:

- One-way white
- One-way amber
- Two-way amber

Add 1.2.4

Bike surface treatment shall be green Methyl Methacrylate (MMA) as per *2.1.9 of this Section*.

2.0 PRODUCTS

2.1 Materials

Add 2.1.0

All materials must meet or exceed Ministry of Transportation Specifications.

Delete 2.1.3.1 and replace with

Thermoplastic Paint (Alkyd):

The paint shall be combined with glass beads and / or other standard bead types and shall give desired wet night reflectivity characteristics of *ASTM E2177* for wet recovery when used in conjunction with a proper surface profile of a durable marking line.

Delete 2.1.3.2 and replace with

Yellow Traffic Paint (Alkyd):

Property	Specification
Colour	Lead Free Yellow
% Pigment by Weight	56±2
Viscosity @ 77˚F, KU	80-95
Weight per Gallon (min.)	11.8
Hegman Grind (min.)	2
Flash Point	Below 20˚F
VOC (max.), g/l	150
% Solids by Weight (min.)	72.0
% Reflectance (min.)	50

Delete 2.1.3.3 and replace with

White Traffic Paint (Alkyd):

Property	Specification
Colour	Lead Free White
% Pigment by Weight	56±2
Viscosity @ 77˚F, KU	80-95
Weight per Gallon (min.)	12.0
Hegman Grind (min.)	2
Flash Point	Below 20˚F
VOC (max.), g/l	150
% Solids by Weight (min.)	72.0
% Reflectance (min.)	85

Delete 2.1.5 and replace with

Glass Beads:

Glass bead product must meet the requirements of *AASHTO M247* with a minimum roundness value of 70% true spheres to qualify under this section. Manufacturers / suppliers are to provide independent testing from accredited North American testing laboratories with results showing compliance to the current *AASHTO M247*. Heavy metal concentrations must be below acceptable maximums outlined in the following table:

Contaminant	**Maximum Concentration (PPM or mg/kg)**
Arsenic	50
Lead	90
Antimony	75

Add 2.1.7

Raised Pavement Markers:

The following raised pavement markers are generally approved for use in the *City*:

- Ennis Flint model 980 formerly Stimsonite 980 (1066).
- Ennis Flint Model C80 formerly Stimsonite 88 (1066).
- Stimsonite reflector #911
- 3M 290 series (851).
- Rayolite 8700 series (154).
- Rayolite All Acrylic series (154).
- Rayolite AA ARC-II series (154).
- Rayolite 2002 series (154).
- Apex 921 AR (179).
- Item iMarker 702 (176).
- 80 / C80 Reflector (999).

Add 2.1.8

Raised pavement markers shall be adhered to the pavement surface with Anchor-it Marker Adhesive HR201 or approved equal.

	Add 2.1.9	Bicycle Green Surface Treatment: Bicycle green surface treatment shall be Methyl Methacrylate (MMA) with glass beads embedded to aid skid resistance with the following specifications: • Ultra-violet (UV) stable. • ISO certified durable road marking material. • Have minimum skid resistance of 49BPN. • Colour shall match the *City*'s current green tint (Pantone #368) which conforms to the FHWA fluorescent green standards. • Glass beads shall conform to *2.1.5 of this Section*.

3.0 EXECUTION

3.3 Application	Append to 3.3.2.3	All paint shall be applied by vehicle with an airless applicator.
	Add 3.3.3.7	Application of the thermoplastic shall be by buggy, with no cones.
	Add 3.3.4	Bicycle green surface treatment shall be roller-applied.

END OF SECTION 32 17 23

Section 32 17 24S Signage

1.0	**GENERAL**	Add 1.0.1	*Section 32 17 24S* refers to those portions of the *Work* that are unique to the supply and installation of both regulatory and non-regulatory temporary and permanent roadway signage. This section must be referenced to and interpreted simultaneously with all other sections pertinent to the *Work* described herein. Sign installation details must be as per *Standard Detail Drawing C19.1* and *C19.2*. Established industry standards shall apply where details and procedures are not specified.
		Add 1.0.2	The *Contractor* shall notify the *Contract Administrator* and apply for and pay for all applicable *Contractor Permits* for any temporary special zones, including temporary stopping-prohibited signage. The *City* typically elects to install the related temporary signage.
		Add 1.03	The *City* shall provide all signage required for the project. The *Contractor* shall include in their schedule when signage is required to allow for manufacturing, refer to *Section 01 32 16.19S Construction Schedule*. A minimum of four weeks in advance is required. All signs shall be picked up at the *City*'s National Works Yard. Coordinate pickup from National Works Yards with the *Contract Administrator*. The *City* will furnish the signage at no charge to the *Contractor,* except when the *Contractor* is working on behalf of a private developer or owner.
1.1	**Related Work**	Add 1.1.1	*Section 01 55 00 Traffic Control, Vehicle Access and Parking*
1.2	**References**	Add 1.2.1	The *Manual of Traffic Control Devices of Canada (MUTCDC),* published by the Transportation Association of Canada (TAC).
1.3	**Measurement and payment**	Add 1.3.1	Unless otherwise noted in the *Contract Documents*, payment for all *Work* under this Section will be incidental to payment for *Work* described in other Sections.
1.4	**Inspection and Testing**	Add 1.4.1	Refer to *Supplemental General Condition 4.12*.

2.0 PRODUCTS

2.1 Signs

Add 2.1.1 Sign blanks shall be of sign-grade aluminum with a thickness of 2mm for the following traffic sign sizes:

- 300mm x 300mm
- 300mm x 450mm
- 450mm x 600mm
- 600mm x 600mm
- 300mm x 600mm
- 450mm x 450mm
- 600mm x 600mm
- 750mm x 600mm
- 600mm x 900mm
- 750mm x 750mm
- 900mm x 900mm
- 600mm x 1050mm
- 800mm x 1200mm

Add 2.1.2 All side-mounted street name sign blades shall be fabricated from 178mm tall sign-grade aluminum with a thickness of 3.15mm and covered with Type 1 reflective sheeting.

Add 2.1.3 Overhead street name signs shall be fabricated from 356mm tall sign-grade aluminum with a thickness of 3.1mm and covered with Type 9 reflective sheeting.

Add 2.1.4 Object marker signs and keep right signs shall be fabricated from 10mm thick corrugated plastic and covered with Type 4 reflective sheeting.

Add 2.1.5 Temporary stopping prohibited signs shall be fabricated from a fiberglass-reinforced polyresin material with a thickness of 1.5mm. Reflective sheeting is not required for this type of sign.

Add 2.1.6 For colour contrast and sign layout, comply with the guidelines and requirements of *MUTCDC*, which sets forth procedures in manufacturing effective traffic and highway control and information signs.

2.2 Reflective Sheeting

Add 2.2.1 Products must meet *ASTM D4956* - Type 1, Type 3 and 4, and Type 9 or better - Type 11 minimum standards for retro-reflectivity. Sign faces shall be covered with pressure sensitive reflective sheeting as per the following:

Reflective Sheeting Type	Use
Engineering or Equivalent ASTM Type 1	Regulatory Signs Side Mounted Street Name Sign Blades
High Intensity or Equivalent ASTM Type 4	Information Signs Directional Signs Road Control Signs Object Marker Signs Keep Right Signs
Diamond Grade or Equivalent ASTM Type 9	Overhead Street Name Signs Stop Signs Yield Signs Warning Signs School Signs Playground Signs Pedestrian Signs

2.3 Sign Font

Add 2.3.1 ClearviewHwy font shall be used for all overhead information signs, overhead street name signs, standard street name signs, and construction signs.

2.4 Sign Installation Hardware

Add 2.4.1 All sign installation hardware (nuts / bolts and washers) must be stainless steel 18-8 S / S.

Add 2.4.2 All sign installations must use (band-it) strapping C20599 201 stainless steel 15.9 mm width and 0.76mm thickness.

Add 2.4.3 Lamp standard side mount hardware must be stainless steel N-70-D021 mounts.

Add 2.4.4 Pipe clamps are to be HS-1-SS 3/8 RP centermount.

2.5 Sign Post Bases

Add 2.5.1 Ericsson Mfg. concrete single-post pyramid bases 24 and 37 KG, or *Approved Equal*.

2.6 Sign Pipe

Add 2.6.1 When steel utility poles such as street light poles and traffic signal poles are not available, sign supports shall be 60mm 13-gauge gator galvanized steel posts in 3.0m/3.7m/4.6m lengths (subject to requirements) comes with 9.5mm up from bottom.

Add 2.6.2 Pipe plastic to be CSA SCH 80 PVC.

3.0 EXECUTION

3.1 Installation

Add 3.1.1 In advance of any sign installation, review the proposed locations on the *Drawings* to ensure that required sign sizes, installation height and facing direction can be achieved.

If any potential conflicts are identified, contact the *City Engineer* for direction and clarification. Signs may not be installed in alternate locations or heights without the prior approval of the *City Engineer*.

Add 3.1.2 Install signs in the locations, heights and facing the directions as described in the *Contract Documents* and in compliance with the requirements of this Section, the *Standard Detail Drawings* and applicable *MUTCD* guidelines.

Add 3.1.3 The post shall be anchored by using a steel sleeve and setscrew so as to facilitate maintenance. Sleeves shall be set in concrete with the setscrew 10mm clear of the concrete surface. Where a concrete sidewalk is not available, the post shall be set in a concrete base of 0.3m diameter and 0.6m depth to prevent overturning as per *Standard Detail Drawing C19.2*.

Add 3.1.4 Any signs to be placed on a structure must be coordinated with the Streets Design Branch through the *City Engineer*.

Add 3.1.4 Attaching of signs to wooden utility poles is not permitted.

END OF SECTION 32 17 24S

Section 32 91 21 Topsoil and Finish Grading

1.0	**GENERAL**		
1.3	**Source Quality Control**	Add 1.3.3	The *Contractor* shall guarantee that the growing medium submitted for laboratory analysis is a representative sample taken from the growing medium to be delivered to the *Site*.
		Add 1.3.4	Failure to test and provide appropriate documentation of test results may be considered grounds for rejection of a proposed growing medium and may result in removal and replacement of the rejected material at the *Contractor*'s expense.
2.0	**PRODUCTS**		
2.2	**Applications**	Delete 2.2	Delete 2.2
2.3	**Native Topsoil**	Delete 2.3	Delete 2.3
2.4	**Imported Topsoil**	Delete 2.4.1	Delete 2.4.1
		Delete 2.4.2	Delete 2.4.2
		Delete 2.4.3	Delete 2.4.3
2.5	**Peat Moss**	Delete 2.5.1 to 2.5.5 and replace with	Peat moss shall not be used.
2.6	**Sand**	Delete 2.6.1 to 2.6.2 and replace with	Sand fill (COV #17) as per *Section 31 05 17 Aggregates and Granular Materials*.
2.7	**Manure**	Delete 2.7.1 to 2.7.5 and replace with	Soil amendment growing medium, as specified in *2.10 of this Section*, shall be used in place of manure.
2.10	**Growing Medium**	Delete 2.10.2 and replace with	Growing medium shall be free from subsoil, plants or their roots, building materials, wood, non-composted wood, wood waste, woody plant parts, insect pests, plant pathogenic organisms, chemical pollutants or substances at levels toxic to plants, stones (in excess of 10mm in maximum dimensions), foreign objects, and other extraneous materials that detract from the desirable physical and chemical properties required for landscaping purposes. All soil product supplied to the *City* is to be free of Neonicotinoid.

Delete 2.10.5 to 2.10.15 and Table 2 and replace with

Properties	Soil Amendment	Street Turf Mix	Street Shrub Mix	Bioretention Soil (Park Turf Mix)
C:N (Carbon : Nitrogen)	25:1-10:1	20:1-10:1	20:1-10:1	20:1-10:1
%OM (of tot. dry wt.) (Organic Matter)	40-65%	3-10%	10-20%	10-20%
%Sand (of tot. dry wt.)	15-35%	30-60%	30-60%	70-85%
%Silt (of tot dry wt.)	5-15%	10-35%	10-35%	5-15%
%Clay (of tot dry wt.)	7-17%	5-15%	5-15%	0-15%
Total Silt and Clay	15-30% max	40% max	40% max	20% max
Acidity (pH)	4.5-8.0	6.0-7.0	4.5-6.5	4.5-8.0
Max Particle Size	100% passing 0.5” sieve	100% passing 0.5” sieve	100% passing 0.5” sieve	100% passing 0.5” sieve
Nitrogen (N)	2	4	2	4
Phosphorus (P) (ppm)	390	324	443	324
Potassium (K) (ppm)	2681	1956	2114	1956
EC (sat extr.) @25˚C (Electrical Conductivity)	n / a	n / a	n / a	n/a
SAR (sat extr.) (Sodium Adsorption Ratio)	8.8%	2.22%	2.34%	2.22%

Add 2.10.18 Growing medium shall be free from nuisance, noxious and invasive weeds and seeds or parts thereof.

Add 2.10.19 Growing medium shall be free of pathogens harmful to humans, including but not limited to Fecal Coliforms, Salmonella and E. coli.

Add 2.10.20 If engineered soil is specified on the *Drawings,* the growing medium shall be as per *Section 32 91 22S Engineered Soil*.

3.0 EXECUTION

3.3	**Processing Growing Medium**	Append to 3.3.1	Screening: .1 Standard (Single Screen) – 100% passing through a 12.7mm screening machine (unless otherwise specified in the table in *2.10.5 of this Section*). .2 Optional Double screen – 100% passing through a 9.52mm screening machine. .3 Double screening is weather dependent and can only be done in dry weather or after 2 to 3 consecutive dry days. .4 Screening of soil must have occurred within one week of delivery.
		Delete 3.3.2 and replace with	Peat moss shall not be used.
3.4	**Placing Growing Medium**	Append to 3.4.2	The growing medium shall be moderately compacted (e.g. 90% density) with a slight crown to account for near-term settlement.
		Delete 3.4.5 and replace with	Boulevard soil shall be placed at a minimum depth of 300mm in turf areas. A minimum depth of 450mm shall be placed in planted areas of the boulevard.
		Add 3.4.6	Underground utilities and conduits shall maintain their required minimum granular cover as specified by the utility. In these areas, at least 150mm of boulevard growing medium shall be placed over the granular cover (300mm preferred); the thickness shall be as per the *Contract Documents*.
		Add 3.4.7	In areas with poor draining subgrade soils, curb drains shall be installed adjacent to the sidewalk or at the back of curb according to the *Contract Documents, Section 03 30 20 Concrete Walks, Curbs and Gutters* and as per *Standard Detail Drawing C6.1*.
3.5	**Applying Fertilizers**	Delete 3.5.1 and replace with	Add fertilizers to bring growing medium fertility within ranges set out in this *Section*, and as recommended by testing of the growing medium.
3.6	**Finished Grading**	Append to 3.6.1	The desired crossfall through a grass or planted boulevard to the curb is 4%; the allowable crossfall of a grass or planted boulevard shall be between 2% and 6% or as otherwise approved by the *City Engineer*. If there is settlement in the boulevard during the two-year *Warranty Period*, the areas must be re-graded / top-dressed to prevent trips (settlements over 6mm), particularly at the edge of curb and edge of sidewalk.

END OF SECTION 32 91 21

Section 32 91 22S Engineered Soil

1.0	**GENERAL**	Add 1.0.1	*Section 32 91 22S* refers to those portions of the *Work* that are unique to the supply and installation of engineered soil mix, including equipment, materials and labour necessary for preparation and placement. This section must be referenced to and interpreted simultaneously with all other sections pertinent to the *Work* described herein.
		Add 1.0.3	Producers of this material must be experienced and pre-approved.
1.1	**Related Work**	Add 1.1.1	*Section 31 22 01 Site Grading*
		Add 1.1.2	*Section 31 23 01 Excavating, Trenching and Backfilling*
		Add 1.1.3	*Section 31 05 17 Aggregates and Granular Materials*
		Add 1.1.4	*Section 32 91 21 Topsoil and Finish Grading*
		Add 1.1.5	*Section 33 11 01 Waterworks*
		Add 1.1.6	*Section 33 40 01 Storm Sewers*
		Add 1.1.7	*Section 33 44 01 Maintenance Holes and Catchbasins*
1.2	**References**	Add 1.2.1	*BCSLA / BCLNA Landscape Standard*
		Add 1.2.2	*Canadian System of Soil Classification*
1.3	**Source Quality Control**	Add 1.3.1	The *Contractor* shall propose suppliers/sources for aggregate and soil for the engineered soil mix to the *City Engineer* for approval 7 *Days* prior to the delivery of any material to the *Site*. Aggregates and soil shall each come from a single source. Source testing of materials to be conducted by a recognized independent testing agency, approved in advance by the *City Engineer*.
		Add 1.3.2	The *Contractor* shall supply growing medium test results to the *Contract Administrator* for review, showing compliance with the material product requirements of *2.1 of this Section*, including recommendation for incorporation of necessary amendments and retesting (if applicable).
		Add 1.3.3	The *Contractor* shall supply aggregate test results to the *Contract Administrator* for review, showing compliance with the material product requirements for aggregate in *2.2 of this Section*.

1.4	**Sample**	Add 1.4.1	Prepare a sample of the engineered soil mix with proposed mix ratios for approval by the *City Engineer* a minimum of 2 *Days* prior to placement. The *City Engineer* may request additional samples of the engineered soil mixture to be tested in the event that further refinement of the mixture is necessary.
1.5	**Scheduling**	Add 1.5.1	Coordination of the installation of the engineered soil mixture is critical. Ensure scheduling has been coordinated with the *Contract Administrator* and related *Contractors*.
		Add 1.5.2	Schedule to include: .1 Date for commencement of preparation of the engineered soil at source. .2 Subgrade preparation at *Site*. .3 Shipping dates. .4 Arrival dates on *Site*. .5 Installation dates.
		Add 1.5.3	Schedule the *Work* to coordinate with installation of any drainage, irrigation, tree grate footings, lighting, paving, and other applicable interdependent work.
1.6	**Measurement and Payment**	Add 1.6.1	Payment for engineered soil includes supply of materials, onsite handling including processing, placement to thickness specified, placement of filter fabric, and finish grading. Payment for engineered soil will be by actual area provided.
1.7	**Inspection and Testing**	Add 1.7.1	A start-up meeting with the *Contract Administrator* is required to confirm the areas of installation and mixing. If not previously submitted, growing medium sample and test report, aggregate stone sample, and engineered soil sample and report are to be supplied at the start-up meeting.
		Add 1.7.2	Coordinate *Site* meetings with the *Contract Administrator* at the following typical inspection times: .1 Drainage installation and connection. .2 Irrigation installation. .3 Mixing of engineered soil mixture. .4 Installation of engineered soil mixture. .5 Subgrade preparation and layout. .6 Installation of trees.
		Add 1.7.3	Where materials are installed in phases, it is the *Contractor*'s responsibility to inform the *Contract Administrator* of critical installation times for each phase as noted in *1.7.2 of this Section*.
		Add 1.7.4	The *Contractor* shall ensure all compaction test results (for all failed and passed tests) and test certificates are submitted to the *Contract Administrator* within 48 hours. Compaction test results shall be submitted by third parties

to the *Contract Administrator*.

1.8 Product Handling

Add 1.8.1 All materials used in the composition of engineered soil shall not be prepared, worked, or travelled upon when in a wet or frozen condition.

Add 1.8.2 Supply and handle dolomite lime, fertilizer, stabilizer, and other amendments in standard, sealed, waterproof containers with net weight and product analysis clearly marked on exterior of package.

1.9 Delivery, Storage, and Protection

Add 1.9.1 Engineered soil shall be prepared on-*site* or at a location pre-approved by the *Contract Administrator* or be supplied from an approved off-*site* supplier.

Add 1.9.2 Undertake all on-*site* storage of prepared engineered soil in such a manner as to prevent damage or separation of any materials.

Add 1.9.3 Install engineered soils as soon as practicable after mixing. Any engineered soils stored overnight, whether on-*site* or at the source, shall be covered with tarpaulin of material approved by the *Contract Administrator* until such time as engineered soils are installed.

Add 1.9.4 Protect all material to be stockpiled in accordance with BC Ministry of Environment guidelines.

2.0 PRODUCTS

2.1 Growing Medium

Add 2.1.1 Growing medium, specific to engineered soil exclusively, shall be in accordance with the following:

Properties	Growing Medium
TEXTURE:	Percent of Dry Weight Mineral Fraction (%)
Sand	45 - 55
Silt and Clay Combined	25 - 45
Silt	25 - 35
Clay	0 - 10
ACIDITY (pH)	6.0 - 7.0
SALINITY (mmhos/cm)	< 3.0
ORGANIC CONTENT: Percent of Dry Weight (%)	15 - 20

Add 2.1.2 Organic material in the growing medium must be well decomposed to prevent oxygen consumption.

2.2	**Aggregate**	Add 2.2.1	Clean stone of high angularity is required.
		Add 2.2.2	Stone dimension aspect ratio shall approach 1:1:1 (length:width:depth) with a maximum of 2:1:1.
		Add 2.2.3	Must consist of 100% fractured aggregate, crushed and screened from an approved supplier.
		Add 2.2.4	Single-size stone, 60 - 80mm clear sieve designation.
		Add 2.2.5	Aggregate to be used for engineered soil shall be free of any foreign elements or material. Provide samples and test reports as described in *1.3* and *1.5 of this Section*.
		Add 2.2.6	Material shall be sound, hard, durable, and free from soft, thin, elongated or laminated particles, organic material, calcium lumps or material, or other substance that would act in a deleterious manner for its use intended.
2.3	**Soil Stabilizer**	Add 2.3.1	Soil binding agent shall be an organic, non-toxic compound designed to act as a tackifier to adhere soil to rock to ensure an even distribution throughout the mix.
2.4	**Granular Base**	Add 2.4.1	Granular base (COV #9) as per *Section 31 05 17 Aggregates and Granular Materials*.
2.5	**Surface Restoration**	Add 2.5.1	Surface restoration as per *Section 32 15 01S Surface Restoration*.
2.6	**Filter Fabric**	Add 2.6.1	Non-woven filter fabric shall be installed as a separation layer directly above the compacted engineered soil mixture. Do not install fabric until adequate compaction of the engineered soil mixture has been confirmed and approved by the *City Engineer*.
		Add 2.6.2	Filter fabric for engineered soil applications shall be selected and designed to withstand wear and tear during construction without deterioration of its strength and filtering properties. Conform to the following ASTM designations: .1 *Grab Tensile Strength ASTM D4632*: min. 400N .2 *Tensile Elongation ASTM D4632*: 50% .3 *CBR Puncture ASTM D6241: min. 1150N* .4 *Flow Rate ASTM D4491*: min. 6,110L/min/m^2
3.0	**EXECUTION**		
3.1	**Preparation of Subgrade**	Add 3.1.1	Verify that grades are correct. If discrepancies occur, notify the *City Engineer* and do not commence the *Work* until directed.
		Add 3.1.2	Excavate trenches in accordance with the requirements of *Section 31 23 01 Excavating, Trenching and Backfilling* allowing for design depth and width of engineered soil mix.

		Add 3.1.3	Excavate subgrade to establish tree pit / trench as indicated on the *Drawings* and as per *Section 32 93 01 Planting of Trees, Shrubs and Ground Covers*.
		Add 3.1.4	Areas designated as engineered soil tree pits for street tree planting shall be compacted to the equivalent of 95% Modified Proctor Density and shall be free of stones, debris, root branches, toxic materials, building materials, and other deleterious materials to the approval of the *City Engineer*.
		Add 3.1.5	Grade soil, eliminating uneven areas and low spots, ensuring positive drainage. Subgrade elevations shall slope parallel to the finished grades and / or toward the subsurface drain lines as indicated in the *Contract Documents*.
		Add 3.1.6	Subgrade shall be approved by the *City Engineer* prior to placement of the engineered soil mix.
3.2	**Subdrains**	Add 3.2.1	Install subdrains to the requirements of *Section 33 11 01 Waterworks*, *Section 33 40 01 Storm Sewers*, and *Section 33 44 01 Maintenance Holes and Catchbasins*.
		Add 3.2.2	Confirm location of subdrain connection to storm sewer system with the *City Engineer* prior to installation.
		Add 3.2.3	Install subdrains prior to the installation of the engineered soil mixture.
3.3	**Irrigation**	Add 3.3.1	Install irrigation main lines, if specified on the *Drawings*, in coordination with installation of the engineered soil. Confirm timing at start-up meeting. Scheduling to must be presented to and approved by Contract Administrator prior to installation.
		Add 3.3.2	Confirm location of irrigation connections with the *City Engineer*.
		Add 3.3.3	Ensure all irrigation pipes are separated from direct contact with engineered soil by means of bedding sand or other measures as pre-approved by the *City Engineer*.
3.4	**Processing Engineered Soil Material**	Add 3.4.1	Base Ratio of Materials: • $4m^3$ of aggregate stone as per *2.2 of this Section*. • $1.25m^3$ of growing medium as per *2.1 of this Section*. • 2kg of stabiliser as per *2.3 of this Section*. Water as required (the amount of water required will vary according to the moisture present in the growing medium).
		Add 3.4.2	All mixing shall be performed on a flat, hard, level surface approved by the *Contract Administrator*, using appropriate soil mixing equipment.

		Add 3.4.3	Combine the aggregate, growing medium, and stabilizer product into a thorough, homogeneous mixture. If materials are dry, moisten the mixture with fine spray of clean potable water while mixing to activate the stabilizer product.
		Add 3.4.4	Ensure consistent even distribution of all components by thorough mixing. The ratio of components will vary and may require adjustment to ensure the soil volume is adequate to fill all voids in the stone.
		Add 3.4.5	Do not overmix. Overhandling can result in separation of the growing medium from the aggregate. Further and final mixing will occur during the placement of the material.
3.5	**Placement**	Add 3.5.1	Do not proceed with the installation of the engineered soil material until all walls, curbs, and utility work in the area have been installed. Structural elements or design features that are dependent on the engineered soil mixture for support may be postponed until after the installation of the mixture.
		Add 3.5.2	Engineered soil shall be moist but not saturated with water when placed. Place and handle material to avoid damage to drainage structures, irrigation equipment, sidewalks, concrete structures, or pavement.
		Add 3.5.3	Do not handle or place engineered soil mix in rain or in freezing conditions.
		Add 3.5.4	Place engineering soil in 300mm lifts. Compact each lift of engineered soil material to the satisfaction of the *City Engineer*.
		Add 3.5.5	Installation of engineered soil within 0.4m of the tree root ball is not recommended. Various techniques / containments such as reinforced wood boxes, steel boxes and large diameter PVC pipe, have been employed to allow for sand to be installed at the tree location with the compacted engineered soil surrounding the hole. At the time of tree installation, the sand and containment are removed and growing medium (as per *2.1 of this Section*) added to surround the root ball. Ensure the medium for the support of the tree grate surround is compacted engineered soil.
3.6	**Installation of Filter Fabric**	Add 3.6.1	Install filter fabric following approval of engineered soil compaction by the *City Engineer*. Ensure minimum 60cm overlap of all fabric seams and beyond edge of engineered soil.
3.7	**Granular Base Material**	Add 3.7.1	Place a minimum 75mm thick granular base on top of the filter fabric over the engineered soil layer. Compact the granular base as per *Section 31 23 01 Excavating, Trenching and Backfilling*.

3.8 Finished Grading

Add 3.8.1 All areas shall be graded to the contours and elevations indicated on the *Contract Documents* and as per *Section 32 91 21 Topsoil and Finish Grading*. Ensure positive drainage.

Add 3.8.2 Finish grade shall be to within 15mm of proposed grades within 3.0m of any adjacent fixed elevation and to within 15mm of proposed grades over any other 3.0m length. Finish grades shall not be uniformly high or low.

END OF SECTION 32 91 22S

Section 32 92 20 Seeding

2.0 PRODUCTS

2.1 Grass Seed Add 2.1.6

The seed mix shall be a premium grade suitable for high-traffic areas and offer good wear and drought tolerance. The mix shall include turf-type Perennial Ryegrass, turf-type Kentucky Bluegrass, and turf-type Red Fescue (including Chewing's and Creeping Fescues).

END OF SECTION 32 92 20

Section 32 92 23 Sodding

2.0 PRODUCTS

2.1	**Sod**	Add 2.1.8	Sod must be suitable for high-traffic areas, offer good wear tolerance, shall be grown on sand or sandy loam based medium and shall be un-netted. Netted Sod and sod grown on silt-clay based medium are not acceptable.
		Add 2.1.9	If deemed suitable for the proposed location, the sod shall be a Canada No. 1 seed mixture, generally consisting of 20-30% Perennial Rye grass, 40% Kentucky Blue grass and 20-40% Chewing Fescue.
		Add 2.1.10	Preference will be given to sods that include drought-tolerant grass species. If drought-tolerant species are not present in the sod, these must be introduced to the turf.

3.0 EXECUTION

3.3	**Fertilizer**	Add 3.3.2	Prior to placing sod, 50g/m^2 of 12-4-8 fertilizer shall be placed on the topsoil below the sod.
3.5	**Conditions for Total Performance**	Add 3.5.1.8	Sodded areas shall be smooth, level and even after sod and topsoil have consolidated.

END OF SECTION 32 92 23

Section 32 93 01 Planting of Trees, Shrubs and Ground Covers

1.0	**GENERAL**	Add 1.0.3	Under the terms of the *Street Tree Bylaw No. 5985*, the Park Board is responsible for the care and custody of boulevard trees on City *Streets*. Permission to plant trees on the *Street* shall be obtained from the *City Engineer*, who will liaise with the Park Board.
		Add 1.0.4	No existing trees are to be removed and replaced as without the permission of the Park Board.
		Add 1.0.5	The *Contractor* is responsible for traffic and parking control during the tree planting process as per *Section 01 55 00 Traffic Control, Vehicle Access and Parking*. The *Contractor* is required to work with the *Contract Administrator* to arrange parking restrictions and curb lane closures.
		Add 1.0.6	The Contractor is responsible for the maintenance of the trees, including summer watering, throughout the two-year *Warranty Period*. The *Contractor* will be responsible for removing and replacing any trees which fail to survive during the two-year *Warranty Period* to the satisfaction of the Park Board.
		Add 1.0.7	The Park Board may be contracted, through the *Contract Administrator* to plant street trees on the *Contractor's* behalf. There is a set fee structure in place that is dependent on the size of the tree and the location of the *Site*. Watering can similarly be arranged.
1.2	**References**	Add 1.2.4	*Canadian Nursery Landscape Association Canadian Standards for Nursery Stock*
		Add 1.2.5	*Street Tree Bylaw, No. 5985*
1.4	**Scheduling**	Add 1.4.4	Trees shall be dug and moved during the dormant season, in a well-watered condition, and in accordance with the *Canadian Nursery Landscape Association Canadian Standards for Nursery Stock*.
		Add 1.4.5	Tree roots shall not be exposed to intense winter cold after they are lifted. Mulch shall be used as protection.
1.6	**Drainage Control**	Add 1.6.2	If indicators of poor drainage are detected before or during the time of planting, notify the *City Engineer*.
		Add 1.6.3	When planting where Park Board has determined that a drainage correction is impossible or impractical, the root collar shall be planted higher in relationship to the surrounding soil by 7.5 to 10cm.
1.10	**Inspection and Testing**	Add 1.10.2	All tree plantings must be inspected by the Parks Board. Inspection is to be coordinated through the *Contract Administrator* with a minimum 72 hours' advance notice.

One week advance notice is preferred.

2.0 PRODUCTS

2.1 Plant Material

Add 2.1.2.13 — Preference will be given to plant materials grown in Pacific Northwest America.

Append to 2.1.2.1 — All trees shall be nursery field grown and be balled and burlapped or in wire basket. Trees may not be container grown. Shrubs, perennials and other similar plants may be container grown.

Append to 2.1.2.3 — All trees shall be:

- on a single leader, with the lowest branch being at least 2m high on the stem
- of 6cm caliper or greater if deciduous
- of 2.5m height or greater if coniferous

Append to 2.1.2.8 — All trees shall be free of:

- pest and disease
- pernicious weeds in the root ball
- injury, or other defects
- girdling roots

Add 2.1.3 — Where planting projects require more than 10 trees, the *City Engineer* reserves the right to select and tag optimal specimens at the source or wholesale nursery.

Add 2.1.4 — Minimum root ball diameters for coniferous trees are:

Height	Tall and columnar	Tall and broad
200cm	50cm	60cm
250cm	55cm	70cm
300cm	70cm	85cm

Add 2.1.5 — Minimum root ball diameters for deciduous trees are:

Caliper	Root ball diameter
6cm	60cm
7cm	70cm
8cm	80cm
9cm	90cm
10cm	100cm
12.5cm	110cm
15cm	120cm

2.13 Root Barriers Add 2.13.1

Root barriers must be made commercially, produced for the purpose of deflecting roots downward, and be of a specification approved by the *City Engineer*.

2.14 Tree Grates Add 2.14.1

For installation in Downtown special planning areas, the following metal tree grate specifications shall be met:

Metal Tree Grate Specifications:

Area	Vendor	Specifications
Downtown South	Dobney Foundry or *Approved Equal*	Sp 36 – 915mm
Library Precinct	Dobney Foundry or *Approved Equal*	Sp 48 – 1219mm
Gastown		1524mm round four-piece radial
Alexander St.	Dobney Foundry or *Approved Equal*	Lp60-R – 1524mm round four-piece – circular pattern
Ceremonial Street Public Realm	Dobney Foundry or *Approved Equal*	Sp 48 – 1219mm
Bosa Site (Terminal and Quebec	Dobney Foundry or *Approved Equal*	Sp 48 – 1219mm
Granville Mall		1524mm round four-piece radial and 1524mm square four-piece radial

Add 2.14.2

Concrete Grate Specifications:

Area	Vendor	Specifications
Varies	City Central Stores	Broom finished concrete grate
Varies	City Central Stores	Exposed aggregate concrete grate

If a broom finished or exposed aggregate concrete grate is specified on the *Drawings*, concrete grates shall be ordered by phoning the *City*'s Central Stores a minimum of four weeks in advance. All exposed aggregate grates shall be picked up on one day, generally from the *City*'s Manitoba Works Yard. All broom finished grates shall be picked up on one day, generally from the *City*'s Kent Yard. Coordinate

pickup with the *Contract Administrator*. The *City* will furnish the concrete grates and lids at no charge to the *Contractor,* except when the *Contractor* is working on behalf of a private developer or owner.

3.0 EXECUTION

3.2	**Subgrade Preparation**	Delete 3.2.3.2 and replace with	Excavation of the subgrade shall be only as necessary to permit the bottom of the rootball to sit on undisturbed material or compacted fill such that the top of the rootball remains at the proper finished grade. If material below the rootball has been disturbed, re-compact all material to prevent settling of the root ball in the hole.
		Add 3.2.3.6	All digging in the street boulevard for street trees must be done by hand. No mechanical equipment is to be used to dig the holes (i.e. no backhoes and post hole diggers).
		Add 3.2.3.7	Wherever possible, the hole shall be dug with sloping sides. The preferred angle is 45˚.
3.3	**Planting**	Delete 3.3.4.2 and replace with	When the backfill has been placed up to 2/3 of the rootball height, basket ties shall be cut and the top 1/3 of the burlap and basket folded back downwards. Remove container from grown stock before planting. No burlap or wire shall be showing above the finished grade. Ties must be pushed back into the lower portion of the hole.
		Delete 3.3.4.4 and replace with	A 10cm raised saucer, of inside diameter equal to the outside diameter of the root ball, shall be constructed around the perimeter of the rootball to enhance water infiltration.
		Append to 3.3.6.3	Ensure tree is planted in the exact centre of the specified planting station straight and true.
		Add 3.3.7	Root barriers must be installed at the time of planting whenever a tree is installed within 2m of a sidewalk or other hardscape feature – excluding roads; or where specified on the *Drawings*. Root barriers shall be installed as per manufacturer's specifications.
3.5	**Watering**	Add 3.5.2	Trees shall be immediately and adequately watered after planting.
3.7	**Mulching**	Add 3.7.3	Mulch shall be placed inside the berms of the saucer, to a depth of 7cm – 9cm. The mulch shall be kept away from the tree trunk.
3.11	**Guarantee/ Maintenance**	Delete 3.11.1 and replace with	The Two-year *Warranty Period* will apply for landscape work. Contractor to guarantee all materials and workmanship for a period of two full years from date of Total Performance, unless specified otherwise in the *Contract Documents*.

END OF SECTION 32 93 01

Section 33 01 30.1 CCTV Inspection of Pipelines

1.0 GENERAL

1.3 Submission of Certification

Add 1.3.3

Television and video equipment proposed for use to complete inspection(s) shall be employed only if approved in advance by the *City Engineer*.

1.5 Scheduling of Work

Add 1.5.3

The *Contractor* shall, at their cost, have the entire sewer system inspected with a closed-circuit television camera, after the completion of backfilling and installation of service connections, and after all flushing operations are complete and all *Maintenance Holes*, catchbasins and other applicable system components have been inspected by the *City Engineer*.

At least the following components shall be included in the required inspection:

- All new storm / sanitary sewer mains.
- All new storm / sanitary service connections (from property line to main with inspection chambers).
- All catchbasin leads (from existing or new catchbasins to new storm main).

1.6 Measurement for Payment

Delete 1.6.1 - 1.6.6

Unless otherwise noted in the *Contract Documents*, payment for all *Work* under this Section will be incidental to payment for *Work* described in other Sections.

3.0 EXECUTION

3.1 CCTV Inspection

Delete 3.1.4 and replace with

During TV inspection, the maximum depth of flow in the sewer shall not exceed the following:

- 20% of pipe diameter for sewers of 150mm to 250mm diameter.
- 25% of pipe diameter for sewers of 300mm to 600mm diameter.
- 30% of pipe diameter for sewers of 675mm diameter and up.

Where depth of flow exceeds the maximum stated, a flow reduction method shall be in accordance with *3.11 of this Section*.

Delete 3.1.8 and replace with

Inspection video images are to be produced in MPEG2 format in either one or a combination of the following methods:

- video capture card and software designed to create and store real-time MPEG2 digital file direct to computer hard drive.
- record all videos at standard VHS speed (SP mode) using S-VHS (Super VHS format).
- by means of video capture card and software compress

			image and create MPEG2 digital file. Data compression bit rate to be set at a minimum of 5 Megabits/sec. • create a separate digital file and, by means of chaptering software, create a separate title for each individual *Maintenance Hole* to *Maintenance Hole* inspection report. Identify each report title on the DVD menu.
		Delete 3.1.9 and replace with	Set zero chainage at centre of every *Maintenance Hole* or on entrance into pipe or start of pipe culvert.
		Delete 3.1.10 and replace with	Report and record on full length of pipeline from centre of *Maintenance Hole* to centre of *Maintenance Hole*, between *Maintenance Hole* or outlet end of pipes, and from one end of pipe culvert to the other.
3.5	**Camera Travel Speed**	Delete 3.5.1.3 and replace with	0.15m/s for diameters exceeding 310mm.
3.6	**Camera Position Chainage Device**	Add 3.6.2	The importance of accurate distance measurements is emphasized. Measurement for location of defects shall be above ground by means of a meter device. Marking on the cable, or similar methods, which would require interpolation for depth of *Maintenance Hole*, will not be allowed.
3.7	**Photographs and / or Digital Images**	Add 3.7.5	Photographs shall be taken: • where sewer defects are shown on the TV monitor. • at not less than three locations throughout each *Maintenance Hole* to *Maintenance Hole* section. • at each *Maintenance Hole* (flash picture). • the *Site* showing the above ground centre line of the sewer from *Maintenance Hole* to *Maintenance Hole* (one only). • as directed by the *Contract Administrator*.
3.8	**Inspection Reporting Hard Copies & Digital Format**	Delete 3.8.8 and replace with	The *Contractor* shall make colour DVD-R format digital recordings of all sewer inspections, which shall become the property of the *City*. Each DVD shall be fully recorded, numbered consecutively, and indexed on the three-ring binder, to be supplied with each DVD. The index shall list each sewer location and the corresponding tape count. Each DVD shall be divided into sections and separated by leaders which shall display the sewer location, type, size, and date on screen. DVDs are to be submitted to the *Contract Administrator* as they are filed.
		Add 3.8.10	Printed records shall be produced by the *Contractor* and shall clearly show the location of significant points and defects in the sewer, referenced to an adjacent *Maintenance Hole*. The record shall be supplied to the *Contract*

Administrator. Reports which are judged inadequate by the *Contract Administrator* due to lack of accuracy, detail, or required information shall be cause for rejection and the respective section of sewer will be re-televised by the *Contractor* at their additional expense. Each report shall also refer to the corresponding videotape number(s) and tape count. Furthermore, a sketch shall be included with the report when pipe routing is not clear, or when *Record Drawings* are incorrect.

Add 3.8.11 — The *Contractor* shall include the following information on the inspection logs:

- Date, report number, tape number, pipe diameter, tape count, pipe material, pipe use, *Maintenance Hole* locations, sewer location, wye locations, direction of camera travel, length of section, joint length, depth of flow, reason for inspection, weather, camera operator's name.
- Comments regarding special problems encountered, signs of surcharging, recommended maintenance, weirs, orifices, special piping, age of sewer.
- *Maintenance Hole* numbers, depth, material, condition, infiltration.
- Cleanliness, alignment, percent of joints leaking, open joints, offset joints, live services, dead services, protruding services, infiltration, broken pipe, collapsed pipe, cracks, dips, ponding, type of service connections, repaired sections.
- Structural condition (i.e. new, good, fair, or poor), alignment (i.e. good, fair, poor), and grade (i.e. good, fair, poor).

3.11 Flow Reduction

Delete 3.11.1 and replace with — Reduce flow in pipeline to depths in accordance with *3.1.4 of this Section* to allow CCTV inspection by combination of the following:

Delete 3.11.3.1 and replace with — Plug designed to either plug all flow or impede flow to depths in accordance with *3.1.4 of this Section*.

Add 3.11.3.4 — The *Contractor* shall be liable for any flooding resulting from their actions.

END OF SECTION 33 01 30.1

Section 33 01 30.2 Cleaning of Sewers

1.0 GENERAL

1.4 Scheduling of Work

Delete 1.4.3 and Replace with

Notify the *Contract Administrator* at least 2 *Days* in advance of any flushing operation(s).

2.0 PRODUCTS

2.1 Equipment

Append to 2.1.1

This equipment shall be constructed for ease and safety of operation. The equipment shall have a selection of two or more high-velocity nozzles. The nozzles shall be capable of producing the scouring action from 15˚ to 45˚ in all size sewer mains designated to be cleaned. Equipment shall also include a high-velocity gun for washing and scouring *Maintenance Hole* walls and floor. The gun shall be capable of producing flows from a fine spray to a solid stream.

Add 2.1.6

The designated sewer *Maintenance Hole* sections shall be cleaned using high-velocity jet equipment. Selection of the equipment used shall be based on the conditions of sewer mains at the time the *Work* commences (i.e. new condition / poor condition). The equipment and methods selected shall be satisfactory to the *City Engineer*. The equipment shall be capable of removing dirt, grease, rocks, sand, and other materials and obstructions from the sewer mains and *Maintenance Holes*.

3.0 EXECUTION

3.1 Sewer Cleaning

Delete 3.1.2 and replace with

All dirt, sand, rocks, grease, and other solid or semi-solid material resulting from the cleaning operation shall be removed by hydro-vacuum pumping at the downstream *Maintenance Hole* of the section being cleaned. Do not pass debris from *Maintenance Hole* to *Maintenance Hole*.

Delete 3.1.3 and replace with

All solids or semi-solids resulting from the cleaning operations shall be removed from the *Site* and disposed of by the *Contractor* at an approved dump site. All materials shall be removed from the *Site* no less often than at the end of each *Day*. Under no circumstances will the *Contractor* be allowed to accumulate debris, or other waste materials on the *Site* beyond the stated time, except in totally enclosed containers and as approved by the *Contract Administrator*. Return decanted or dewatered liquid to the sewer of origin.

Add 3.1.6

During sewer cleaning operations, satisfactory precautions shall be taken in the use of cleaning equipment. When hydraulically propelled cleaning tools (which depend upon water pressure to provide their cleaning force) are used, precautions shall be taken to ensure that the water pressure created does not damage or cause flooding of public or

			private property being served by the sewer.
		Add 3.1.7	If cleaning of an entire section cannot be successfully performed from one *Maintenance Hole*, the equipment shall be set up on the other *Maintenance Hole* and cleaning again attempted. If, again, successful cleaning cannot be performed or the equipment fails to traverse the entire *Maintenance Hole* section, it will be assumed that a major blockage exists and the cleaning effort shall be abandoned until the major blockage is repaired by the *Contractor*.
		Add 3.1.8	Acceptance of the sewer line cleaning shall be made upon the successful completion of the television inspection as identified in *Section 33 01 30.1 CCTV Inspection of Pipelines* and shall be to the satisfaction of the *City Engineer*. If the television inspection shows the cleaning to be unsatisfactory, the *Contractor* shall be required to re-clean and re-inspect the sewer main, at their expense, until the cleaning is shown to be satisfactory and approved by the *City Engineer*.
3.2	**Water Supply**	Delete 3.2.1 and replace with	The *Contractor* will be responsible for making any arrangements necessary and paying the permit costs for the use of City water from City fire hydrants and complying with all backflow requirements outlined in the Hydrant Use Permit.
3.4	**Sewer Flushing**	Add 3.4.5	Flushing with clean water shall be carried out on all service connection lines located between the mainline sewers, catchbasins, and other related structures before flushing the main. The *Contractor* must ensure proper backflow prevention is in place when hooking up to a *City* hydrant to prevent cross contamination of the potable water supply.
		Add 3.4.6	The *Contractor* shall ensure flushing with potable water does not occur within 300m of an outfall to receiving waters and where sanitary system may overflow to the outfall. Chlorinated water flushed from mains shall be designated into a sanitary sewer, or be treated in such a manner that does not pose a threat to aquatic life in receiving water. Obtain approval from Fisheries and Oceans and BC Fish and Wildlife Authority and implement dechlorination procedures as required prior to discharge of chlorinated water anywhere other than into a sanitary sewer.

END OF SECTION 33 01 30.2

Section 33 11 01 Waterworks

1.0 GENERAL

1.4 Material Certification

Add 1.4.3

Material delivery and storage to meet the requirements of the manufacturer. Materials damaged during transportation or through rough handling shall be repaired to the satisfaction of the *Contract Administrator* prior to installation. If, in the opinion of the *Contract Administrator*, the damaged material cannot be satisfactorily repaired, then the damaged material shall be removed from the *Site* and replaced with new material.

Add 1.4.4

Testing on gaskets, pipe and fittings shall be submitted to the *Contract Administrator* for review a minimum of 14 *Days* prior to materials being shipped to the *Site*.

1.5 Shop Drawings and Technical Data

Delete 1.5.1 and replace with

Submit *Shop Drawings* and technical data, as requested by the *Contract Administrator*, in accordance with *Supplemental General Condition 5.0*.

Shop Drawings and accompanying information shall show construction details, material specifications, joint details, grade of plate, tolerances, reinforcing steel, coating, lining, average length, dimensions, and other such details either specifically requested or required to show compliance with these specifications.

1.6 Record Drawings

Append to 1.6.1

The *Contractor* shall provide red-line markups to the *Engineer of Record* who will then prepare the *Record Drawings*. *Record Drawings* shall be prepared as outlined in *Section 01 33 01 Project Record Documents*.

Add 1.6.2

Provide connection change-over sheets for each *Block*. Blank copies of this form are available from the *Contract Administrator*.

1.7 Scheduling of Work

Delete 1.7 and replace with

Refer to *Supplemental General Condition 4.16*.

1.8 Measurement and Payment

Delete 1.8 and replace with

.1 All units of measurement for payment will be as specified herein unless shown otherwise in the *Schedule of Quantities and Prices*.

.2 The *Form of Tender* describes separate payment items for various sections of water main consistent with pipe diameters and location of mains shown on the *Drawings*.

.3 Measurement for payment for water main will be made in a lump sum for each payment item as indicated in the *Schedule of Quantities and Prices*.

.4 Payment for water main will include saw-cutting, excavation, disposal of surplus excavated material, bedding, supply and installation of all pipe, valves, hydrants and fittings, all thrust blocking, polyethylene encasement and support concrete, bolts, gaskets and

tie-rods, imported fill, cleaning, pressure and leakage testing, flushing, disinfection, bacteriological testing by a third-party, removal and disposal of abandoned main as shown on the *Contract Drawings*, tie-in to existing system, service connection change over (transfer to new main), service replacements as shown on Contract Drawings, temporary servicing and all other work and materials necessary to complete the installation as shown on the *Drawings* and specified herein.

.5 Unless noted otherwise in the *Contract Documents*, payment for hydrants, including lateral connections from water main to hydrants, valve and adjustable valve box, will be incidental to payment for water main installation.

.6 Unless noted otherwise in the *Contract Documents*, payment for service connections, including the scope defined in *1.8.4 of this Section*, surface restoration and mainline saddles where specified, corporation stops, curb stops, and all related fittings and appurtenances specified or shown will be incidental to payment for water main installation. The waterworks connection database service lists are provided for reference only. The *Contractor* must verify locations and material in the field. All services from the old main must be changed over to the new main. The database may not have listed all the addresses or services. Payment for all services changed over from the existing main to the new main, whether listed in the database or not, will be incidental to payment for water main installation.

.7 Unless noted otherwise in the *Contract Documents*, payment for mainline valves, including valves, valve boxes and support or anchor blocks will be incidental to payment for water main installation.

.8 Unless noted otherwise in the *Contract Documents*, payment for air-release / air-vacuum and combination air valves, chambers and apparatus will be incidental to payment for water main installation.

.9 Unless noted otherwise in the *Contract Documents*, payment for polyethylene bagging shown on the *Drawings* will be incidental to payment for water main installation. Payment for polyethylene bagging not shown on the *Drawings* will be measured in lineal meters at the unit price as indicated in the *Schedule of Quantities and Prices*.

.10 Miscellaneous fittings and appurtenances not specifically identified on the *Drawings*, and not included in the described separate payment items in the *Form of Tender*, are deemed to be included in described payment items.

.11 Unless noted otherwise in the *Contract Documents*, payment for abandoning old water main, removal of old valves and hydrants, including scope defined in *3.25 of*

this Section will be incidental to payment for water main installation.

.12 Payment for removing old curb stop riser pipe that contains asbestos will be in units removed.

.13 Unless noted otherwise in the *Contract Documents*, payment for sawcutting of asphalt and concrete pavement up to 150mm depth will be incidental to payment for water main installation.

.14 Payment for sawcutting of asphalt and concrete pavement deeper than 150mm up to 300mm depth, including removal of *Cut* material will be measured in lineal meters at the unit price as indicated in the *Schedule of Quantities and Prices*.

.15 Unless noted otherwise in the *Contract Documents*, payment for removal of existing water main as shown on the *Contract Drawings*, including sawcutting, excavation, backfilling, disposal, surface restoration and temporary servicing will be incidental to payment for water main installation.

2.0 PRODUCTS

2.1	**General**	Delete 2.1.1 and replace with	Pipe material to be as shown on the *Drawings*.
		Delete 2.1.3	Delete 2.1.3
2.2	**Mainline Pipe, Joints and Fittings**	Delete 2.2.1.1 and replace with	Ductile iron pipe to conform to current *AWWA C151 / A21.51*, thickness Class 52, double cement mortar lined to *AWWA C104 / A21.4* with the added requirement that the lining not exceed a maximum thickness of 6.4mm for 100-300mm pipe, and 9.5mm for 450mm pipe. Seal coat to be tough, semi-plastic and adherent to the extent that it cannot be wholly removed by physical scraping except by removing lining also.
		Delete 2.2.1.2 and replace with	Joints: Single Nitrile (NBR) gasket for push-on bell and spigot type joint and / or mechanical pipe joints.
		Add 2.2.1.3	Exterior surface of all pipes unless specified otherwise shall be coated in accordance with *AWWA C151 / A21.51*. The material shall be smooth, durable, water-resistant and shall be tough and well-bonded to the pipe. Storing pipe outdoors for a period of 12 months shall have no adverse effect on its condition.
		Add 2.2.1.4	The nominal laying length of the pipe, as defined in *AWWA C151 / A21.51, Section 51-4* shall be 5.5 or 6.0m.

Delete 2.2.2 and replace with

Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe:

.1 Materials:

.1 PVCO pipe shall be manufactured from rigid polyvinyl chloride (PVC) compound meeting the requirements of *ASTM D1784* cell class 12454B.

.2 Gaskets shall meet *ASTM F477* for high-head applications and shall be Nitrile (NBR).

.2 Hydrostatic Design Basis:

.1 Starting-stock PVC pipe shall have a hydrostatic design basis (HDB) of 4000psi.

.2 Finished PVCO pipe shall have an HDB of 7100psi.

.3 Pipe:

.1 Pipe shall be biaxially oriented (molecularly oriented in hoop and axial directions).

.2 Pipe shall be produced with cast-iron-pipe outside diameters (CIOD) in all sizes.

.3 Pipe shall be joined by integral-bell gasketed joints conforming to *ASTM D3139*.

.4 Pipe spigot ends shall be chamfered by the manufacturer.

.5 Pipe ends shall be capped at the production facility prior to storage and shipping.

.6 Pipe shall be color-coded blue.

.4 CIOD Certifications:

.1 PVC compound shall be CSA-certified to *ASTM D1784* cell-class 12454B.

.2 PVCO pipe shall be CSA-certified to *CAN / CSA B137.3.1* and third-party certified to *NSF Standard 14* and *AWWA C909*.

.3 PVCO pipe joints shall be third-party certified to *ASTM D3139*.

.5 Standards:

.1 PVCO pipe shall conform to the following standards:

- *ANSI / NSF Standard 14: Plastic Piping*.

.2 System Components and Related Materials:

- *ANSI / NSF Standard 61: Drinking Water System Components – Health Effects*.
- *ASTM D1784: Rigid Polyvinyl Chloride (PVC) Compounds*.
- *ASTM D3139: Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals*.
- *ASTM F477: Elastomeric Seals (Gaskets) for Joining Plastic Pipe*.
- *AWWA C909: Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe, 4" Through 24" (100 mm Through 600 mm)*.
- *CSA B137.3: Molecularly oriented polyvinyl*

chloride (PVCO) pipe for pressure applications.

Delete 2.2.3.1.1 and replace with	HDPE pipe shall conform to *AWWA C906* and the polyethylene resin compound shall be qualified to meet the current *ASTM D3350*. The pipe shall contain no recycled compound except that which is generated in the manufacturer's own plant from resin of the same specification and from the same raw material supplier.
Add 2.2.3.1.4	HDPE pipe shall be supplied in the nominal pipe size as specified on the *Drawings*.
Add 2.2.3.1.5	The pipe shall be rated for 1103KPa (160psi) working pressure for water at 23°C.
Add 2.2.3.1.6	The marking shall be clear, continuous and permanently marked with indent printing in intervals of not more than 1.5m and shall include the nominal pipe size, pressure rating, manufacturer's name or trademark, date of manufacture and appropriate manufacturing standard. The pipe shall have a continuous longitudinal blue line / stripe to denote water content.
Add 2.2.3.1.7	The pipe shall be supplied in manufacturer's standard stocked lengths of 15m unless otherwise specified by the *City Engineer*. All pipes shall be packaged with care to prevent cuts, scratches and other damage.
Add 2.2.3.1.8	The surface shall be homogeneous inside and out and completely free from cuts, cracks, holes, blisters, voids, foreign inclusions or other defects or irregularities that are visible to the naked eye and that may affect the pipe's wall integrity.
Delete 2.2.3.2 and replace with	Joints: HDPE pipe shall be joined in the field by method of thermal butt fusion to *ASTM D2657* providing long continuous leak proof lengths and shall be capable of conveying water at the design working pressure of the piping system. Butt fusion joining of pipe shall be performed in accordance with the procedures qualified and established by the pipe manufacturer or fusion equipment manufacturer. HDPE pipe shall not be joined by solvent cements, adhesives (such as epoxies), or threaded-type connections.
Add 2.2.3.3.5	Fittings shall be designed and manufactured to operate at not less than the design working pressure of the pipe system for which it is to be installed. HDPE pipe flange assemblies shall be used to make connections to alternate piping materials such as ductile iron. The metal slip on flanges shall be drilled to *ANSI B16.1*, Class 125 bolt circles and supplied with corrosion resistant coating.
Delete 2.2.4.1	Delete 2.2.4.1

Delete 2.2.4.2 and replace with	Fittings shall be ductile iron and shall conform to *AWWA C110 / A21.10* suitable for pressure rating of 2415kPa (350psi), double cement mortar lined to *AWWA C104 / A21.4*. The maximum cement lining thickness shall not exceed the specified minimum "double thickness" by more than 150 percent.
Delete 2.2.4.3 and replace with	Compact fittings shall be ductile iron and shall conform to *AWWA C153 / A21.53* suitable for pressure rating of 2415kPa (350psi), double cement mortar lined to *AWWA C104 / A21.4*. The maximum cement lining thickness shall not exceed the specified minimum "double thickness" by more than 150 percent.
Delete 2.2.4.4	Delete 2.2.4.4
Delete 2.2.4.5	Delete 2.2.4.5
Delete 2.2.4.6 and replace with	Single Nitrile (NBR) gasket for push-on bell and spigot type joint and / or mechanical pipe joints. All push-on joint hubs to be equipped with tie-rod lugs.
Delete 2.2.4.7.2 and replace with	On AWWA C110 fittings to *AWWA C110 / A21.10* with minimum pressure rating 2415kPA (350psi) or higher as specified in the *Contract Documents*.
Delete 2.2.4.7.3 and replace with	On AWWA C153 fittings to *AWWA C153 / A21.53* with minimum pressure rating of 2415kPA (350psi) or higher as specified in the *Contract Documents*.
Add 2.2.4.7.4	Flanges may be either hub type or ring type. Flanges shall be raised face type for sizes up to 300mm diameter. Flanges larger than 300mm diameter shall be either flat or raised face type. Flat faced flanges shall be faced after drilling.
Delete 2.2.4.9 and replace with	Bolts and nuts used with mechanical joints shall be made of high tensile strength (60,000psi, 400MPa) low alloy weathering steel conforming to *Section 11-7.5 of AWWA C111 / A21.11* composition specification.
Delete 2.2.4.10.1 and replace with	Tie rods shall be made of high tensile strength, low alloy weathering steel conforming to *Section 11-7.5 of AWWA C111* composition specification. Stainless steel rods are not to be used unless otherwise specified by the *City Engineer*.
Delete 2.2.4.10.2	Delete 2.2.4.10.2
Add 2.2.4.10.3	Tie rods are to be installed using DensoTape or *Approved Equal* around all nuts and threads to facilitate the removal of these nuts in the future. Nuts are to be tightened to a minimum torque of 10kg-m (10ft-lbs). All tie rods are to be installed along the center line of the pipe section joining the various fittings together. The length of these tie rods is to be sized such that they will clear the flange of the fitting to enable restraining nuts to have their full body length over

available tie rod threads.

Add 2.2.4.10.4

All tie rods are to be sized according to the following:

- Up to 200mm pipe – 20mm Rods.
- Up to 300mm pipe – 22mm Rods.
- Over 300mm pipe – 28mm Rods.

or sized according to the *Engineer of Record* and *Standard Detail Drawing W17.2*.

Delete 2.2.4.12.1.1 and replace with

Couplings shall be mechanical type and shall be Dresser Style 38 or 162 Robar or *Approved Equal*, suitable for 1034kPa (150psi) pressure class and 50% surge, with ends suitable for the piping materials used. Flanged adapters shall be Dresser Style 128 Robar or *Approved Equal*, with flanges conforming in drilling and dimension to *ANSI B16.1* for casting iron flange Class 125, unless otherwise specified by the *City Engineer*. Cast iron couplings shall not be allowed.

Delete 2.2.4.12.1.6 and replace with

Bolts and nuts used with mechanical joints shall be made of high tensile strength (60,000 psi, 400MPa) low alloy weathering steel conforming to *Section 11-7.5 of AWWA C111 / A21.11* composition specification.

Delete 2.2.4.13.3 and replace with

Bolts and nuts used with mechanical joints shall be made of high tensile strength (60,000 psi, 400MPa) low alloy weathering steel conforming to *Section 11-7.5 of AWWA C111 / A21.11* composition specification. Rolled threads, fit and dimensions to *AWWA C111*. Tie bolts shall be of sufficient length to span standard bell of pipe.

Delete 2.2.4.13.4 and replace with

Tie rods shall be of material (high strength, low alloy steel) and diameter as tee bolts required by *AWWA C111*.

Delete 2.2.4.13.5 and replace with

Wedge action restrainers, a specialized version of the follower gland of a mechanical joint, are to be used as restrainers for ductile iron pipe with mechanical joint fittings. Dimensions of the gland shall be such that it can be used with the standardized mechanical joint bell and tee head bolts conforming to *ANSI / AWWA C111 / A21.11* and *ANSI / AWWA C153 / A21.52*. Unless specified otherwise, tee head bolts will be provided with fittings / pipe not wedge action restraints. Torque limiting twist-off nuts shall be used to ensure proper actuation for the restraining wedges.

The joint restraint rung and its wedging components shall be made of ductile iron conforming to *ASTM A536*. The wedges shall be ductile iron heat treated to a minimum hardness of 370BHN.

The restraints shall have a rated working pressure of 2400kPa (350psi) minimum with a 2:1 safety factor for the supplied size.

Delete 2.2.4.13.7 and replace with	Wedge action restraint harnesses are to be used as restrainers for ductile iron pipe with push-on pipe joints. Harnesses utilize a wedge action restraint as outlined in *2.2.4.13.5 of this Section*, tie rods and nuts as outlined in *2.2.4.13.3* and *2.24.13.4 of this Section*, and a mechanical joint gland (mechanical joint) retainer as outlined in *2.2.4.13.5 of this Section*. The restraints shall be a rated working pressure of 2400kPa (350psi) minimum with a 2:1 safety factor for size supplied.
Append to 2.2.4.14.1.2	Gaskets to be Nitrile (NBR).
Delete 2.2.4.14.1.5 and replace with	Bolts and nuts used with mechanical joints shall be made of high tensile strength (60,000 psi, 400MPa) low alloy weathering steel conforming to *Section 11-7.5 of AWWA C111 / A21.11* composition specification.
Add 2.2.4.14.1.9	Tees are typically cut in for services 75mm and larger; tapping sleeves may be used in exceptional circumstances if approved by the *City Engineer*.
Add 2.2.4.14.5	All main stops shall be adaptable to be used with a Mueller tapping machine.
Delete 2.2.4.15 and replace with	Repair clamps shall be constructed of 18-8 stainless steel passivated for corrosion resistance. Stainless steel components shall be Type 304 or 304L. All surfaces including weld areas shall be thoroughly cleaned of scale, grease or other contaminants. Welding must be performed in a controlled environment to prevent sensitization. Nuts and bolts shall be Type 304 18-8 stainless steel 5/8 X 11 NC rolled thread lubricated to prevent galling. Gasket shall be Nitrile (NBR).
Add 2.2.4.16	Brass and screwed brass.
Add 2.2.4.16.1	Material shall conform to *ASTM B62*.
Add 2.2.4.16.2	The working pressure shall be 1,035kPa (150psi).
Add 2.2.4.17	Joint Wrapping:
Add 2.2.4.17.1	All water mains less than 3m horizontal and 1m vertical separation from sewers shall be wrapped with heat shrink plastic or packed with inert petrolatum compound and wrapped with tape as per the following standards: • ANSI/AWWA C214 (factory applied) • ANSI/AWWA C209 (field applied) • AN51/AWWA C217 (petrolatum tape)
Delete 2.2.5.2 and replace with	Joints: push-on bell and spigot joints complete with Nitrile (NBR) gasket.

		Add 2.2.6.4	Minimum yield strength of steel pipe shall be 1,436KPa (208psi).
		Add 2.2.6.5	Interior and exterior of pipe to be coated with coal tar enamel. Interior lining will consist of coal tar primer followed by coal tar enamel (2.4mm ± 0.8mm) and the exterior coating will be the same plus bonded M-K non-asbestos felt, coal tar enamel seal coat and Kraft paper outer wrap, all in accordance with *AWWA C203*. Kraft paper to be within 300mm of pipe end.
2.3	**Valves and Valve Boxes**	Delete 2.3.1.3	Delete 2.3.1.3
		Delete 2.3.1.4 and replace with	The *City* does not allow gate valves larger than 300mm unless approved by the *City Engineer*. Reduce down or use butterfly valves in accordance with the *Drawings* and the *City Engineer*.
		Add 2.3.1.5	Geared valves shall have an indicator mounted in a position where it can be clearly seen, which shows accurately and clearly the amount which the main gate is open.
		Delete 2.3.2.2 and replace with	To *AWWA C500*: 75 to 300mm to working pressure 1380kPa (200psi); 400mm and larger to working pressure 1035kPa (150psi), ductile iron body, bronze mounted solid wedge, or double disc, non-rising stem, hub, mechanical joint, or flanged ends.
		Delete 2.3.2.3 and replace with	To *AWWA C509*: 75 to 300mm to working pressure 1380kPa (200psi); ductile iron body, resilient seated, non-rising stem, hub, mechanical joint or flanged ends.
		Add 2.3.5.5	Float: Stainless steel or ABS plastic moulding.
		Add 2.3.5.6	Linkage: Integral with float bronze.
		Add 2.3.5.7	Pins: Stainless steel or bronze.
		Add 2.3.5.8	Vent Seal: Buna-N or nylon.
		Delete 2.3.6.2 and replace with	Installation of the precast units shall be in accordance with *Standard Detail Drawing W3.1*. The 250mm diameter riser pipe shall be SDR 64 PVC with minimum 3.2mm wall thickness. Valve boxes to line up with the direction of the water main, or, if on a service, in line with the service main.
		Add 2.3.6.3	Valve boxes and lids shall be telescopic, grey iron castings and conform to *Standard Detail Drawings W15.1* and *W15.2*. Castings shall be ordered by phoning the *City*'s Central Stores a minimum of four weeks in advance. All castings shall be picked up at the *City*'s Manitoba Works Yard on one day. Coordinate pickup from Manitoba Works Yards with the *Contract Administrator*. The *City* will furnish the valve boxes and lids at no charge to the *Contractor,* except when the *Contractor* is working on behalf of a private developer or owner.

		Delete 2.3.7.1 and replace with	On 20mm and 25mm diameter services, curb stops (Ford Model BH41-233Q, B41-344Q, B41-666, B41-777 or *Approved Equal*) and curb stop valve boxes to be as shown on *Standard Detail Drawing W2a.1*. The *City* will furnish the riser caps at no charge to the *Contractor*, except when the *Contractor* is working on behalf of a private developer or owner. Coordinate pickup of materials with the *Contract Administrator*. Set box plumb over stop and adjust top flush with final grade elevation.
		Delete 2.3.7.2 and replace with	On 40mm and 50mm diameter services, curb stops (Ford Model BH41-233Q, B41-344Q, B41-666, B41-777 or *Approved Equal*) and meter box to be as shown on *Standard Detail Drawing W2a.2*. Set box plumb over stop and adjust top flush with final grade elevation. Leave curb stop valves fully closed.
		Delete 2.3.7.3 and replace with	On 100mm and larger services, service valve boxes to be as shown on *Standard Detail Drawing W2a.3*.
		Delete 2.3.7.4	Delete 2.3.7.4
		Delete 2.3.7.5	Delete 2.3.7.5
2.4	**Valve and Large Meter Chambers**	Delete 2.4.6.1 and replace with	Manufacturer's Nitrile (NBR) ring gaskets.
2.5	**Service Connections, Pipe, Joints and Fittings**	Delete 2.5.4 and replace with	Use of tapping sleeves to *2.2.4.14 of this Section* may be allowed for services 75mm and larger at the approval of the *City Engineer*. Tees are generally cut into the mainline for services 75mm and larger.
		Add 2.5.6	If cathodic protection of the water main is required, use of an insulating main stop is required for each service connection. The material of insulated curb stop approved for use in the water system is Cambridge Brass Model No. 202. In making this determination, the *City* is not strictly bound by the specified standards, but instead exercises judgement in the best interests of the *City*'s specification and maintenance. Unless prior written approval is obtained, only this approved material of insulated curb stop shall be supplied.
2.6	**Hydrants**	Delete 2.6.1.1 and replace with	Shut Off: compression type as per the *Supplemental Specifications* or *Contract Documents*.
		Delete 2.6.2 and replace with	Hydrants shall be painted with Cloverdale Marine Enamel Paint 1187-Bright Red.

2.7	**Underground Service Line Valves and Fittings**	Delete 2.7.1 and replace with	Underground service line valves and fittings 19 to 50mm to *AWWA C800* suitable for 2086kPa (300psi) working pressure.
		Delete 2.7.2.1 and replace with	20 to 50mm: brass, AWWA thread inlet, compression type outlet.
		Delete 2.7.3.1 and replace with	20 to 25mm to be brass; inverted key, ball or cylinder type construction utilizing rubber O-ring seals.
		Delete 2.7.3.2 and replace with	40 and 50mm to be brass; ball or cylinder type construction utilizing rubber O-ring seals.
		Add 2.7.5	Pipe threads to *AWWA C800*.
		Add 2.7.6	Compression connections shall be Mueller 110, Mueller Insta-Tite, Ford pack joint or *Approved Equal*.
		Add 2.7.7	Main stops and curb stops shall be without waste or drain plugs. All curb stops shall be tee head and low torque variety.
2.8	**Granular Pipe Bedding and Surround Material**	Add 2.8.3	Pipe bedding to be to be one of the following, as indicated in the *Contract Documents* or as directed by the *City Engineer*: .1 Sand fill (City of Vancouver Aggregate #17) for pipe with polyethylene encasement as per *Section 31 05 17 Aggregates and Granular Materials*. .2 19mm Minus Combined Crushed Aggregate Fill (Mulch) (City of Vancouver Aggregate #9) for pipe without polyethylene encasement as per *Section 31 05 17 Aggregates and Granular Materials*. .3 In accordance with *Standard Detail Drawings G4.2* and *G4.3*.
2.9	**Backfill Material**	Add 2.9.3	Backfill material to be one of the following, as indicated in the *Contract Documents* or as directed by the *City Engineer:* .1 19mm Minus Combined Crushed Aggregate Fill Mulch) (City of Vancouver Aggregate #9) as per *Section 31 05 17 Aggregates and Granular Materials*. .2 Sand Fill (City of Vancouver Aggregate #17) as per *Section 31 05 17 Aggregates and Granular Materials*. .3 Controlled Density Fill as per *Section 31 23 23 Controlled Density Fill*. .4 Granular Native Material (if approved for use by the *City Engineer*) as per *Section 31 05 17 Aggregates and Granular Materials*. .5 Recycled Aggregates (if approved for use by the *City Engineer*) as per *Section 31 05 17 Aggregates and Granular Materials*.

2.10 Meters

Add 2.10.1 Standard Specifications:

All meters shall conform to the applicable American Water Works Association standards or latest revision thereof unless otherwise provided herein:

.1 *AWWA C700 Cold-Water Meters – Displacement Type, Bronze Main Case*.

.2 *AWWA C701 Cold-Water Meters – Turbine Type*.

.3 *AWWA C702 Cold-Water Meters – Compound Type*.

.4 *AWWA C703 Cold-Water Meters – Fire-Service Type*.

.5 *AWWA M22 Sizing Water Service Lines and Meters*.

.6 *AWWA M6 Water Meters-Selection, Installation, Testing and Maintenance*.

.7 *AWWA C707 Encoder-Type Remote-Registration Systems for Cold-Water Meters*.

Add 2.10.2 Size and Type of Meter:

Rated meter size shall be in terms of the normal size of opening in the inlet and outlet spuds or flanges of the meter.

These specifications shall cover the sizes of meters listed as follows:

.1 20mm, 25mm, 40mm, 50mm *AWWA C700 – Displacement Type, Bronze Main Case*.

.2 40mm, 50mm, 75mm, 100mm *AWWA C701 - Turbine Type*.

.3 75mm, 100mm, 150mm, 200mm *AWWA C702 – Compound Type*.

.4 100mm, 150mm, 200mm, 250mm *AWWA C703 – Fire Service Type*.

Add 2.10.3 Dimensions of Meters:

.1 Meter dimensions referred to in this standard shall be in accordance with the dimensions given in the appropriate AWWA standards with the following exceptions: Compound meters that are 75mm, 100mm and 150mm in size, intended for installation in the *City*'s standard meter chambers or mechanical rooms shall have dimensions as follows:

.1 75mm and 100mm compound meters: length to be equal to, or less than 600mm; width to be equal to, or less than 300mm.

.2 150mm compound meters shall be no longer than 600mm; width to be equal to, or less than 800mm.

.2 These dimensions were developed in order that existing meters could be replaced without having to change or alter the *City*'s standard meter chamber and / or piping configurations. Compound meters with one body are preferred.

Add 2.10.4 Materials:

Main casings of all meters 20mm to 50mm inclusive shall be of bronze construction. Main casings of all other sizes of meters shall be bronze, steel ductile iron or *Approved Equal*. Coating or coating material shall be suitable for contact with drinking water as per *ANSI / NSF Standard 61*. A light cold-applied asphalt treatment will not be acceptable. Meters 25mm in diameter and less shall have bottom frost protection devices.

Add 2.10.5 Remote Registration System:

In which the direct mounted encoder register shall employ a leak detection indicator on the dial face, provide an 8-digit format, the unit shall encode all significant meter registration digits that indicate the highest values of recorded water consumption, on meters of all sizes and transmit the information in units of 100 cubic feet to the remote mounted receptacle located elsewhere with the option to adjust the reading resolution. All encoder registers must be compatible with latest Sensus Metering Systems AutoRead (and AutoVu), and be capable of being read by a drive by unit or a fixed-based reading system.

Add 2.10.6 Units of Registration:

.1 All encoder registers shall report in multiples of cubic feet.

.2 All register units must be readable. The register of readout units of registration shall be in accordance with *AWWA C700 Section 4.3* with the following restriction: direct reading registers shall have the numeral wheels, which indicate in less than 100 cubic feet, blanked out so that the reading indicated is 100 cubic foot units. Decimal places are to be included on the dial. At least two out of the eight digits will hold decimal places and therefore will be to the right of the decimal point. The decimal places provide low resolution for testing and maintenance.

.3 All registers must be permanently vapour sealed, must withstand all weather conditions and effects including internal fogging and internal condensation, and must be capable of being completely submerged in water for the duration of the two-year *Warranty Period*.

.4 Meters shall be potted with a minimum of 6.1m of wire.

.5 The numeral wheels shall turn so that the figures are read from the inlet side. All meters shall be capable of being fitted with a remote registration system as described in *2.10.5 of this Section* and shall meet the following requirements:

.1 Remote receptacles shall comply with *AWWA C707* unless otherwise provided herein.

.2 The remote receptacle, where indicated, must be provided for attachment to a pit lid with another unit

also designed for attachment by wall mounting. Both units must be corrosion resistant, resistant to ultra violet degradation and unaffected by rain or condensation. The wall mounted receptacle must be able to be sealed to prevent tampering.

.3 The remote receptacle is to be capable of being installed up to 30.48m away from the encoder register located at the meter.

Add 2.10.7 End Connection:

40mm, 50mm, 75mm, 100mm, 150mm and 200mm shall be supplied with flanged ends in accordance with AWWA standards.

Add 2.10.8 Measuring Chambers:

Measuring chambers of the displacement type may operate on the nutating disc or oscillating piston principle. Measuring chambers of turbine meters may operate on traditional propeller principle or floating ball technology.

Add 2.10.9 Compound and Fire Service Meters:

All fire service meters shall conform to be requirement of the Underwriter's Laboratory or an approved equivalent authority. On compound and fire service meters, the low duty side shall be designed to carry flows sufficient to prevent silting of the low duty side when the high duty side is in operation. Additionally, due to meter station / chamber specifications, a shallow strainer style is preferred in which the strainer does not fall well below the meter body.

Add 2.10.10 Test Plugs:

All compound meters 75mm and larger will be furnished with a test plug.

Add 2.10.11 Accuracy:

All meters shall be tested for accuracy by the manufacturer in accordance with the applicable AWWA standard. Each meter shall be tagged with factory test results.

3.0 EXECUTION

3.1 General

Delete 3.1.1 and replace with: Pipe bedding details, including granular surround (pipe cushion) and material specifications to be as shown on the *Drawings*, including *Standard Detail Drawings G4.2* and *G4.3*.

Add 3.1.2 Under no circumstances shall any person connect to or operate the *City*'s water system without approval from the *City Engineer*. In the event that the *City*'s water system is compromised by violation of the above, fines may be assessed by the *City Engineer* and shall be payable by the *Contractor*.

3.2 Preparation

Add 3.2.2 Pipe must be stacked using timbers to keep bottom tiers off the ground. Pipe must be stored to prevent dirt and debris

			from entering the pipe.
3.3	**Trenching**	Delete 3.3.3 and replace with	For distribution mains, trench depth to provide cover over pipe of not less than 0.9m for arterial roads / downtown and 0.75m for elsewhere from finished grade unless shown otherwise on the *Contract Drawings*. For transmission mains, trench depth to provide cover over pipe of not less than 1.2m from finished grade unless shown otherwise on the *Contract Drawings*.
3.5	**Granular Bedding**	Append to 3.5.1	Granular bedding shall be as per *2.8 of this Section*.
		Delete 3.5.6 and replace with	Place water main pipe and water services in trench and backfill with approved imported material and compact as specified. Use hand tools to compact material under haunch area of pipe and around fittings and other materials.
		Delete 3.5.7 and replace with	Use imported bedding material as per *Section 31 05 17 Aggregates and Granular Materials*.
		Delete 3.5.8	Delete 3.5.8
		Delete 3.5.9	Delete 3.5.9
3.6	**Pipe Installation**	Delete 3.6.6 and replace with	Joint deflection is only allowed on distribution sized mains 300mm diameter and smaller. Allowable deflection is to be in accordance with *AWWA C600* for ductile iron pipe and *AWWA C605* for PVC pipe but in no case greater than 3˚. Do not exceed maximum joint deflection recommended by the pipe manufacturer. For PVC pipe deflections exceeding manufacturer's recommendation, use: .1 PVC High Deflection coupling rated at 1380kPA (200psi) (100mm-300mm). .2 PVC long radius 5˚ bend rated at 1620kPa (235psi) (100mm-750mm).
		Delete 3.6.7 and replace with	Prevent groundwater, dirt and other foreign materials from entering the water main during construction. Cap the water main with a watertight plug at open ends as per *AWWA C651*, except for the addition of other pipes to the system, to prevent the entry of water and foreign materials. If contamination occurs in a water main that is not connected to the existing system, the *Contractor* must immediately stop construction and flush mains with clean water, chlorinate and test as per *AWWA C651*. If contamination occurs in a water main that is in service or already connected to the existing system, the *Contractor* must stop construction, and immediately take the main out of service, flush the main, chlorinate and test per *AWWA C651*, at the *Contractor*'s expense.
		Append to 3.6.9	For Tyton joints, bevelling of cut pipe shall be done to resemble manufacturer's bevel.

3.7	**Valve Installation**	Delete 3.7.2	Delete 3.7.2
3.8	**Valve Chambers**	Delete 3.8.5 and replace with	Set bottom section of precast unit in bed of cement mortar and bond to bottom slab. Make each successive joint watertight with approved Nitrile (NBR) ring gaskets, mastic joint filler, cement mortar, or combination thereof.
		Add 3.8.13	Installation of the precast units shall be in accordance with *Standard Detail Drawing W3.1*. The 250mm diameter riser pipe shall be SDR64 PVC with minimum 3.2mm wall thickness. Valve boxes to line up with the direction of the water main, or, if on a service, in line with the service main.
3.9	**Under-crossing**	Add 3.9.19	Trenchless installations shall be in accordance with the requirements in the *City of Vancouver Engineering Design Manual*, the *Contract Documents, and* as directed by the *City Engineer*.
3.10	**Service Connection Installation**	Delete 3.10.1 and replace with	No water services shall be installed or transferred to the water main without approval of the *City Engineer*. Pre-servicing in anticipation of future development will not be permitted. Install service connections to *3.6 of this Section* and as shown on *Standard Detail Drawings W2a.1* to *W2a.8* as directed by the *Contract Drawings* or the *City Engineer*.
		Delete 3.10.3	Delete 3.10.3
		Delete 3.10.5 and replace with	Services that are 100mm or larger require a tee or tap tee off of the water main as follows:

Pipe Diameter (mm)	Maximum Tap without Saddle (mm)	Maximum Tap with Saddle (mm)
100	25[(1)]	50
150	25[(1)]	50
200	25	50
250	25	50
300	40	75

Notes:

[(1)] Generally maximum 20mm; however, tapping up to 25mm must be approved by the *City Engineer*

		Delete 3.10.7 and replace with	Tap main at 2:00 o'clock or 10:00 o'clock position only and as shown on *Standard Detail Drawings W2a.1* and *W2a.2*, not closer to joint nor closer to adjacent service connections than recommended by manufacturer, or 1m, whichever is greater. No two adjacent connections on same pipe length to be on same plane of pipe.

		Append to 3.10.8	Curb stops to be reopened after the *City Engineer* can review and confirm passing of pressure tests and chlorination / bacteriological tests.
		Delete 3.10.11 and replace with	Install curb stop, Ford Model BH41-233Q, B41-344Q, B41-666, B41-777 or *Approved Equal*, with valve riser and cap on services 50mm or less in diameter. The *City* will furnish the riser caps at no charge to the *Contractor,* except when the *Contractor* is working on behalf of a private developer or owner. Equip larger services with a gate valve and cast iron box. Set box plumb over stop and adjust top flush with final grade elevation. Leave curb stop valves fully closed.
		Add 3.10.13	During connection installation and / or connection rehook, locate curb stop valve and measure long length from the *Street* or lane and measure a short length from the opposite property line. These measurements will be transferred to the change-over sheet.
		Add 3.10.14	Some old curb stop riser pipes may contain asbestos. Prior to removing any old riser pipes, the *Contractor* shall determine if asbestos is present. If asbestos is present, the *Contractor* shall comply fully with all WorkSafeBC requirements in the removal of the riser pipe. Payment for the removal of such pipes will be made at the unit price as indicated in the *Schedule of Quantities and Prices*.
3.12	**Hydrants**	Delete 3.12.2 and replace with	Install hydrant assemblies in accordance with *AWWA Manual of Practice* and in accordance with *Standard Detail Drawing W4.1* and *W4.2*.
		Delete 3.12.4	Delete 3.12.4
		Append to 3.12.6	Notify the *Contract Administrator* 3 *Days* in advance of putting hydrant out of service to allow required notifications.
3.13	**Thrust Blocks**	Delete 3.13.1 and replace with	Place concrete thrust blocks between valves, tees, plugs, caps, bends, changes in pipe diameter, reducers, hydrants and fittings and undisturbed ground as shown on the *Drawings* or as directed by the City *Engineer* and as detailed on *Standard Detail Drawing W1.1* to *W1.3*. Minimum size of thrust blocks to be as shown on the *Drawings*. No thrust blocks shall be permitted in disturbed or unstable soils such as peat or loose fills. Restrained joint designs will be required.
3.14	**Corrosion Protection**	Add 3.14.2	Encase water main in polyethylene tubes as shown on the *Drawings* or as directed by the *City Engineer*.
		Add 3.14.3	Install polyethylene tubes in accordance with *ANSI / AWWA C105 / A21.5 Standard – Installation Method A*.
		Add 3.14.4	Unless noted otherwise in the *Contract Documents*, payment for polyethylene encasement will be incidental to payment for water main installation.

		Add 3.14.5	Addition and deletions to polyethylene encasement will be measured in lineal meters and paid or deducted at the bid price as indicated in the *Schedule of Quantities and Prices*.
3.15	**Pipe Surround**	Delete 3.15.2 and replace with	End dumping (dumping fill out of a dump truck directly into an excavation) is not acceptable. Native material (such as the material in the excavation wall) must be kept out of the fill material and fill must be placed in a uniform manner that prevents voids.
		Delete 3.15.3 and replace with	Compaction to be done in a minimum three lifts to minimum 95% Modified Proctor Density: bedding, 600mm below final grade, and final grade. Each lift shall not be more than 600mm.
3.16	**Backfill**	Delete 3.16.2 and replace with	Backfill, including type of material and compaction requirements as shown on the *Drawings*, including *Standard Detail Drawing G4.2* and *G4.3*.
		Add 3.16.3	Distribution Water Main Construction: Water main connections / services, tie-ins, other water excavations require continued compaction testing throughout. Compaction testing for typical trenches with 750mm to 900mm cover are required in 300mm lifts for large plate tampers and 600mm for Hoe Packs (rubber tire backhoes). Crews must ensure when using multiple types of backfill material that the material is leveled off while maintaining a consistent depth. Each lift noted above must be tested for every 15m of trench length.
		Add 3.16.4	Transmission Water Main Construction: Compaction testing will be same as outlined in *3.16.3 of this Section*. However, in some instances where it is impractical to compact the pipe zone using conventional techniques, hydro-compaction may be considered with the *City Engineer*'s approval. For larger depth excavations where track shovels are involved in compaction, approval may be obtained to increase lift size after consultation with the *City Engineer*.
3.17	**General Procedure Flushing, Testing, and Disinfection**	Append to 3.17.1	Disinfection procedure to include retaining water containing not less than 50mg/L free chlorine in water system for a period of at least 24 hours, in accordance with *AWWA C651*, Continuous Feed Method with liquid chlorine. An outline of proposed disinfection procedure accompanied by a marked-up schematic drawing to be submitted for approval to the *City Engineer* 48 hours in advance of commencement of disinfection. Testing must be conducted by a *City Engineer*-approved third party.
		Add 3.17.7	Flushing water shall not be discarded through some sewers, water courses or ditches that discharge into natural waterways. Flushing water shall be discarded into a sanitary sewer or a combined sewer with sufficient capacity to carry the flow. Use of a combined sewer is subject to approval by

the *City Engineer*. If a combined sewer is not available, the flushing water must be shipped from the *Site* to a suitable dump site.

3.18 Cleaning and Preliminary Flushing

Delete 3.18.1 and replace with

Before flushing and pressure testing, ensure waterworks system is completely finished except tie-ins to existing water mains.

3.19 Testing Procedure

Append to 3.19.1

Notify the *Contract Administrator* 72 hours in advance of testing.

Delete 3.19.2 and replace with

Before pipe is filled with water, pipe bedding, concreting of all valves and fittings and backfilling to be completed as required in this specification. Fill each section of pipe and allow to remain full of water for a period of at least 24 hours prior to commencement of any pressure tests. Submit pipeline to a test pressure of 1550kPa (225psi). Ensure that test pressure does not exceed pipe or thrust restraint design pressures.

No pipe installation will be accepted if the leakage is greater than that determined by the following formula:

$$L = \frac{SD\sqrt{P}}{133{,}200}$$

Where:

L = allowable leakage, in US gallons per hour

S = length of pipe tested, in feet

D = nominal diameter of the pipe, in inches

P = average test pressure during the leakage test, in pounds per square inch (gauge)

In metric units,

$$L = \frac{SD\sqrt{P}}{2{,}816}$$

Where:

L = allowable leakage, in litres per hour

S = length of pipe tested, in meters

D = nominal diameter of the pipe, in inches

P = average test pressure during the leakage test, in bars

Delete 3.19.3 and replace with

Perform pressure and leakage testing of ductile iron piping to *AWWA C600* and *AWWA M41* except where superseded by these specifications.

Add 3.19.7

Coal tar enamelled steel pipe shall have a maximum working pressure of 1725kPa (250psi). The hydrostatic test pressure after installed shall be 2415kPa (350psi).

3.21	**Disinfection and Flushing Procedures**	Append to 3.21.8	or until chlorine concentration in remaining water is equal to the source water residual.
		Add 3.21.11	The *Contractor* shall ensure flushing with potable water does not occur within 300m of an outfall to receiving waters and where sanitary system may overflow to the outfall. Chlorinated water flushed from mains shall be designated into a sanitary sewer, or be treated in such a manner that does not pose a threat to aquatic life in receiving water. Obtain approval from Fisheries and Oceans and BC Fish and Wildlife Authority and implement dechlorination procedures as required prior to discharge of chlorinated water anywhere other than into a sanitary sewer.
		Add 3.21.12	One water sample per *Block* from the new water main, and one sample from the source to be collected for bacterial tests (Total and Fecal Coliforms). No sample shall be collected from fire hydrants.
		Add 3.21.13	Submit to the *Contract Administrator* a certificate from the testing firm confirming the chlorination tests have been successfully carried out. Laboratory results for bacterial results must be approved by the *City Engineer* before acceptance and before connections to existing water mains, or transfer of existing water services, will be permitted.
		Add 3.21.14	Fittings, valves and sleeves required to complete the tie-in from existing to proposed water mains shall be swabbed with a 1% hypochlorite solution as per *AWWA C651*.
3.23	**Connections to Existing Mains**	Delete 3.23.1 and replace with	Unless specified otherwise by the *City Engineer* or in the Contract Documents, only *City* water crews will be allowed to perform any construction procedures to existing water mains. Connection *Work* shall be scheduled with the *Contract Administrator* 10 *Days* in advance.
		Add 3.23.2	Where the *Contractor* is permitted to perform construction procedures on existing water mains, the *City Engineer* must be on-*Site* prior to excavation within 1.5m of the existing water main(s). The *Contract Administrator* shall be provided 48 hours' notice in advance for inspection. If the *City Engineer* is not on-*Site* during exposure of the water main(s), the *Contractor* will be liable for all water main deficiencies that are subsequently found by the *City Engineer*. To prevent damage to existing utilities, excavate last 300mm over utility by hand.
3.24	**Restoration of Service**	Add 3.24.1	Once all tie-ins, chlorination and pressure testing are complete and the new water piping is ready to be put into service, the *Contractor* will ensure that all valves, including hydrant valves are in good operational order and are in the open position unless otherwise stated on the *Drawings* and Specifications. The *Contractor* is required to maintain a log book for the closing and opening of valves. The *City Engineer* and the *Contractor* will conduct joint inspections

of the valves prior to *Substantial Performance*. Each valve found to be in its incorrect position at the time of this inspection will incur a charge of $200.00 per valve to the *Contractor*.

3.25 Abandonment of Pipe

Add 3.25.1 Abandoned water mains are to be plugged with a wooden plug at any point where an open abandoned water main exists. Wood plugs will be supplied by the *City* at no charge to the *Contractor*, except when the *Contractor* is working on behalf of a private developer or owner. Coordinate pickup of materials with the *Contract Administrator*.

Add 3.25.2 Once the old main has been taken out of service, each grey iron telescopic valve box, top, bottom and lid (refer to *Standard Detail Drawing W3.1*), and fire hydrants must be removed. Backfill the barrel extending to the valve nut and restore the surface to match established standards in *Section 31 23 01 Excavating, Trenching and Backfilling, Section 32 15 01S Surface Restoration*, and *Section 31 22 16 Reshaping Granular Roadbed*.

Add 3.25.3 Salvaged valve box castings and lids and hydrants may, at the discretion of the *City Engineer*, be asked to be returned to the *City*'s works yard. Arrange delivery times through the *Contract Administrator*.

Add 3.25.4 No salvaged fittings or pipe to be used on the *Work* without prior approval from the *City Engineer*.

Add 3.25.5 Remove abandoned water mains at locations shown on the *Contract Drawings* and dispose at a disposal area approved by the *Contract Administrator*.

3.26 Valve Operation

Add 3.26 Unless specified otherwise by the *City Engineer* or in the Contract Documents, only *City* water crews will be allowed to operate existing water valves. Valve operating *Work* shall be scheduled with the *Contract Administrator* 10 *Days* in advance. At the time of scheduling, the *Contractor* shall provide the *Contract Administrator* with a list of the valves to be opened or closed.

END OF SECTION 33 11 01

1.0	**GENERAL**	Add 1.0.3	All *Work* performed on existing sewer systems or on the installation of new sewer mains, services and / or other sewer related structures shall be done in accordance with these Specifications, the *Contract Documents*, and the *Drawings*.
1.4	**Material Certification**	Append to 1.4.1	Certification by Standards Council of Canada approved independent third party that products conform to CSA standards is acceptable in lieu of CSA certification.
1.5	**Scheduling of Work**	Delete 1.5.1 to 1.5.4 and replace with	Refer to *Supplemental General Condition 4.16*.
		Add 1.5.5	Notify the *Contract Administrator* at least 2 *Days* in advance of any flushing operation(s).
1.6	**Measurement and Payment**	Delete 1.6.2 and replace with	Payment for sanitary sewer includes saw-cut pavement, trench excavation, disposal of surplus excavated material, supply and installation of all pipe, fittings and related materials, bedding, imported backfill as shown on the *Drawings*, cleaning, flushing and testing, all surface restoration as specified under *3.6 of Section 31 23 01 Excavating, Trenching and Backfilling* except permanent pavement restoration, and all other work and materials necessary to complete installation as shown on the *Drawings* and specified under this Section. Measurement will be made horizontally from *Maintenance Hole* centreline to *Maintenance Hole* centreline over surface after *Work* has been completed.
		Delete 1.6.3 and replace with	Payment for service connections includes tee or wye to the main line and all related fittings and components specified and / or shown on *Standard Detail Drawings S7.1* to *S7.4*. Payment includes all applicable service pipes, materials and *Work* described in *1.6.2 of this Section*. The *Contractor* shall install one sanitary service connection for each lot or as directed by the *City Engineer*. Measurement for service connection will be for each complete service installed, excluding the inspection chamber which is covered under *1.6.4 of this Section*, with no regard to length of service pipe installed.
		Add 1.6.3.1	Payment for re-connecting existing active service connections (originally connected to the existing main) within the new trench area will be for each complete service installed.
		Add 1.6.3.2	Payment for relaying service connections outside new sewer trench will be paid for at the *Contract* unit price per linear meter under the item “Relay Service Connections” as indicated in the *Schedule of Quantities and Prices*. Measurement will be made horizontally per linear meter

from main sewer line to the point of tie-in to existing connections, with no regard to pipe size or depth range. Unless noted otherwise in the *Contract Documents*, payment for permanent surface restorations for service connections will be incidental to payment for *Work* described in other Sections.

Add 1.6.3.3 If the *Contract Drawings* indicate new mainline sewer alignment, payment for relaying existing service connection(s) from the old sewer alignment to the new alignment will be for each complete service installed, with no regard to pipe length, pipe size or depth range.

Any additional service relayed beyond the old alignment shall be paid for at the *Contract* unit price per linear meter under the item "Relay Service Connections" as indicated in the *Schedule of Quantities and Prices*. Measurement will be made horizontally per linear meter from old main sewer line to the point of tie-in to existing connections, with no regard to pipe size or depth range. Unless noted otherwise in the *Contract Documents*, payment for permanent surface restorations for service connections will be incidental to payment for *Work* described in other Sections.

Add 1.6.3.4 Pre-servicing for future service connections at a different location of existing connection(s) (including wyes, and risers capped at mainline trench edge) shall be paid per additional connection at the *Contract* unit price under item "Pre-Servicing" as indicated in the *Schedule of Quantities and Prices*, with no regard to pipe size or depth range. Pre-servicing shall include installation of wyes and risers and capping at the mainline trench edge as per *Standard Detail Drawings S7.1* to *S7.4*.

Add 1.6.8 Unless noted otherwise in the *Contract Documents*, payment for the supply, installation, and removal of shoring will be incidental to payment for sewer installation and other sewer-related installation *Work*.

Add 1.6.9 Payment to abandon or decommission existing sanitary, combined sewer mains, *Maintenance Holes* or service connections as shown on the *Contract Drawings* will be a lump sum price as indicated in the *Schedule of Quantities and Prices*. Payment shall include all labour and materials related to the *Work*.

Add 1.6.10 Unless noted otherwise in the *Contract Documents*, payment for CCTV inspection will be incidental to payment for related sewer *Work*.

2.0 PRODUCTS

Add 2.0.1 All materials shall be new and undamaged. Unless approved otherwise by the *City Engineer*, the same manufacturer of each item shall be used throughout the construction of the *Work*.

Add 2.0.2 The following pipe is permitted for gravity sewers, connections and fittings. The pipe material and pipe class shall be as per the *Drawings*.

Material	Class	Size	Use	Standard
Concrete	Non-Reinf. Cl. 3	150 – 750mm	Mains	*ASTM C14M*
Concrete	Reinf. Cl. III, IV, or V	300 – 1650mm	Mains	*ASTM C76M*
PVC Gravity Sewer Pipe	DR28	100 – 150mm	Conn.	*CSA B182.2-M* *ASTM D3034*
PVC Gravity Sewer Pipe	DR35	200 – 375mm	Mains / Conn.	*CSA B182.2-M* *ASTM D3034*
Vitrified Clay	Extra Strength	100 – 375mm	Mains / Conn.	*ASTM C700* *ASTM C425*
Ductile Iron	Cl. 50, 51, 52	100 – 600mm	Mains / Conn.	*AWWA C151* *AWWA C104* *AWWA C111*
Blue Brute PVC Pipe	DR14, 18, 25	100-300mm	Mains	*AWWA C900* *CSA B137.3*

All other materials and sizes require the approval of the *City Engineer*.

Add 2.0.3 All joints shall be sealed with rubber gaskets which shall be in accordance with the following specifications:

Material	Standard Specifications
Concrete Pipe	*ASTM C443M*
Vitrified Clay Pipe	*ASTM C425*
Ductile Iron Pipe	*AWWA C111*
PVC Gravity	*CSA B182.2, ASTM D3212, ASTM F477*

2.2	**Plastic Pipe, Mainline Smooth Profile**	Delete 2.2.1 and replace with	Polyvinyl chloride pipe 100mm to 150mm in diameter, DR28, 200mm to 375mm in diameter, DR35. Pipe to have minimum pipe stiffness (F/Y) of 320kPa at 5.0% deflection, *ASTM D2412*. Pipe to be manufactured to *ASTM D3034*.
		Delete 2.2.2 and replace with	Pipes to be certified to *CSA B182.2* for pipe size diameter 100mm to 375mm.
2.3	**Service Connections**	Add 2.3.0	Sanitary service connections and inspection chambers to be constructed in accordance with and as shown on *Standard Detail Drawings S7.1* to *S7.4* and *S9.1*.
		Append to 2.3.4	Service connection material shall meet the specifications outlined in *2.0.2 of this Section*.
		Delete 2.3.5.2	Delete 2.3.5.2
		Delete 2.3.8.1 and replace with	In-situ installation of tees and wyes into concrete, vitrified clay, or PVC mainline pipe shall be made with approved PVC saddle installed to the manufacturer's specifications into a neatly cored hole in the pipe wall.
		Delete 2.3.8.2 and replace with	In-situ installation of tees into concrete, vitrified clay or PVC mainline pipe shall be made with an insertable tee when connection is more than two sizes smaller than the mainline.
		Add 2.3.11	The *Contractor* shall leave 100mm wyes for all lots. Match existing connection diameter if larger. All lots have existing service connections even if no connection information or locations are indicated on the *Contract Drawings*.
		Add 2.3.12	If the location of existing connection(s) are not suitable due to possible future obstructions or are deemed unsuitable for any reason by the *City Engineer*, the *Contractor* shall, in addition to tying in the existing connections(s), install additional connections for the purpose of pre-servicing at an appropriate location as determined by the *City Engineer*. Pre-servicing shall include installation of wyes and risers and capping at the ditch line as per *Standard Detail Drawings S7.1* to *S7.4*.
		Add 2.3.13	All new connections shall be made with standard manufactured wye fittings. The wye shall be of the same material as the mainline, except PVC SDR 35 pipe may be used for manufactured wyes on concrete pipe.
		Add 2.3.14	Only long radius bends shall be used for connections. No changes in pipe direction or grade greater than recommended joint tolerances will be permitted.

2.5	**Granular Pipe Bedding and Surround Material**	Add 2.5.3	Bedding and haunching material shall be used to support the bottom of the sewer, *Maintenance Holes*, or related structures. Pipe bedding and haunching shall be one of the following, as indicated in the *Contract Documents* or as directed by the *City Engineer*: .1 20mm Clear Crushed Aggregate (City of Vancouver Aggregate #15) as per *Section 31 05 17 Aggregates and Granular Materials*. .2 19mm Minus Combined Crushed Aggregate Fill (Mulch) (City of Vancouver Aggregate #9) as per *Section 31 05 17 Aggregates and Granular Materials*. This aggregate to be used in dry conditions only. In accordance with *Standard Detail Drawing G4.4.*
		Add 2.5.4	Initial backfill material shall be used above the haunching material and shall be one of the following, as indicated in the *Contract Documents* or as directed by the *City Engineer*: .1 Sand fill (City of Vancouver Aggregate #17) as per *Section 31 05 17 Aggregates and Granular Materials*. .2 25mm Minus Combined Crushed Recycled Aggregate (City of Vancouver Aggregate#30) as per *Section 31 05 17 Aggregates and Granular Materials*. In accordance with *Standard Detail Drawing G4.4.*
2.6	**Backfill Material**	Add 2.6.3	Refer to *Standard Detail Drawing G4.4*. This backfill material shall be free of large stones and / or frozen material. Backfill material shall be to be one of the following, as indicated in the *Contract Documents* or as directed by the *City Engineer*: .1 19mm Minus Combined Crushed Aggregate (City of Vancouver Aggregate #9) as per *Section 31 05 17 Aggregates and Granular Materials*. .2 Sand Fill (City of Vancouver Aggregate #17) as per *Section 31 05 17 Aggregates and Granular Materials*. .3 25mm Minus Combined Crushed Recycled Aggregate (City of Vancouver Aggregate #30) as per *Section 31 05 17 Aggregates and Granular Materials*. .4 20mm Clear Crushed Aggregate (City of Vancouver Aggregate #15) as per *Section 31 05 17 Aggregates and Granular Materials*.
2.7	**Mechanical Sewer Couplings**	Add 2.7.1	Prior to commencing construction, the *Contractor* shall obtain the written approval of the *City Engineer* for the type of sewer coupling that will be used for installation of the *Work*. After obtaining this approval, the *Contractor* will not be permitted to substitute alternative sewer couplings unless the subsequent written approval of the *City Engineer* is obtained. Non-compliance shall be cause for the complete rejection of the installed *Work*.

Add 2.7.2 This section covers the specifications for flexible coupling assemblies to join plain end sewer pipe, and to adapt various plain end pipe materials and sizes to each other in sizes 100mm and up to and including 375mm in diameter.

This specification gives minimum requirements for materials, chemical properties, physical properties, testing procedures, finishes, and markings.

Add 2.7.3 Definitions:

.1 Coupling shall mean the complete assembly, and shall include the gasket, clamps, bushings, shear rings, and any other part required to make a leak proof joint meeting these specifications.

.2 Gasket shall mean the sleeve used to join two pipes.

.3 Clamp shall mean the complete assembly used to secure the gasket to the pipe being joined.

.4 Bushing shall mean a cylinder of material used to make up any difference between the inside diameter of the gasket and the outside diameter of the pipe being joined.

.5 Shear ring shall mean an assembly used to increase the shear resistance of the coupling.

.6 All references to standards such as CSA and ASTM in this specification shall mean the latest revision.

Add 2.7.4 General Requirements:

.1 The coupling shall make a joint between sections of pipe with outside diameters in the range specified in the following table which shall not fail or leak when tested in accordance with *2.7.5.2 of this Section*.

	Pipe O.D. Size Range		
Nominal Diameter (mm)	**Vit. Clay 1 (mm)**	**Vit. Clay 2 (mm)**	**Cast Iron / Plastic (mm)**
100	127 – 137	137 – 147	107 – 114
150	183 – 196	196 – 203	159 – 168
200	239 – 258	254 – 264	206 – 222
250	293 – 320	-	260 – 272
300	359 – 371	-	310 – 325
375	418 - 462	470 - 490	380 - 396

.2 Gaskets and bushings shall be one piece and shall be manufactured from an elastomeric material which meets the chemical and physical requirements of *2.7.5 of this Section*.

.3 Clamps and tightening mechanisms shall be of 300 series stainless steel conforming to *ASTM A167*. Clamps and

tightening mechanisms shall withstand 1.5 times the torque required to maintain an effective seal when tested in accordance with *2.7.5.2 of this Section* without defect or distortion. They shall withstand a minimum torque of 56.8N-m.

.4 The coupling shall be free from porosity and air pockets, and its surface shall be smooth and free from pitting, cracks, blisters, air marks or any other imperfections which could affect its performance in service.

.5 Gaskets shall not have centre stops.

.6 No part of the coupling shall protrude into the waterway at a joint.

Add 2.7.5 Detailed Requirements:

.1 General:

.1 All couplings shall meet or exceed the requirements of the latest issue of CAN/*CSA B602*. In addition to compliance with the above specification, all couplings shall meet the shear resistance test specified in *2.5.7.2 of this Section*. The *Contractor* may be required to supply evidence that the sewer couplings comply with these Specifications. The *Contractor* shall bear all expenses incurred to provide the *Contract Administrator* with this evidence.

.2 Shear Resistance Test:

.1 The joint made by a coupling shall have sufficient resistance to shear to meet the following test.

.2 The two lengths of pipe shall be joined using a coupling in accordance with the manufacturer's specifications. The two joined lengths of pipe shall be supported on blocks at three locations. One length shall be supported on two blocks, one near the uncoupled end and the other immediately adjacent to the coupling. This length shall then be firmly restrained in position. The other coupled length shall be supported by a single block located at least 1.0m from the coupling. A load of 2.7kg/mm of nominal pipe diameter shall be uniformly applied over an arch a longitudinal length of 300mm at the end, immediately adjacent to the coupling, of the pipe having only one support. Under this loading, the joint shall show no visible leakage or deflection of more than 0.04mm/mm diameter from true alignment when an internal hydrostatic pressure of 30kPa (4psi, 3.05m head of water) is applied for a period of one hour after the application of the shear load with the temperature of water, pipe and atmosphere within the range 16˚C to 24˚C.

.3 Coupling Length:

.1 All 100mm and 150mm diameter couplings shall be not less than 100mm long.

.2 All 200mm and 250mm diameter couplings shall be not less than 120mm long.

.3 All 300mm and 375mm diameter couplings shall be not less than 140mm long.

.4 Bushings:

.1 Bushings supplied loose with a coupling are not acceptable.

.2 Bushings shall be permanently fixed in position, in such a way that separation will not take place under any circumstances.

.3 Only one bushing will be allowed on one end of the coupling. The opposite end of the coupling shall be sized to fit the pipe dimension shown in the previous table. The reduction in size of the inside diameter shall extend to 1/2 of the length of the coupling.

.5 Shear Rings:

.1 Couplings without shear rings are not acceptable. Additionally, couplings with corrugated type shear rings are not acceptable.

.6 Marking:

.1 Each coupling shall be clearly marked with the manufacturer's name, size, and model number.

3.0 EXECUTION

3.1 General

Delete 3.1.1 and replace with

All materials under this section shall be constructed according to the dimensions and material specifications as stated in these Specifications and / or as shown on *Standard Detail Drawing G4.4.*

Add 3.1.2

All sewer pipes, *Maintenance Holes*, and other sewer appurtenances shall conform in quality to the conditions specified herein and shall be laid, jointed and installed in strict accordance with the manufacturer's specifications as extended in these specifications and the *Drawings*.

3.3 Trenching

Add 3.3.3

The typical bottom of all trench excavations for pipes, *Maintenance Holes*, and related structures shall be excavated to a depth of 150mm below the bottom of the pipe or structure and refilled to the required grade and elevation for the full width of the trench as per *3.5 of this Section*.

Add 3.3.4

For pipe bedding on rock foundations, the excavation depth shall be sufficient to provide a minimum clearance of 200mm below the sewer, *Maintenance Hole*, or related structure.

		Add 3.3.5	The sewer excavation shall not extend beyond the specified limits of excavation. The maximum width of the trench shall be as specified herein or in the *Contract Documents*, from a point 300mm above the top of the largest pipe to the trench bottom. Where the width of the sewer excavation below the crown of the pipe extends beyond the specified limits either due to encountering unstable material or due to over-excavation for any other reasons, the anticipated external loading condition on the pipe shall be reviewed for compliance with the original design. If necessary, the class of bedding and / or pipe shall be upgraded as required to meet the new design loading condition. The appropriate method of upgrading shall be subject to the approval of the *City Engineer*.
3.4	**Concrete Bedding and Encasement**	Add 3.4.4	Concrete bedding (or concrete cradling) may be required as specified on the *Drawings* or as requested by the *City Engineer* where soft or unstable ground conditions exist. Where used, concrete bedding takes the place of granular bedding and it shall be so placed that it gives uniform support to at least the bottom 1/4 of the pipe. The concrete may be placed in a wet consistency after the pipe has been laid to line and grade on concrete blocks and worked well under and around the pipe, or it may be placed in a dry consistency in the bottom of the trench and the pipe snugged into it to proper line and grade, or in any other way (on approval of the *City Engineer*) that will achieve the desired results of maximum support.
		Add 3.4.5	There shall be a minimum of 100mm of concrete under the pipe and the concrete bedding shall extend to the limits of the trench width.
		Add 3.4.6	Before placing the concrete, the trench bottom shall be cleaned of all loose and mucky material and water.
3.5	**Granular Bedding**	Append to 3.5.1	Granular bedding and haunching shall be in accordance with *2.5 of this Section*.
		Append to 3.5.3	The bedding material shall be shaped to the correct grade by raking or screeding.
		Append to 3.5.4	Bell or coupling holes shall be dug such that the full barrel of the pipe is supported throughout its length by the bedding material.

3.6	**Pipe Installation**	Append to 3.6.1	All necessary facilities and equipment shall be provided for by the *Contractor* for lowering and properly placing sections of pipe in the trench without damage. Furthermore, pipes shall be handled at all times with the greatest care and with equipment designed so that no damage occurs to any pipe or fittings. No pipe shall be laid which is damaged, cracked, checked or spalled, or has any other defect beyond the specification tolerances, and all such sections shall be permanently removed from the *Site*. The *Contractor* will be held liable for all costs associated with replacing and removing defected pipes and fittings.
		Append 3.6.2	Vitrified clay pipe to be installed as per the specifications herein.
		Delete 3.6.6 and replace with	No pipes shall be deflected either vertically or horizontally. If deflection is expressly ordered or permitted by the *City Engineer*, it shall not exceed 1/2 that recommended by the manufacturer of the pipe.
		Delete 3.6.9.7 and replace with	No joints shall be deflected unless permitted by the *City Engineer* as per *3.6.6 of this Section*.
		Add 3.6.14	Sewer pipe shall not be placed on bedding containing frozen, unsuitable, and / or unstable material.
		Add 3.6.15	All pipes shall be laid with the joints close and evenly abutting all around the pipe. A true even surface must be obtained along the invert of the joints. If, in the process of making the joints, previous lengths are moved or disturbed causing the gasket to move or joint to break, the pipe joint shall be remade.
		Add 3.6.16	Walking on, or disturbing pipe in any manner, after the joints have been made, shall not be permitted.
		Add 3.6.17	No pipes shall be supported by blocks of any description or mounds of bedding material as a means of setting the pipe to line and grade.
		Add 3.6.18	Precautions shall be taken to ensure that displacement of the pipe in the trench does not occur through soil displacement or floatation due to the presence of trench water. Pipe that has been displaced shall be removed from the trench and re-laid.
		Add 3.6.19	The elevation of all sewers, structures and / or related appurtenances shall be determined by means of laser, transit / level, grade boards, lines, poles, plumb bobs or other means approved by the *City Engineer*. At all installations, when requested by the *City Engineer*, an acceptable means of checking the grade and line of the sewer main, *Maintenance Hole* or related structure shall be made available.

		Add 3.6.20	The minimum vertical separation between sewers that cross shall be 0.3m, unless approved otherwise by the *City Engineer*.
		Add 3.6.21	At the end of each *Day*, the open ends of the pipes laid in the trench shall be protected with suitable bulkheads to prevent the entry of any foreign material into the pipes.
3.7	**Pipe Surround**	Append to 3.7.1	On completion of pipe, *Maintenance Hole*, and other related structure installation, and subsequent checks for true elevation and alignment, the whole width of the trench remaining above the bedding shall receive haunching and initial backfill as specified on *Standard Detail Drawing G4.4* and as per *2.5 of this Section*.
		Add 3.7.4	Haunching shall be hand placed and thoroughly tamped with approved iron tampers in 150mm lifts to at least 95% Modified Proctor density. The haunching shall provide uniform longitudinal and side support.
		Add 3.7.5	Initial backfill, as per *2.5.4 of this Section*, shall be hand placed and hand compacted as per *3.7.2 of this Section*. This material shall be brought up to at least 300mm above the top of the largest diameter sewer pipe within the trench.
3.8	**Connections to Existing Mainline Pipes**	Append to 3.8.1	Saddles are not permitted on 200mm diameter or less combined sewers.
3.9	**Backfill**	Delete 3.9.2 and replace with	Backfill requirements, including type of material and compaction requirements, as shown on the *Drawings*, including *Standard Detail Drawing G4.4*.
3.10	**Service Connection Installation**	Delete 3.10.1 and replace with	Sewer service connections shall be constructed as shown and specified on *Standard Detail Drawing S7.1* to *S7.4* and *S9.1* or as otherwise directed by the *City Engineer*.
		Delete 3.10.2 and replace with	The specifications for the construction of service connections shall be the same as for sewer mains.
		Add 3.10.5	Connections shall be provided only at the locations indicated in the *Contract Documents* or as otherwise directed by the *City Engineer*. The *Contractor* shall install one sanitary service connection for each lot or as directed by the *City Engineer*.
		Add 3.10.6	Wyes for future service connections will have leads to edge of the trench and will be capped with manufacturer's recommended watertight caps complete with rubber gaskets.
		Add 3.10.7	Storm and sanitary sewer connections shall be laid side-by-side to the same invert at the property line unless otherwise approved or directed by the *City Engineer*.

		Add 3.10.8	Unless approved or directed otherwise by the *City Engineer*, sewer service connection trenches shall be excavated so that the trench line is at right angles to the road right-of-way. The grade of the service connection shall be uniform from a distance of 1.0m from the main sewer to the property line except in the case of a riser type service connection, where the uniform grade shall be from the end of the riser to the property line. All service connections shall be constructed to a minimum grade of 2.0% unless approved otherwise by the *City Engineer*. In no case, shall the grade of a service connection be less than 1.25%.
		Add 3.10.9	Existing services are to be rodded and cleared of any roots and debris prior to connecting new services. Rodding shall be completed from the edge of the mainline trench to the property line (or easement boundary). The *Contractor* shall ensure existing service connections are not damaged in any way after the tie-in installation.
3.11	**Cleaning and Flushing**	Delete 3.11.1 and replace with	Flush completed sanitary sewer per *Section 33 01 30.2 Cleaning of Sewers*. Upon completion of the construction of the whole sewer system, every *Maintenance Hole*, and other related structure shall be inspected by the *City Engineer* to ensure that all gravel, sand, dirt, and other debris is removed before any flushing of the system is carried out.
		Delete 3.11.2 and replace with	The *Contractor* will be responsible for making any arrangements necessary and paying the permit costs for the use of City water from City fire hydrants and complying with all backflow requirements outlined in the Hydrant Use Permit.
3.12	**Leakage Testing General**	Add 3.12.4	The *Contractor* will be responsible for having all sewers, as requested by the *City Engineer*, properly tested with approved equipment and trained labour.
		Add 3.12.5	After flushing of the entire system has been completed, the whole system shall be drained adequately to allow the *City Engineer* to inspect each *Maintenance Hole*, service connection, mainline sewer, and other related structures forming part of the complete sewer system.
		Add 3.12.6	Upon completion of the sewer installation and backfilling procedures, the interior of the sewer shall be cleaned of all foreign material and shall be tested for alignment, infiltration, obstructions, cleanliness, and other visual defects. The *Contractor* shall provide for all labour, tools, rope, ball, lights, mirrors, and any other equipment necessary to examine all *Work* as required by the *City Engineer* and / or as set out herein.
		Add 3.12.7	Unless requested otherwise by the *City Engineer*, sanitary sewers will require leakage testing. For the sections of sewers to be tested, all sewers, *Maintenance Holes*, and services shall be water or air tested for exfiltration in the

			presence of the *Contract Administrator*. Testing shall only be carried out after the pipe has been backfilled, and only on completed sections between *Maintenance Holes*.
3.13	**Water Exfiltration Test**	Delete 3.13.8 and replace with	*Maintenance Holes* shall be tested for leakage by filling the chamber to the underside of the roof slab with water. No measurable drop in one hour will constitute an acceptable test for *Maintenance Holes*.
3.14	**Low Pressure Air Test**	Delete 3.14.1 and replace with	In lieu of the water test for exfiltration, the sewer main and service connections in each section may be tested by a low-pressure air test. *Maintenance Holes* shall be tested by either the water exfiltration test or by a low-pressure air test where specific approval of the test procedure has been approved by the *City Engineer*.
		Delete 3.14.2	Delete 3.14.2
		Delete 3.14.3 and replace with	Before the commencement of the test period, the internal air pressure in the test section shall be maintained at 25kPa (4psi) above the average ground water pressure for at least 5.0 minutes. The air pressure must be regulated to prevent the pressure inside the test section from exceeding 35kPa (5psi) above the average groundwater pressure.
3.16	**Short Term Deflection Test**	Delete 3.16.1 and replace with	A mandrel, as defined in *3.16.3 of this Section*, shall be pulled through flexible sewer pipe to demonstrate that the pipe deflection does not exceed acceptable limits as defined in the *ASTM D3034*. The device shall be pulled manually through the pipe after the completion of backfilling and installation of service connections. When closed circuit television inspection is required to be performed, the deflection testing shall be performed in conjunction with the television inspection. When done in conjunction with the television inspection, the mandrel shall be located in front of, and in clear view of, the television camera. To ensure accurate testing, the sewer line must be thoroughly cleaned.
		Add 3.16.2	In addition to the standard 30-day ring deflection test, the *Contractor* may be required, should the *City Engineer* determine there may be some deflection, to perform another ring deflection test for the same sewer one-year complete installation. The *Contractor* will be liable for all costs associated with this additional test.
		Add 3.16.3	The mandrel shall be cylindrical in shape, constructed with nine evenly spaced arms and shall generally conform to *Standard Detail Drawing S18.1*. The minimum diameter of the circle scribed around the outside of the mandrel arms shall be equal to the allowable computed deflected diameter 0.1mm. The contact length of the mandrel shall be measured between the points of contact on the mandrel arm. The mandrel shall be checked with a go / no-go proving ring. The proving ring shall have a diameter equal to the computed deflected diameter 0.1mm. An acceptable

mandrel shall not pass through the proving ring. The proving ring shall be fabricated from 6mm minimum thick steel. Furthermore, the *Contract Administrator* may require the *Contractor* to prove both the mandrel and proving ring's adherence to these Specifications.

Add 3.16.4

Standard *City* mandrels, as per *Standard Detail Drawing S18.1* and *ASTM D3034*, shall be used for all deflection tests, unless otherwise directed by the *City Engineer*. Other deflection testing equipment will be acceptable upon the approval of the *City Engineer* (i.e. Deflectometer). Typical mandrel and proving ring dimensions for SDR 35 flexible sewer pipe are shown in the following table:

Nominal Pipe Size (mm)	Mandrel Arm Radius (mm)	Mandrel Contact Length (mm)	Proving Ring Inside Diameter (mm)
150	67.45	100	134.9
200	90.05	150	180.1
250	112.25	200	224.5
300	133.50	250	267.0
375	163.30	300	326.6

Add 3.16.5

Any section of pipe that does not allow the mandrel to pass shall be considered to have failed the deflection test.

3.17 Individual Joint Test

Delete 3.17.1 and replace with

In lieu of exfiltration testing and subject to approval of the *City Engineer*, perform joint testing of installed pipe sections in accordance with *ASTM C1103*.

3.18 Video Inspection

Append to 3.18.1

All video inspections shall be completed as per *Section 33 01 30.1 CCTV Inspection of Pipelines*.

3.19 Installation Standard

Append to 3.19.1

The *Contractor* shall rectify all defects and other necessary *Work* that the *City Engineer* has discovered as a result of carrying out the inspection of the whole of the *Work*. After any defects have been rectified, these sections of sewer shall be re-inspected, at the *Contractor*'s expense, to the satisfaction of the *City Engineer*. The repair procedures and materials are subject to approval of the *City Engineer*.

Append to 3.19.4

Repairs and retesting are at the *Contractor*'s expense.

Delete 3.19.5

Delete 3.19.5

		Add 3.19.6	All sewer lines shall be inspected by the *City Engineer* (appropriate methods of inspection to be provided by the *Contractor*) to detect such defects as cracked or broken pipes, misaligned and / or obstructed sections of sewer, sagged or ponded sections of sewer, deformed sections of sewer (in the case of PVC pipe), and poorly installed joints.
3.20	**Connections to Existing Mains**	Delete 3.20.1 and replace with	Unless specified otherwise by the *City Engineer* or in the Contract Documents, only *City* sewer crews will be allowed to perform any construction procedures to existing sewer mains. Connection *Work* shall be scheduled with the *Contract Administrator* 10 *Days* in advance.
		Delete 3.20.2 and replace with	Where the *Contractor* is permitted to perform construction procedures on existing sewer mains, the *City Engineer* must be on-*Site* prior to excavation within 1.5m of the existing sewer main(s). The *Contract Administrator* shall be provided 48 hours' notice in advance for inspection. If the *City Engineer* is not on-*Site* during exposure of the sewer main(s), the *Contractor* will be liable for all sewer main deficiencies that are subsequently found by the *City Engineer*. To prevent damage to existing utilities, excavate last 300mm over utility by hand.

END OF SECTION 33 30 01

Section 33 34 01 Sewage Forcemains

1.0 GENERAL

1.8	**Measurement and Payment**	Delete 1.8.10 and replace with	Payment for tie-ins to existing sanitary sewers includes all work and components but excludes necessary maintenance holes, all as shown on *Contract Drawings*. Payment for maintenance holes as required for tie-ins will be made separately under *Section 33 44 01 Maintenance Holes and Catchbasins*.

2.0 PRODUCTS

2.2	**Pipe, Joints and Fittings**	Append to 2.2.9	Nuts, bolts and washers may be 316 stainless steel to ASTM F593 where specified in *Contract Documents* or *Drawings*.
		Append to 2.2.10.1	Tie rod material shall be as specified in *Contract Documents*.
		Append to 2.2.11	Fabricated steel pipe fittings: to AWWA C208 and AWWA C207 if flanged, interior and exterior protected with hot applied coal tar enamel to AWWA C203 or liquid epoxy coated to AWWA C210.
2.3	**Valves and Valve Boxes**	Delete 2.3.4.1 and replace with	Stainless steel body.
		Add 2.3.4.6	Air-release, Air/Vacuum and Combination Air Valves shall be Vent-O-Mat products, or *Approved Equal*.
		Delete 2.3.5.1 and replace with	Valve boxes and lids shall be telescopic, grey iron castings and conform to *Standard Detail Drawings S17.2* and *S17.3*. Castings shall be ordered by phoning the *City*'s Central Stores a minimum of four weeks in advance. All castings shall be picked up at the *City*'s Manitoba Works Yard on one day. Coordinate pickup from Manitoba Works Yards with the *Contract Administrator*. The *City* will furnish the valve boxes and lids at no charge to the *Contractor,* except when the *Contractor* is working on behalf of a private developer or owner.
		Delete 2.3.5.2 and replace with	Valve box riser to be 250mm diameter PVC DR 35 or better.

3.0 EXECUTION

3.5	**Granular Bedding**	Delete 3.5.6 and replace with	Place ductile iron forcemain pipe as per *Standard Detail Drawing G4.5*.
3.6	**Pipe Installation**	Delete 3.6.5 and replace with	Orientate bell end of pipes to receive flow from the connecting pump station.
		Append to 3.6.9	Field cut pipes to be end-dressed with Devcon Brushable Ceramic, or *Approved Equal*, to restore corrosion protection. Pipe shall not be installed until field coating is dry to touch.
3.14	**Cleaning and Flushing**	Delete 3.14.3 and replace with	The *Contractor* will be responsible for making any arrangements necessary and paying the permit costs for the use of City water from City fire hydrants and complying with all backflow requirements outlined in the Hydrant Use Permit.

END OF SECTION 33 34 01

Section 33 40 01 Storm Sewers

1.0	**GENERAL**	Add 1.0.3	All *Work* performed on existing sewer systems or on the installation of new sewer mains, services and / or other sewer related structures shall be done in accordance with these Specifications, the *Contract Documents*, and the *Drawings*.
1.4	**Material Certification**	Append to 1.4.1	Certification by Standards Council of Canada approved independent third party that products conform to CSA standards is acceptable in lieu of CSA certification.
1.5	**Scheduling of Work**	Delete 1.5.1 to 1.5.3 and replace with	Refer to *G*eneral Conditions, *Clause 4.16, Notice of Disruption*.
		Add 1.5.4	Notify the *Contract Administrator* at least 2 *Days* in advance of any flushing operation(s).
1.6	**Measurement and Payment**	Delete 1.6.2 and replace with	Payment for storm sewer includes saw-cutting pavement, trench excavation, disposal of surplus excavated material, supply and installation of all pipe, fittings and related materials, bedding, imported backfill as shown on the *Drawings*, cleaning and flushing, testing, (if applicable), all surface restoration as specified under *Section 31 23 01 Excavating, Trenching and Backfilling*, except permanent pavement restoration, and all other work and materials necessary to complete installation as shown on the *Drawings* and specified under this Section. Measurement for storm sewer will be made horizontally from *Maintenance Hole* centreline to *Maintenance Hole* centreline over surface after *Work* has been completed.
		Delete 1.6.3 and replace with	Payment for service connections includes tee or wye to the main line and all related fittings and components specified and / or shown on *Standard Detail Drawings S7.1* to *S7.4*. Payment includes all applicable service pipes, materials and *Work* described in *1.6.2 of this Section*. The *Contractor* shall install one storm service connection for each lot or as directed by the *City Engineer*. Measurement for service connections will be for each complete service installed, with no regard to length of service pipe installed.
		Add 1.6.3.1	Payment for re-connecting existing active service connections (originally connected to the existing main) within the new trench area will be for each complete service installed.
		Add 1.6.3.2	Payment for relaying service connections outside new sewer trench will be paid for at the *Contract* unit price per linear meter under the item “Relay Service Connections” as

indicated in the *Schedule of Quantities and Prices*. Measurement will be made horizontally per linear meter from main sewer line to the point of tie-in to existing connections, with no regard to pipe size or depth range. Unless noted otherwise in the *Contract Documents*, payment for permanent surface restorations for service connections will be incidental to payment for *Work* described in other Sections.

Add 1.6.3.3 If the *Contract Drawings* indicate new mainline sewer alignment, payment for relaying existing service connection(s) from the old sewer alignment to the new alignment will be for each complete service installed, with no regard to pipe length, pipe size or depth range.

Any additional service relayed beyond the old alignment shall be paid for at the *Contract* unit price per linear meter under the item "Relay Service Connections" as indicated in the *Schedule of Quantities and Prices*. Measurement will be made horizontally per linear meter from old main sewer line to the point of tie-in to existing connections, with no regard to pipe size or depth range. Unless noted otherwise in the *Contract Documents*, payment for permanent surface restorations for service connections will be incidental to payment for *Work* described in other Sections.

Add 1.6.3.4 Pre-servicing for future service connections at a different location of existing connection(s) (including wyes, and risers capped at mainline trench edge) shall be paid per additional connection at the *Contract* unit price under item "Pre-Servicing" as indicated in the *Schedule of Quantities and Prices*, with no regard to pipe size or depth range. Pre-servicing shall include installation of wyes and risers and capping at the mainline trench edge as per *Standard Detail Drawings S7.1* to *S7.4*.

Add 1.6.5.1 Payment for re-connecting existing catch basin lead pipes (originally connected to the existing main) within the new trench area will be for each catch basin re-connected.

Add 1.6.5.2 Payment for relaying catch basin lead pipes outside new sewer trench will be paid for at the *Contract* unit price per linear meter under the item "Relay Catchbasin Leads" as indicated in the *Schedule of Quantities and Prices*. Measurement will be made horizontally per linear meter from main sewer line to the point of tie-in to existing catch basin leads with no regard to pipe size or depth range. Unless noted otherwise in the *Contract Documents*, payment for permanent surface restorations for relaying catch basin lead pipes will be incidental to payment for *Work* described in other Sections.

	Add 1.6.5.3	If the *Contract Drawings* indicate new mainline sewer alignment, payment for relaying existing service catch basin lead pipes from the old sewer alignment to the new alignment will be for each complete service installed, with no regard to pipe length, pipe size or depth range. Any additional catch basin leads relayed beyond the old alignment shall be paid for at the *Contract* unit price per linear meter under the item "Relay Catchbasin Leads" as indicated in the *Schedule of Quantities and Prices*. Measurement will be made horizontally per linear meter from old main sewer line to the point of tie-in. Unless noted otherwise in the *Contract Documents*, payment for relaying catch basin lead pipes will be incidental to payment for *Work* described in other Sections.
	Delete 1.6.11 and replace with	Unless noted otherwise in the *Contract Documents*, payment for CCTV inspection will be incidental to payment for related sewer *Work*.
	Add 1.6.12	Unless noted otherwise in the *Contract Documents*, payment for the supply, installation, and removal of shoring will be incidental to payment for sewer installation and other sewer-related installation *Work*.
	Add 1.6.13	Payment to abandon or decommission existing storm, combined sewer mains, *Maintenance Holes* or service connections, as shown on the *Contract Drawings*, will be a lump sum price as indicated in the *Schedule of Quantities and Prices*. Payment shall include all labors and materials related to the *Work*.
2.0 PRODUCTS	Add 2.0.1	All materials shall be new and undamaged. Unless approved otherwise by the *City Engineer*, the same manufacturer of each item shall be used throughout the construction of the *Work*. Concrete pipe shall be free of chips, cracks, porous concrete, or any other defects which would impair joint sealing and durability.
	Add 2.0.2	The following pipe is permitted for gravity and pressure main sewers, connections and fittings. The pipe material and pipe class shall be as per the *Drawings*.

Material	Class	Size	Use	Standard
Concrete	Non-Reinf. Cl. 3	150 – 750mm	Mains	*ASTM C14M*
Concrete	Reinf. Cl. III, IV, or V	300 – 1650mm	Mains	*ASTM C76M*
PVC Gravity Sewer Pipe	DR28	150mm	Conn.	*CSA B182.2-M* *ASTM D3034*
PVC Gravity Sewer Pipe	DR35	200 – 375mm	Mains / Conn.	*CSA B182.2-M* *ASTM D3034*
Vitrified Clay	Extra Strength	150 – 375mm	Mains / Conn.	*ASTM C700* *ASTM C425*
Ductile Iron	Cl. 50, 51, 52	150 – 600mm	Mains / Conn.	*AWWA C151* *AWWA C104* *AWWA C111*
Blue Brute PVC Pipe	DR14, 18, 25	150-300mm	Mains	*AWWA C900* *CSA B137.3*

All other materials and sizes require the approval of the *City Engineer*.

Add 2.0.3

All joints shall be sealed with rubber gaskets which shall be in accordance with the following specifications:

Material	Standard Specifications
Concrete Pipe	*ASTM C443M*
Vitrified Clay Pipe	*ASTM C425*
Ductile Iron Pipe	*AWWA C111*
PVC Gravity	*CSA B182.2, ASTM D3212, ASTM F477*

2.2 PVC Pipe, Mainline Smooth Wall

Delete 2.2.1 and replace with

Polyvinyl chloride pipe 150mm in diameter, DR28, 200mm to 375mm in diameter, DR35. Pipe to have minimum pipe stiffness (F/Y) of 320kPa at 5.0% deflection, *ASTM D2412*. Pipe to be manufactured to *ASTM D3034*.

Pipes to be certified to *CSA B182.2* for pipe size diameter 150mm to 375mm.

2.6 Service Connections

Add 2.6.0	Storm service connections and inspection chambers to be constructed in accordance with and as shown on the latest version of *Standard Detail Drawings S7.1* to *S7.4* and *S9.1*.
Delete 2.6.1 and replace with	Storm sewer service connections to be 150mm minimum diameter; maximum diameter as specified on the *Drawings*.
Delete 2.6.2 and replace with	Storm sewer service connections 150mm diameter to be PVC Type PSM DR 28 sewer pipe.
Delete 2.6.3 and replace with	150mm DR 28 PVC storm sewer service connection pipe to have a minimum pipe stiffness of 625kPa. Pipe to be manufactured to *ASTM D3034* and certified by Canadian Standards Association to *CSA B182.2*.
Append to 2.6.4	Service connection material shall meet the specifications outlined in *2.0.2 of this Section*.
Delete 2.6.5.2	Delete 2.6.5.2
Delete 2.6.8.1 and replace with	In-situ installation of tees and wyes into concrete, vitrified clay, or PVC mainline pipe shall be made with approved PVC saddle installed to the manufacturer's specifications into a neatly cored hole in the pipe wall.
Delete 2.6.8.2 and replace with	Connections to profile PVC pipe or open profile HDPE pipe shall be made with a preformed tee or wye fitting when the connection is up to two sizes smaller than the mainline pipe. For connections more than two sizes smaller than the mainline pipe, an insertable tee for PVC pipe or open profile HDPE pipe is permitted. When an insertable tee is used, hole cut into mainline pipe to cut as few ribs as possible.
Add 2.6.11	The *Contractor* shall leave 150mm wyes for all lots. Match existing connection diameter if larger. All lots and catchbasins have existing service connections even if no connection information or locations are indicated on the *Contract Drawings*.
Add 2.6.12	If the location of existing connection(s) are not suitable due to possible future obstructions or are deemed unsuitable for any reason by the *City Engineer*, the *Contractor* shall, in addition to tying in the existing connections(s), install additional connections for the purpose of pre-servicing at an appropriate location as determined by the *City Engineer*. Pre-servicing shall include installation of wyes and risers and capping at the ditch line as per *Standard Detail Drawings S7.1* to *S7.4*.
Add 2.6.13	All new connections shall be made with standard manufactured wye fittings. The wye shall be of the same material as the mainline, except PVC SDR 35 pipe may be used for manufactured wyes on concrete pipe.

Add 2.6.14 Only long radius bends shall be used for connections. No changes in pipe direction or grade greater than recommended joint tolerances will be permitted.

2.9 Granular Pipe Bedding and Surround Material

Add 2.9.3 Bedding and haunching material shall be used to support the bottom of the sewer, *Maintenance Holes*, or related structures. Pipe bedding and haunching shall be one of the following, as indicated in the *Contract Documents* or as directed by the *City Engineer*:

.1 20mm Clear Crushed Aggregate (City of Vancouver Aggregate #15) as per *Section 31 05 17 Aggregates and Granular Materials*.

.2 19mm Minus Combined Crushed Aggregate Fill (Mulch) (City of Vancouver Aggregate #9) as per *Section 31 05 17 Aggregates and Granular Materials*. This aggregate to be used in dry conditions only.

In accordance with *Standard Detail Drawing G4.4*.

Add 2.9.4 Initial backfill material shall be used above the haunching material and shall be one of the following, as indicated in the *Contract Documents* or as directed by the *City Engineer*:

.1 Sand fill (City of Vancouver Aggregate #17) as per *Section 31 05 17 Aggregates and Granular Materials*.

.2 25mm Minus Combined Crushed Recycled Aggregate (City of Vancouver Aggregate #30) as per *Section 31 05 17 Aggregates and Granular Materials*.

In accordance with *Standard Detail Drawing G4.4*.

2.10 Backfill Material

Add 2.10.3 Refer to *Standard Detail Drawing G4.4*. This backfill material shall be free of large stones and / or frozen material. Backfill material shall be to be one of the following, as indicated in the *Contract Documents* or as directed by the *City Engineer*:

.1 19mm Minus Combined Crushed Aggregate (City of Vancouver Aggregate #9) as per *Section 31 05 17 Aggregates and Granular Materials*.

.2 Sand Fill (City of Vancouver Aggregate #17) as per *Section 31 05 17 Aggregates and Granular Materials*.

.3 25mm Minus Combined Crushed Recycled Aggregate (City of Vancouver Aggregate #30) as per *Section 31 05 17 Aggregates and Granular Materials*.

.4 20mm Clear Crushed Aggregate (City of Vancouver Aggregate #15) as per *Section 31 05 17 Aggregates and Granular Materials*.

2.11 Mechanical Sewer Couplings

Add 2.11.1 Prior to commencing construction, the *Contractor* shall obtain the written approval of the *City Engineer* for the type of sewer coupling that will be used for installation of the *Work*. After obtaining this approval, the *Contractor* will not be permitted to substitute alternative sewer couplings unless the subsequent written approval of the *City Engineer*

is obtained. Non-compliance shall be cause for the complete rejection of the installed *Work*.

Add 2.11.2 This section covers the specifications for flexible coupling assemblies to join plain end sewer pipe, and to adapt various plain end pipe materials and sizes to each other in sizes 100mm and up to and including 375mm in diameter.

This specification gives minimum requirements for materials, chemical properties, physical properties, testing procedures, finishes, and markings.

Add 2.11.3 Definitions:

.1 Coupling shall mean the complete assembly, and shall include the gasket, clamps, bushings, shear rings, and any other part required to make a leak proof joint meeting these specifications.

.2 Gasket shall mean the sleeve used to join two pipes.

.3 Clamp shall mean the complete assembly used to secure the gasket to the pipe being joined.

.4 Bushing shall mean a cylinder of material used to make up any difference between the inside diameter of the gasket and the outside diameter of the pipe being joined.

.5 Shear ring shall mean an assembly used to increase the shear resistance of the coupling.

.6 All references to standards such as CSA and ASTM in this specification shall mean the latest revision.

Add 2.11.4 General Requirements:

.1 The coupling shall make a joint between sections of pipe with outside diameters in the range specified in the following table which shall not fail or leak when tested in accordance with *2.11.5.2 of this Section*.

	Pipe O.D. Size Range		
Nominal Diameter (mm)	**Vit. Clay 1 (mm)**	**Vit. Clay 2 (mm)**	**Cast Iron / Plastic (mm)**
100	127 – 137	137 – 147	107 – 114
150	183 – 196	196 – 203	159 – 168
200	239 – 258	254 – 264	206 – 222
250	293 – 320	-	260 – 272
300	359 – 371	-	310 – 325
375	418 – 462	470 – 490	380 – 396

.2 Gaskets and bushings shall be one piece and shall be manufactured from an elastomeric material which meets the chemical and physical requirements of *2.11.5 of this Section*.

.3 Clamps and tightening mechanisms shall be of 300 series stainless steel conforming to *ASTM A167*. Clamps and tightening mechanisms shall withstand 1.5 times the torque required to maintain an effective seal when tested in accordance with *2.11.5.2 of this Section* without defect or distortion. They shall withstand a minimum torque of 56.8N-m.

.4 The coupling shall be free from porosity and air pockets, and its surface shall be smooth and free from pitting, cracks, blisters, air marks or any other imperfections which could affect its performance in service.

.5 Gaskets shall not have centre stops.

.6 No part of the coupling shall protrude into the waterway at a joint.

Add 2.11.5 Detailed Requirements:

.1 General

.1 All couplings shall meet or exceed the requirements of the latest issue of *CAN/CSA B602*. In addition to compliance with the above specification, all couplings shall meet the shear resistance test specified in *2.11.5.2 of this Section*. The *Contractor* may be required to supply evidence that the sewer couplings comply with these Specifications. The *Contractor* shall bear all expenses incurred to provide the *Contract Administrator* with this evidence.

.2 Shear Resistance Test

.1 The joint made by a coupling shall have sufficient resistance to shear to meet the following test.

.2 The two lengths of pipe shall be joined using a coupling in accordance with the manufacturer's specifications. The two joined lengths of pipe shall be supported on blocks at three locations. One length shall be supported on two blocks, one near the uncoupled end and the other immediately adjacent to the coupling. This length shall then be firmly restrained in position. The other coupled length shall be supported by a single block located at least 1.0m from the coupling. A load of 2.7kg/mm of nominal pipe diameter shall be uniformly applied over an arch a longitudinal length of 300mm at the end, immediately adjacent to the coupling, of the pipe having only one support. Under this loading, the joint shall show no visible leakage or deflection of more

than 0.04mm/mm diameter from true alignment when an internal hydrostatic pressure of 30kPa (4psi, 3.05m head of water) is applied for a period of one hour after the application of the shear load with the temperature of water, pipe and atmosphere within the range 16˚C to 24˚C.

.3 Coupling Length

.1 All 100mm and 150mm diameter couplings shall be not less than 100mm long.

.2 All 200mm and 250mm diameter couplings shall be not less than 120mm long.

.3 All 300mm and 375mm diameter couplings shall be not less than 140mm long.

.4 Bushings

.1 Bushings supplied loose with a coupling are not acceptable.

.2 Bushings shall be permanently fixed in position, in such a way that separation will not take place under any circumstances.

.3 Only one bushing will be allowed on one end of the coupling. The opposite end of the coupling shall be sized to fit the pipe dimension shown in the previous table. The reduction in size of the inside diameter shall extend to 1/2 of the length of the coupling.

.5 Shear Rings

.1 Couplings without shear rings are not acceptable. Additionally, couplings with corrugated type shear rings are not acceptable.

.6 Marking

.1 Each coupling shall be clearly marked with the manufacturer's name, size, and model number.

3.0 EXECUTION

3.1 General

Delete 3.1.1 and replace with

All materials under this section shall be constructed according to the dimensions and material specifications as stated in these Specifications and / or as shown on *Standard Detail Drawing G4.4*.

Add 3.1.2

All sewer pipes, *Maintenance Holes*, and other sewer appurtenances shall conform in quality to the conditions specified herein and shall be laid, jointed and installed in strict accordance with the manufacturer's specifications as extended in these Specifications and the *Drawings*.

3.3 Trenching

Add 3.3.3

The typical bottom of all trench excavations for pipes, *Maintenance Holes*, and related structures shall be excavated to a depth of 150mm below the bottom of the pipe or structure and refilled to the required grade and elevation for the full width of the trench as per *3.5 of this Section*.

		Add 3.3.4	For pipe bedding on rock foundations, the excavation depth shall be sufficient to provide a minimum clearance of 200mm below the sewer, *Maintenance Hole*, or related structure.
		Add 3.3.5	The sewer excavation shall not extend beyond the specified limits of excavation. The maximum width of the trench shall be as specified herein or in the *Contract Documents*, from a point 300mm above the top of the largest pipe to the trench bottom. Where the width of the sewer excavation below the crown of the pipe extends beyond the specified limits either due to encountering unstable material or due to over-excavation for any other reasons, the anticipated external loading condition on the pipe shall be reviewed for compliance with the original design. If necessary, the class of bedding and / or pipe shall be upgraded as required to meet the new design loading condition. The appropriate method of upgrading shall be subject to the approval of the *City Engineer*.
3.4	**Concrete Bedding and Encasement**	Add 3.4.4	Concrete bedding (or concrete cradling) may be required as specified on the *Drawings* or as requested by the *City Engineer* where soft or unstable ground conditions exist. Where used, concrete bedding takes the place of granular bedding and it shall be so placed that it gives uniform support to at least the bottom 1/4 of the pipe. The concrete may be placed in a wet consistency after the pipe has been laid to line and grade on concrete blocks and worked well under and around the pipe, or it may be placed in a dry consistency in the bottom of the trench and the pipe snugged into it to proper line and grade, or in any other way (on approval of the *City Engineer*) that will achieve the desired results of maximum support.
		Add 3.4.5	There shall be a minimum of 100mm of concrete under the pipe and the concrete bedding shall extend to the limits of the trench width.
		Add 3.4.6	Before placing the concrete, the trench bottom shall be cleaned of all loose and mucky material and water.
3.5	**Granular Bedding**	Append to 3.5.1	Granular bedding and haunching shall be in accordance with *2.9 of this Section*.
		Append to 3.5.3	The bedding material shall be shaped to the correct grade by raking or screeding.
		Append to 3.5.4	Bell or coupling holes shall be dug such that the full barrel of the pipe is supported throughout its length by the bedding material.

3.6 Pipe Installation

Append to 3.6.1 — All necessary facilities and equipment shall be provided for by the *Contractor* for lowering and properly placing sections of pipe in the trench without damage. Furthermore, pipes shall be handled at all times with the greatest care and with equipment designed so that no damage occurs to any pipe or fittings. No pipe shall be laid which is damaged, cracked, checked or spalled, or has any other defect beyond the specification tolerances, and all such sections shall be permanently removed from the *Site*. The *Contractor* will be held liable for all costs associated with replacing and removing defected pipes and fittings.

Append to 3.6.2 — Vitrified clay pipe to be installed as per the specifications herein.

Delete 3.6.6 and replace with — No pipes shall be deflected either vertically or horizontally. If deflection is expressly ordered or permitted by the *City Engineer*, it shall not exceed 1/2 that recommended by the manufacturer of the pipe.

Delete 3.6.9.7 and replace with — No joints shall be deflected unless permitted by the *City Engineer* as per *3.6.6 of this Section*.

Add 3.6.14 — Sewer pipe shall not be placed on bedding containing frozen, unsuitable, and / or unstable material.

Add 3.6.15 — All pipes shall be laid with the joints close and evenly abutting all around the pipe. A true even surface must be obtained along the invert of the joints. If, in the process of making the joints, previous lengths are moved or disturbed causing the gasket to move or joint to break, the pipe joint shall be remade.

Add 3.6.16 — Walking on, or disturbing pipe in any manner, after the joints have been made, shall not be permitted.

Add 3.6.17 — No pipes shall be supported by blocks of any description or mounds of bedding material as a means of setting the pipe to line and grade.

Add 3.6.18 — Precautions shall be taken to ensure that displacement of the pipe in the trench does not occur through soil displacement or floatation due to the presence of trench water. Pipe that has been displaced shall be removed from the trench and re-laid.

Add 3.6.19 — The elevation of all sewers, structures and / or related appurtenances shall be determined by means of laser, transit / level, grade boards, lines, poles, plumb bobs or other means approved by the *City Engineer*.

At all installations, when requested by the *City Engineer* an acceptable means of checking the grade and line of the sewer main, *Maintenance Hole* or related structure shall be

			made available.
		Add 3.6.20	The minimum vertical separation between sewers that cross shall be 0.3m, unless approved otherwise by the *City Engineer*.
		Add 3.6.21	At the end of each *Day*, the open ends of the pipes laid in the trench shall be protected with suitable bulkheads to prevent the entry of any foreign material into the pipes.
3.7	**Pipe Surround**	Append to 3.7.1	On completion of pipe, *Maintenance Hole*, and other related structure installation, and subsequent checks for true elevation and alignment, the whole width of the trench remaining above the bedding shall receive haunching and initial backfill as specified on *Standard Detail Drawing G4.4* and as per *2.9 of this Section*.
		Add 3.7.4	Haunching shall be hand placed and thoroughly tamped with approved iron tampers in 150mm lifts to at least 95% Modified Proctor Density. The haunching shall provide uniform longitudinal and side support.
		Add 3.7.5	Initial backfill, as per *2.9.4 of this Section*, shall be hand placed and hand compacted as per *3.7.2 of this Section*. This material shall be brought up to at least 300mm above the top of the largest diameter sewer pipe within the trench.
3.8	**Connections to Existing Mainline Pipes**	Append to 3.8.1	Saddles are not permitted on 200mm diameter or less combined sewers.
3.9	**Backfill**	Delete 3.9.2 and replace with	Backfill requirements, including type of material and compaction requirements, to be as shown on the *Drawings*, including *Standard Detail Drawing G4.4*.
3.10	**Service Connection Installation**	Delete 3.10.1 and replace with	Sewer service connections shall be constructed as shown and specified on *Standard Detail Drawings S7.1* to *S7.4* and *S9.1* or as otherwise directed by the *City Engineer*.
		Delete 3.10.2 and replace with	The specifications for the construction of service connections shall be the same as for sewer mains.
		Add 3.10.5	Connections shall be provided only at the locations indicated in the *Contract Documents* or as otherwise directed by the *City Engineer*.
		Add 3.10.6	Wyes for future service connections will have leads to edge of the trench and will be capped with manufacturer's recommended watertight caps complete with rubber gaskets.
		Add 3.10.7	Storm and sanitary sewer connections shall be laid side-by-side to the same invert at the property line unless otherwise approved or directed by the *City Engineer*.

		Add 3.10.8	Unless approved or directed otherwise by the *City Engineer*, sewer service connection trenches shall be excavated so that the trench line is at right angles to the road right-of-way. The grade of the service connection shall be uniform from a distance of 1.0m from the main sewer to the property line except in the case of a riser type service connection, where the uniform grade shall be from the end of the riser to the property line. All service connections and catchbasin leads shall be constructed to a minimum grade of 2.0% unless approved otherwise by the *City Engineer*. In no case, shall the grade of a service connection or catchbasin lead be less than 1.25%.
		Add 3.10.9	Existing services and catchbasin leads are to be rodded and cleared of any roots and debris prior to connecting new services. Rodding shall be completed from the edge of the mainline trench to the property line (or easement boundary). The *Contractor* shall ensure existing service connections are not damaged in any way after the tie-in installation.
3.11	**Cleaning and Flushing**	Delete 3.11.1 and replace with	Flush completed storm sewer per *Section 33 01 30.2 Cleaning of Sewers*. Upon completion of the construction of the whole sewer system, every *Maintenance Hole*, catchbasin, and other related structure shall be inspected by the *City Engineer* to ensure that all gravel, sand, dirt, and other debris is removed before any flushing of the system is carried out.
		Delete 3.11.2 and replace with	The *Contractor* will be responsible for making any arrangements necessary and paying the permit costs for the use of City water from City fire hydrants and complying with all backflow requirements outlined in the Hydrant Use Permit.
3.12	**Inspection and Testing**	Add 3.12.4	Leakage testing is generally not required for storm sewers. However, where storm sewers have been installed in areas of contaminated soils or contaminated ground water, they too shall be tested for leakage. The *Contractor* shall confirm with the *City Engineer* if a leakage test is required. If a leakage test is required, it shall be undertaken as per *Section 33 30 01 Sanitary Sewers*.
3.13	**Installation Standard**	Append to 3.13.1	The *Contractor* shall rectify all defects and other necessary *Work* that the *City Engineer* has discovered as a result of carrying out the inspection of the whole of the *Work*. After any defects have been rectified by the *Contractor*, these sections of sewer shall be re-inspected by the *City Engineer*, at the *Contractor*'s expense, to the satisfaction of the *Contract Administrator*. The repair procedures and materials are subject to approval of the *City Engineer*.

		Append to 3.13.4	Repairs and retesting are the *Contractor*'s expense.
		Delete 3.13.5	Delete 3.13.5
		Add 3.13.6	All sewer lines shall be inspected by the *City Engineer* (appropriate methods of inspection to be provided by the *Contractor*) to detect such defects as cracked or broken pipes, misaligned and / or obstructed sections of sewer, sagged or ponded sections of sewer, deformed sections of sewer (in the case of PVC pipe), and poorly installed joints.
3.14	**Connections to Existing Mains**	Delete 3.14.1 and replace with	Unless specified otherwise by the *City Engineer* or in the *Contract Documents*, only *City* sewer crews will be allowed to perform any construction procedures to existing sewer mains. Connection *Work* shall be scheduled with the *Contract Administrator* 10 *Days* in advance.
		Delete 3.14.2 and replace with	Where the *Contractor* is permitted to perform construction procedures on existing sewer mains, the *City Engineer* must be on-*Site* prior to excavation within 1.5m of the existing sewer main(s). The *City Engineer* shall be provided 48 hours' notice in advance for inspection. If the *City Engineer* is not on-*Site* during exposure of the sewer main(s), the *Contractor* will be liable for all sewer main deficiencies that are subsequently found by the *City Engineer*. To prevent damage to existing utilities, excavate last 300mm over utility by hand.
3.16	**Short Term Deflection Test**	Add 3.16.1	A mandrel, as defined in *3.16.3 of this Section*, shall be pulled through flexible sewer pipes to demonstrate that the pipe deflection does not exceed acceptable limits as defined in the *ASTM D3034*. The device shall be pulled manually through the pipe after the completion of backfilling and installation of service connections. When closed circuit television inspection is required to be performed, the deflection testing shall be performed in conjunction with the television inspection. When done in conjunction with the television inspection, the mandrel shall be located in front of, and in clear view of, the television camera. To insure accurate testing, the sewer line must be thoroughly cleaned.
		Add 3.16.2	In addition to the standard 30-day ring deflection test, the *Contractor* may be required, should the *City Engineer* determine there may be some deflection, to perform another ring deflection test for the same sewer upon one-year complete installation. The *Contractor* will be liable for all costs associated with this additional test.
		Add 3.16.3	The mandrel shall be cylindrical in shape, constructed with nine evenly spaced arms and shall generally conform to *Standard Detail Drawing S18.1*. The minimum diameter of the circle scribed around the outside of the mandrel arms shall be equal to the allowable computed deflected

diameter 0.1mm. The contact length of the mandrel shall be measured between the points of contact on the mandrel arm. The mandrel shall be checked with a go / no-go proving ring. The proving ring shall have a diameter equal to the computed deflected diameter 0.1mm. An acceptable mandrel shall not pass through the proving ring. The proving ring shall be fabricated from 6mm minimum thick steel. Furthermore, the *City Engineer* may require the *Contractor* to prove both the mandrel and proving ring's adherence to these Specifications.

Add 3.16.4 Standard *City* mandrels, as per *Standard Detail Drawing S18.1* and *ASTM D3034*, shall be used for all deflection tests, unless otherwise directed by the *City Engineer*. Other deflection testing equipment will be acceptable upon the approval of the *City Engineer* (i.e. Deflectometer). Typical mandrel and proving ring dimensions for SDR 35 flexible sewer pipe are shown in the following table:

Nominal Pipe Size (mm)	Mandrel Arm Radius (mm)	Mandrel Contact Length (mm)	Proving Ring Inside Diameter (mm)
150	67.45	100	134.9
200	90.05	150	180.1
250	112.25	200	224.5
300	133.50	250	267.0
375	163.30	300	326.6

Add 3.16.5 Any section of pipe that does not allow the mandrel to pass shall be considered to have failed the deflection test.

END OF SECTION 33 40 01

Section 33 44 01 Maintenance Holes and Catchbasins

1.0 GENERAL Add 1.0.2

All *Work* performed on existing sewer systems or on the installation of new *Maintenance Holes* or other sewer related structures shall be done in accordance with these Specifications and the *Drawings*.

1.4 Material Certification Append to 1.4.1

Certification by Standards Council of Canada approved independent third party that products conform to CSA standards is acceptable in lieu of CSA certification.

1.7 Accuracy of Setting-out and Positioning Add 1.7.1

The maximum allowable errors from the true position of the finished Work are given in *1.7.2 of this Section*. The *Contractor* shall note that all portions of the *Work* must be set out and positioned to comply with the allowable tolerances on pipes, couplings, pipe couplings and other equipment. If the structures and / or pipes are not constructed within the limits of the specified errors, and if in the *City Engineer's* opinion, remedial or extra work is necessitated thereby, then the *Contractor* shall, at their own expense, execute or otherwise bear the cost of such remedial *Work* requested by the *City Engineer*.

Add 1.7.2

It shall be noted that the rate of deviation for the maximum allowable horizontal and vertical errors from true position of finished *Work* shall not exceed 10mm in 3m from the required line and 6mm in 3m from the required grade.

Item	Max. Allowable Error from True Position of Finished *Work*		
	Horizontal	Vertical	
		Top Elev.	Invert Elev.
Maintenance Holes, Catchbasins, and Related Structures	30mm	10mm	10mm

Add 1.7.3

The *Contractor* shall have all *Maintenance Holes*, catchbasins, and related structures checked for horizontal and vertical alignment after the *Work* has been installed but prior to backfilling.

2.0 PRODUCTS

2.1 Materials Add 2.1.0

All materials under this section shall be constructed according to the dimensions and material specifications as stated in this Section, *Section 33 30 01 Sanitary Sewers*, *Section 33 40 01 Storm Sewers*, and / or as shown on *Standard Detail Drawings S1.1* to *S5.12* and *S11.1* to *S11.15*.

Delete 2.1.2 and replace with	Concrete to be minimum 28MPa or as specified otherwise on the *Drawings*.
Delete 2.1.4 and replace with	*Maintenance Hole* barrels shall be made with precast concrete sections or poured in place concrete. Precast *Maintenance Holes* shall be manufactured to *ASTM C478M* complete with galvanized steel, polypropylene, or aluminum rungs. *Maintenance Hole* sections shall be sized in accordance with *Standard Detail Drawing S1.1*.
Delete 2.1.6 and replace with	Reinforced concrete lids shall be designed for 1.25 times the H20 truck loading with standard 625mm diameter opening to *ASTM C-478* standards.
Delete 2.1.7.1 and replace with	Lids shall be designed for 1.25 times the H20 truck loading with a standard 625mm diameter opening to *ASTM C478M* standards.
Delete 2.1.10.1 and replace with	Catchbasins shall conform to *Standard Detail Drawings S11.1* to *S11.15*. Catchbasins shall be ordered by phoning the *City*'s Central Stores a minimum of six weeks in advance. Catchbasins shall be picked up at the *City*'s Manitoba Works Yard. Coordinate pickup from the Manitoba Works Yard with the *Contract Administrator*. The *City* will furnish the catchbasins at no charge to the *Contractor,* except when the *Contractor* is working on behalf of a private developer or owner.
Add 2.1.13.3	Gutter inlet grates are normally used; however, curb inlet catchbasins shall be used where specified on the *Drawings*.
Add 2.1.22.4	Extreme caution is urged regarding the use of pre-benched *Maintenance Hole* bases. As many sewer service connection and main sewer elevations, as well as other utilities, are at unknown depths, required design changes following excavation and exposure are frequent, necessitating changes to the pipe configurations at proposed *Maintenance Holes*.
Add 2.1.24	Castings shall conform to the *Standard Detail Drawings*. Castings shall be ordered by phoning the *City*'s Central Stores a minimum of four weeks in advance. All castings shall be picked up at the *City*'s Manitoba Works Yard on one day. Coordinate pickup from the Manitoba Works Yard with the *Contract Administrator*. The *City* will furnish the castings at no charge to the *Contractor,* except when the *Contractor* is working on behalf of a private developer or owner.

END OF SECTION 33 44 01

Section 33 50 01S Third-Party Utilities

1.0 GENERAL

Add 1.0.1 This section outlines the requirements specific to *Third-Party Utility* initiated construction within the *City*. For *Third-Party Utility* construction, the term "*Contractor*" in other *Sections* of these *Construction Specifications* shall be replaced with "*Third-Party Utility*".

Add 1.0.2 *Third Party-Utility* ("Utility") company installation and maintenance work on City *Streets* will at all times comply with all applicable federal, provincial and municipal statutes, laws and by-laws or other applicable rules and regulations in performance of the work. Work is to be carried out by the utility company's employees or their contractor, to the satisfaction of the *City Engineer* or its representatives.

Add 1.0.3 New overhead or underground utility construction on the *Street* may only proceed once approval of the utility permit drawing has been granted from the *City Engineer* (City of Vancouver Utilities Management Branch). This approval is valid for a period of one year from the signed date of approval. If construction has not commenced by the end of that period, the *City* must be notified that the installation has been cancelled, or a request to re-approve the drawing must be made. The *City* reserves the right to make changes or include special conditions to the drawing, and it is the sole responsibility of the utility company to ensure all changes are incorporated and conditions met.

1.1 Related Work

Add 1.1.1 *Section 01 55 00 Traffic Control, Vehicle Access and Parking*

Add 1.1.2 *Section 03 30 20 Concrete Walks, Curbs and Gutters*

Add 1.1.3 *Section 03 30 53 Cast-in-Place Concrete*

Add 1.1.4 *Section 31 05 17 Aggregates and Granular Materials*

Add 1.1.5 *Section 31 14 60 Dust Control*

Add 1.1.6 *Section 31 23 01 Excavating, Trenching and Backfilling*

Add 1.1.7 *Section 31 23 23 Controlled Density Fill*

Add 1.1.8 *Section 31 24 13 Roadway Excavation, Embankment and Compaction*

Add 1.1.9 *Section 32 11 16.1 Granular Subbase*

Add 1.1.10 *Section 32 11 23 Granular Base*

Add 1.1.11 *Section 32 12 17 Superpave Hot-Mix Asphalt Concrete Paving*

Add 1.1.12 *Section 32 13 13 Portland Cement Concrete Paving*

Add 1.1.13 *Section 32 14 01 Unit Paving*

Add 1.1.14 *Section 32 15 01S Surface Restoration*

Add 1.1.15 *Section 32 17 23 Painted Pavement Markings*

Add 1.1.16 *Section 32 91 21 Topsoil and Finish Grading*

1.2 Scheduling

Add 1.2.1 All approved utility permit drawings are reviewed for traffic concerns, tree protection requirements, neighbourhood notifications and other issues unique to the selected alignment. As City *Streets* are corridors shared by various interests, the *City Engineer* (City of Vancouver Utilities Management Branch), after proposed work has been approved, requires a minimum of four working days notification prior to the commencement of all utility construction. The notification process provides adequate time for the *City* to identify and review any potential conflicts that may arise, as well as ensuring all construction requirements have been met.

Add 1.2.2 Utility construction projects requiring a traffic plan must submit a plan for approval a minimum of 5 *Days* in advance of the construction start date. Refer to *Section 01 55 00 Traffic Control, Vehicle Access and Parking* for additional requirements.

Add 1.2.3 If there is a requirement for review and approval from the Vancouver Park Board, the additional notification will require a minimum of 5 *Days*.

Add 1.2.4 The *City Engineer* (City of Vancouver Utilities Management Branch) serves as the single point of contact for all scheduling, as the Utilities Inspector is not available for scheduling issues. When a pre or post-construction meeting is requested by the utility company, the Utilities Inspector will act as the *City* representative. Arrangements for their attendance are made through the *City Engineer* (City of Vancouver Utilities Management Branch).

Add 1.2.5 Any construction commencing without proper notification to the *City Engineer* (City of Vancouver Utilities Management Branch) or neighbourhood where the work will be conducted, will result in an immediate stop work order. The *City* recognizes that circumstances can arise where exceptions to the above process will be necessary and all attempts will be made by the *City Engineer* (City of Vancouver Utilities Management Branch) to accommodate these exceptions to schedules.

1.3 Allowable Hours for Construction

Add 1.3.1 This section shall be followed in conjunction with any applicable General Conditions.

Add 1.3.2 The *City Engineer* (Traffic and Data Management Branch) will determine the allowable hours for construction based on traffic volumes and compliance with the Noise Control Bylaw. The Noise Control Bylaw sets the time limits for street construction that exceeds the noise limits set out in the Noise Control Bylaw. The limits are between the hours of 7:00am and 8:00pm on any weekday including Saturday and between the hours of 10:00am and 8:00pm on any Sunday. These hours are subject to change with the bylaw. The utility company will also accommodate, where reasonable, special events and other construction related activities as determined by the *City*.

Add 1.3.3 Extended hours of operation for specific construction activities on selected dates, at the discretion of the *City Engineer* (City of Vancouver Utilities Management Branch), may be requested in writing from the Mayor's Office. Exceptions must be received by the *City* a minimum of 10 *Days* prior to any construction activities.

As special events, statutory holidays, emergency work and unforeseen circumstances can cause variations in traffic flow, the utility company shall use good judgement when scheduling hours of work and possible lane closures.

If the utility company determines that some construction activities cannot be reasonably completed within the allotted timeframes, the *City* will consider proposed variances submitted by the utility company. Proposed variances must be submitted a minimum of 10 *Days* prior to the scheduled implementation of the traffic management plan. Refer to the General Conditions for typical permitting requirements for noise control bylaw exceptions.

Add 1.3.4 Some construction activities, such as 24 hour tunneling, may require long-term variances. A detailed noise study on anticipated noise levels and proposed mitigation measures will be undertaken by a qualified noise consultant. A variance may then be issued with a set of maximum noise levels and conditions that must be satisfied during variance hours to maintain this variance.

1.4 Emergency Work

Add 1.4.1 When a utility company must undertake emergency work, they are required to immediately notify the *City Engineer* (City of Vancouver Utilities Management Branch), who will in turn provide assistance in addressing traffic concerns, conflicts with other utilities, transit, emergency services and the neighbourhood. Emergency work is expected to be carried out until the repair has been completed. When an emergency *Cut* or road activity is required, the *City* must be notified of the following:

- Name of the utility company and contractor undertaking the work.
- Description of the emergency work required.
- Preliminary drawing of the proposed repair work.
- Estimate of the duration of the work.
- Explanation for the work proceeding without the required permits and schedules.

1.5 Local Neighbourhood Notification Requirements

Add 1.5.1 The utility company shall provide written notification, on utility company letterhead, of any pending construction projects to all residences, businesses and business improvement areas (BIAs) within a defined area of the project, as specified by the *City Engineer* (City of Vancouver Utilities Management Branch). The notification must be provided two weeks prior to the installation of the utility equipment and include:

- Utility company, contractor name and phone number.
- Type and location of the proposed installation.
- Start-up date and estimated duration of construction.
- Short description of work done, including *City* approval.
- Description of any anticipated traffic impacts.

Add 1.5.2 Particular attention must be paid to those construction projects in locations where there are public facilities such as parks, community centers, and schools. The utility company must contact the park, community center, or school to ensure that construction activities will not impose major inconveniences or adversely affect any special events that may be planned. Temporarily avoiding work in the adjacent properties may be required.

Add 1.5.3 Any utility construction in the proximity of a fire hall or hospital must be coordinated by the utility company, such that public safety access can be maintained at all times.

Add 1.5.4 The *City Engineer* (City of Vancouver Utilities Management Branch) must be informed and included in all construction notification correspondences.

1.6 Inspection

Add 1.6.1 The City Utilities Inspector will conduct a site visit to each utility construction project at least once a day, and more if deemed necessary. The primary role of the Utilities Inspector is to oversee utility construction activities in relation to the *City*'s established standards, policies, and guidelines. This includes vehicle and pedestrian safety as it relates to the Traffic Management Plan and site cleanliness. Noncompliance with any standards, policies or guidelines may result in a stop work order.

Add 1.6.2 Utilities installing plant on City *Streets* are required to have a competent Utility Company Inspector. The primary responsibility of the Inspector will be to ensure all

construction requirements of the utility installation are adhered to, as laid out in the permit approval drawing. This includes, but is not limited to, being responsible for the performance of the contractor, correct installation of the utility equipment, ensuring public safety, site cleanliness, adherence to traffic requirements and neighbourhood notification. Furthermore, the Inspector must be available during working hours through the course of the utility installation to address any issues.

Add 1.6.2.1 The Utility Company Inspector acting in conjunction with the City Utilities Inspector, with approval of the *City Engineer* (City of Vancouver Utilities Management Branch), may make changes to the construction schedule, equipment installation details, and traffic plan layout, if the construction activities deem it necessary. Conflicts that arise with surrounding residents or businesses are the responsibility of the Utility Company Inspector to address and resolve.

Add 1.6.3 At all times during the utility construction, plant installation or maintenance work, there will be a competent site supervisor. The site supervisor will assume the Utility Company Inspector's responsibilities when the Utility Company Inspector is unavailable.

1.7 Traffic Management

Add 1.7.1 This section shall be followed in conjunction with *Section 01 55 00 Traffic Control, Vehicle Access and Parking*.

Add 1.7.2 As a condition of approval for the Utility Permit, the *City Engineer* (City of Vancouver Utilities Management Branch) may require an acceptable Traffic Management Plan be provided to the *City*, a minimum of 5 *Days* prior to the start of construction activities.

The utility company is responsible for providing, installing, and maintaining all traffic control and protective devices as outlined in the *BC MOTI Traffic Control Manual for Work on Roadways*. The utility company will supply both construction warning (1.2m x 2.4m, 1.2m x 1.8m and 1.5m x 1.0m) and job site identification (1.5m x 1.0m) signage to be installed by the utility company within the work zone and by the *City* outside the work zone. All costs of supplies, installation, maintenance and removal will be the responsibility of the utility company.

If these criteria are not met by the utility company, the *City Engineer* (City of Vancouver Utilities Management Branch) will issue a stop work order, until the situation is rectified. Moreover, the utility company may also be issued a fine.

The Contractor identification sign will display the Contractor's name, a brief description of the work, and a telephone number that directly connects the caller to the Contractor's personnel, who are familiar with and are currently active on the project.

		Add 1.7.4	Greenways, in the *City*, are linear public corridors for both pedestrians and cyclists that connect parks, nature reserves, cultural features, historic sites, neighbourhoods and retail areas. Greenways can be waterfront promenades, urban walks, environmental demonstration trails, heritage walks and nature trails. They expand opportunities for urban recreation, provide alternative ways to move through the *City*, and enhance the experience of nature, community and city life. A comprehensive map of all City greenways is available on the *City* website. The development of City greenways may incorporate enhanced street tree planting, landscaping, public art, benches and other features, and as a result these corridors are often more congested than other City *Streets*. The *City Engineer* (City of Vancouver Utilities Management Branch) requires utility companies make provisions for these greenways in their proposed work. In addition, specific greenways, because of their design, may only provide limited vehicle access. In such cases, the *City Engineer* (City of Vancouver Utilities Management Branch) will review and assist in determining optimal utility construction alignment.
1.8	**Pre/Post Construction Meetings**	Add 1.8.1	When a pre or post construction meeting is requested by the utility company, the City Utilities Inspector serves as the *City* representative. The role of the Utilities Inspector in all pre-construction meetings will be to review construction set-up, schedule, and ensure compliance with the requirements as set out by the *City Engineer* (City of Vancouver Utilities Management Branch). At post-construction meetings, the Utilities Inspector examines the construction site documenting issues regarding the final restoration, and damages to City *Streets* resulting from utility construction.
		Add 1.8.2	It is in the best interest of the utility company to maintain a photographic record of the construction site prior to the commencement of the construction, and upon the completion of the temporary restoration. This will detail any locations where disagreements may arise between the *City*, public, neighbours or other utilities.
1.9	**Subsurface Locates**	Add 1.9.1	The *City* encourages utility companies to physically confirm the location of underground utilities prior to construction. Techniques such as "M" Scoping, Ground Penetrating Radar and test holes are all acceptable practices. Arrangements must be made through the *City Engineer* (City of Vancouver Utilities Management Branch) for all test hole sites. Records identifying underground equipment are available through the *City Engineer* (City of Vancouver Utilities Management Branch) office, with additional utility information available through BC One Call.

1.10 Temporary "No Stopping" Signs/ Lost Meter Revenue

Add 1.10.1

Utility construction projects occupying a vehicle traffic lane or blocking a pedestrian sidewalk will require the installation of temporary no stopping signs. This allows for the realignment of traffic patterns to accommodate construction activities, as well as providing safe routes for pedestrians and vehicles. A utility construction site occupying the *Street* without temporary "no stopping" signs and operating contrary to existing parking regulations, in violation of the Parking Bylaw, will be issued tickets and possibly a stop work order. In situations where the installation of temporary no stopping signs includes parking meters, the utility company will be charged lost meter revenue for each meter occupied.

1.11 Access to Properties

Add 1.11.1

Vehicle and pedestrian access to commercial and residential properties must be maintained at all times. When trenching along these locations, the properties affected will be notified in advance of any construction activities. The advance notice will provide those affected the opportunity to make alternative access arrangements, if necessary. Construction trenches at property entrances must be backfilled or plated at the end of each day, to allow access.

1.12 Trenchless Technology

Add 1.12.1

The use of trenchless technologies in the *City*, as a means of installing underground utility equipment, must be approved by the *City Engineer* (City of Vancouver Utilities Management Branch) prior to any construction activities. The *City* requires those companies employing trenchless technologies to utilize test holes at all utility crossings to minimize the risk of damage to existing utility equipment, and for the safety of the surrounding neighbourhood.

1.13 Construction Material Storage

Add 1.13.1

Utility companies, at their own risk and responsibility, are permitted to store construction materials and equipment within the area defined by their construction site, but must not create any risk of injury or obstruct movement of pedestrians and vehicles. All materials and equipment shall be neatly stacked, properly covered and secured at the end of each day. In addition, there will be no unnecessary storage of construction materials overnight on the construction site.

The loading and unloading of construction materials and equipment will take place between the hours of construction permitted by the traffic regulations.

Add 1.13.2

New replacement poles awaiting installation are permitted to be stored on the City *Streets* for a maximum of one week prior to installation, at the risk and responsibility of the utility company. The acceptable location for the temporary storage of the poles is on the boulevard of a local *Street* or laneway. Conditions regarding storage include that poles shall:

- Be secured in place at all times.
- Not block moving or parked vehicles.
- Not impede pedestrian traffic.
- Never be stored in front of a residence or business.

Any damage resulting from pole storage shall be repaired by the utility company.

1.14 Notification of Damage to Other Utilities

Add 1.14.1

In the event that a contractor damages *City* owned equipment during construction, the contractor must immediately notify the appropriate City Operations Branch and the City Utilities Inspector. In failing to reach the Utilities Inspector, the contractor must notify the *City Engineer* (City of Vancouver Utilities Management Branch) office.

If utility equipment other than *City* owned equipment is damaged, the contractor must first notify the affected utility, and then the City Utilities Inspector or the *City Engineer* (City of Vancouver Utilities Management Branch) office.

1.15 Streams and Environmentally Sensitive Areas

Add 1.15.1

It is the responsibility of the utility company to apply for and secure all necessary permits and approvals from government agencies responsible for the protection of environmentally sensitive areas, prior to the *City*'s approval of the permit plan.

1.16 Survey Monuments

Add 1.16.1

This section shall be followed in conjunction with Section 01 *55 00 Traffic Control, Vehicle Access and Parking*.

Add 1.16.2

It is the responsibility of the utility company to provide the *City* with a minimum one-week notice for any monuments possibly at risk of damage during utility construction activities. All three types of survey monuments appear identical to the existing monuments used in the *City*. They are easily identifiable in the field as either a brass disc recessed in a chamber with a hinged metal lid cover in the sidewalk, or a brass disc set into a curb top or gutter. There may also be other survey markers found at intersection corners such as lead plugs and iron pins. The *City* should be notified of utility work in these areas, and a City crew may inspect the area for any existing legal survey marks and reference them as required. This service is provided by the Land Survey Branch, for utility work, at no cost.

Add 1.16.3

Any monument that has been disturbed or removed will be considered destroyed if:

- The grade of the road at the location of the monument is being lowered or raised, as a result of construction.
- The installation of any underground utility is occurring within a 2.0m radius from the monument. This will require the monument to be referenced and monitored by the *City*, to ensure no impact on its location has

occurred.

- The installation of any aboveground equipment is occurring within a 2.0m radius from an HPN monument. Such installations may interfere with the GPS Reference Network System.

1.17	**Sewers and Drainage 'D' Permits for Utility Company Maintenance Hole Drains**	Add 1.17.1	Maintenance hole drains can be installed by the utility company to the designated sewer main. The utility company is responsible for doing the connection under the *City*'s inspection.
1.18	**Public Art**	Add 1.18.1	The *City*'s Public Art Program encourages the development of public art throughout the *City*, and it is not uncommon to have art incorporated within City *Streets*. In any situation where public art is at risk of damage because of a proposed utility construction project, it is the responsibility of the utility company to provide the *City* with at least two weeks' notice to allow the *City* to make the necessary arrangements for the temporary removal of the public art.
1.19	**Attachments to City Structures**	Add 1.19.1	Attachments to City Structures will be reviewed on a case by case basis taking into consideration structural, maintenance and operational concerns and aesthetics. Specific requirements will be set dependent on the proposal and the structure.
1.20	**Measurement and Payment**	Add 1.20.1	Payment for all *Work* under this Section will be incidental to *City* permits and existing agreements between the *Third-Party Utility* and the *City*.
		Add 1.20.2	Any damage to adjacent public infrastructure will be, at the *Contractor*'s expense, repaired to the *City Engineer's* satisfaction and to these Specifications.
1.21	**Record Drawings**	Add 1.21.1	Record Drawings serve as the final record of what has been installed within the City *Streets*, and the *City* may be required to rely exclusively on a Record Drawing for design, construction or maintenance activities. The Record Drawing must show all information incorporated by the *City* upon approval, alongside those changes made in the field, and shall be provided to the *City* within 30 calendar days following the completion of construction. All Record Drawings submitted to the *City* must be certified by the permit holder as the final Record Drawings.
		Add 1.21.2	Record Drawings must be submitted based upon a copy of the approved permit file number with the "_Record" suffix (i.e., DS-6709_Record.dwg).

2.0 PRODUCTS NOT USED

3.0 EXECUTION

3.1 Saw-Cutting Add 3.1.1

Saw cutting is only permitted once Traffic Regulations and/or a Traffic Management Plan has been submitted, approved and implemented. Slurry generated from saw-cutting activities may contain several contaminants, and as such, the utility company must ensure that their contractors are controlling and securing any slurry resulting from saw-cutting activities to meet or exceed applicable municipal, provincial and federal standards.

Some recommended methods in preventing the discharge of saw-cutting slurry include, but are not limited to, the following:

- Minimize the quantity of water used to cool the saw.
- Avoid saw-cutting activities in wet weather.
- Cover or barricade catchbasins using filter fabric, inlet filters or sand/gravel bags.
- Shovel, absorb or vacuum all slurry discharge.

3.2 Special Pavements Add 3.2.1

In select areas throughout the *City*, a number of *Streets* have been surfaced with special pavements. In this context, special pavements refer to all non-asphalt and non-concrete surfaces such as brick, granite, etc. When excavating through these surfaces, all efforts must be made to preserve the original surface material for reinstallation as part of the permanent restoration process. In other areas of the *City*, namely older *Streets* and lanes, the original "historical" pavement surface (designated and protected under the authority of City Council) may have been repaired or overlaid with asphalt or concrete. When excavating these areas, all efforts must be made to separate these special pavements from the rest of the excavation spoils. Once excavated, the materials must be delivered to the *City*'s National Works Yard (or alternate location) for storage. Upon delivery, the contents must be clean and free of gravel and other excavation spoils. In situations of uncertainty, where a utility company is unsure whether or not surface material should be preserved, they are advised to contact the *City Engineer* (City of Vancouver Utilities Management Branch) for direction.

Apart from the standard improved surface treatment of concrete sidewalks and concrete or asphalt roads, there are additional treatments that have been employed in select areas in the *City*. Some of these are unique to specific areas, while others are the result of initiatives from private developers. Developers utilizing these treatments are expected to retain a stockpile of replacement materials. The *City Engineer* (City of Vancouver Utilities Management

Branch) will coordinate with utility companies to resolve any issues that may arise in the event that an alignment conflicts with an existing unique streetscape facility (e.g., inlaid medallions, heritage plaques). Typically, these unique inlaid materials are of a modular nature, and can therefore be removed with little risk of damage prior to construction. It is the responsibility of the utility company to reinstate the *Street* to its original preconstruction condition.

3.3 Concrete Encasement

Add 3.3.1

The *City* requires that all concrete-encased ducts shall:

- Be able to support their weight over a perpendicularly positioned utility trench.
- Have a minimum 75mm width around the conduit.
- Have both vertical sides of the concrete-encased ductbank formed.
- Meet minimum requirements as set by the most current *C.S.A. Standard A23.1 / A23.2 - Concrete Materials and Methods of Concrete Construction / Methods of Test and Standard practices for Concrete*.

3.4 Street Trees

Add 3.4.1

Requirements for protecting trees within or near a constructions site, during excavation and trenching activities include the following:

- Avoid trenching within the greater of:
  - 1.5m measured at 1.4m high from the main truck or
  - six times the tree trunk diameter measured at 1.4m high from the main trunk.
- Tunnel beneath roots whose diameters are greater than 1/3 the trunk diameter.
- Never remove more than 33 percent of the entire root mass of a tree and no more than 25 percent from one side.
- Take into consideration previous street and utility work that may have damaged roots on opposing sides of the tree.
- Torn roots are not acceptable. Always make clean cuts with sharp axes or saws.
- Excavations that require shoring must make provisions to allow large tree roots to cross the trench (i.e., in similar fashion that service connections cross shored trenches).
- Barrier fencing must be used for tree protection and must:
  - Allow for free and clear passage of pedestrians on the sidewalk and adjacent portion of boulevard.
  - Provide for clear visibility of fire hydrants, driveway access, crosswalks, etc. (“see-through” fencing such as snow fencing should be used).
  - Be 0.6m or more from the curb to provide for the

opening of car doors.

- Be placed at minimum 0.3m from the edge of any sidewalk located within a boulevard.

3.5 Utility Abandonments

Add 3.5.1

All abandoned underground pipes must be capped off, with all openings sealed to prevent soils from washing into them. Pipes greater than 600mm in diameter and less than 1.5m in depth, measured from the top of the pipe, must be filled with washed sand, controlled density fill, or other comparable material that is acceptable to the *City*.

Add 3.5.2

In situations where a utility company encounters abandoned equipment during construction within an approved alignment, including equipment of others, they will be held responsible for removing such equipment and all associated costs. The utility company must notify the *City Engineer* (City of Vancouver Utilities Management Branch) and if required, coordinate with the utility company owning the abandoned equipment, prior to its removal.

3.6 Installation of Vents, Vaults, and Foundations

Add 3.6.1

All foundations, steam vents, vault boxes are to be installed flush with the ground.

3.7 Surface Inlay Construction

Add 3.7.1

In addition to the actual fibre, other construction equipment / materials are used in the deployment of this utility. At present, these include Cylindrical Access Nodes (CANS) and Vertical Deflecting Conduit (VDC).

- Cylindrical Access Nodes – CANS are used as splice points for fibre connections. Installations are restricted to *Street* intersections, with a maximum of one node per *Block*.
- Vertical Deflecting Conduit – VDC is used as a protective sheath for the fibre. It is accepted for installation in boulevards, sidewalk joints, gutter joints, concrete road joints and asphalt roads, where the depth and alignment criteria can be achieved.

All work within the *Street* right-of-way requires an approved Municipal Access Agreement between the *City* and the utility company.

Add 3.7.2

Asphalt core samples are to be completed at least once per *Block* to prove depth of asphalt. The *City Engineer* (City of Vancouver Utilities Management Branch) Inspector must be present when the core samples are taken.

Add 3.7.3

Surface inlay construction must adhere to all *City* Bylaws and the Utilities Standards for utility construction. The *City* will determine construction specifics concerning traffic requirements including days and hours of work. When required, the *City* will request a traffic plan to be submitted as per *1.7 of this Section*. All construction on City *Streets*

must comply with the Ministry of Transportation *Traffic Control Manual for Work on Roadways*.

Add 3.7.4 The maximum width of a saw cut in the *Street* is 13mm, although the width must be kept to a minimum at all times to preserve the asphalt or concrete surface integrity.

Add 3.7.5 The following steps must be taken to acquire an adequate joint sealant for surface inlay:

- The *Cut* is required to be free of foreign debris, any water remaining within the *Cut* is to be removed "dry" by compressed air or by other means.
- Once the equipment is placed into the *Cut*, a minimum of 20mm vertical cover must be maintained between the road surface and the top of the equipment.
- The *Cut* is backfilled by pouring 1118 fumed grout or any Portland cement based non-shrink grout into the *Cut*, so it flows around and settles just above the equipment. Alternately, the *Cut* can have foam spacers with a rubber hold-down installed over the cable. This will control the movement of the cable in the trench.
- The remainder of the *Cut* is filled with Type 2 asphalt and sand mixture.
- Any excess of this mixture that overflows the *Cut* is to be removed.

All backfill material is to be inspected yearly to ensure there has been no failure. Any deficiencies found are to be repaired immediately.

3.8 Geosynthetics

Add 3.8.1 Geotextile fabric is normally situated 300mm below the underside of the asphalt concrete pavement, and serves as a separation barrier to prevent the gravel material in the road base from pushing into the peat. Geogrid mesh is generally located within the gravel road base, approximately 200mm below the underside of the asphalt concrete pavement. The geogrid interlocks itself with the gravel road base and provides added strength to the pavement structure.

When utility construction requires the excavation of a trench in the aforementioned *Streets*, caution must be taken to retain the geotextile and geogrid materials. Once the pavement surface has been saw cut and removed, the trench should be hand dug to expose the geogrid, which should then be carefully cut and removed. It is important that the geogrid not be pulled from the trench during its removal, as attempts to pull it from the trench without first ensuring the mesh is free and cut properly, may potentially stretch or damage the geogrid and pavement structure beyond the limits of the excavation. Subsequently, the gravel road base

beneath the geogrid should be hand dug to expose the geotextile fabric, and cleanly cut and removed from the trench.

During backfilling operations, for restoration of the utility trench, the *City* recommends that utility companies follow the steps outlined below:

.1 Gravel should be placed and compacted in 150mm lifts, until it is flush with the geotextile.

.2 A new piece of geotextile, free from tears or defects, should be placed in the trench with edges overlapping the existing in-place geotextile.

.3 Following replacement of the geotextile, backfilling may resume and the trench can be compacted to the level of the geogrid.

.4 The geogrid retained during the excavation process can be placed in the trench. It is important that the geogrid remain flat while in the trench and that the gravel directly covering the geogrid is placed carefully to ensure that the geogrid does not fold or kink.

.5 Overlap the new geogrid a minimum 300mm. Cut and tie pieces of the geogrid to the in-place geogrid using plastic "tie-wraps" at 100-150mm spacing.

.6 The remainder of the trench may be backfilled and compacted in two lifts, flush to the underside of the pavement.

In practice, it may be difficult to save the geotextile and geogrid during the excavation process. Nevertheless, it is important that the geotextile and geogrid be cut cleanly and carefully removed from the excavation. New geotextile and / or geogrid material is available through the City Streets Operations Branch.

3.9 Street Restoration

Add 3.9.1

All surface restoration shall *Section 32 15 01S Surface Restoration* in addition to *3.9.2 to 3.9.5 of this Section*.

Add 3.9.2

Pavements, sidewalk *Cuts* and excavations shall be backfilled and restored as outlined per *Section 31 23 01 Excavating, Trenching and Backfilling* and *Section 32 15 01S Surface Restoration*. Compaction tests may be required at the discretion of the City Utilities Inspector at the utility company's expense, with the findings sent to the City Utilities Inspector. Any grass, trees, shrubbery or landscaping damaged during construction shall be restored to their original condition, at the utility company's expense, as directed by the *City*.

Add 3.9.3 Temporary Pavement:

When a utility company has elected not to complete the permanent restoration of their utility service *Cut*, upon the completion of the civil build, all improved surfaces (sidewalk, pavement, curb and gutter) must be temporarily repaired with an asphalt patch. The repair must be flush with surrounding surfaces, providing a safe surface for both pedestrian and vehicle movement. On surfaces designated solely for pedestrian use, a 25mm thick layer of hot or cold mix asphalt is acceptable. On vehicle-travelled surfaces, the *City* requires a minimum thickness of 50mm of hot mix asphalt and a minimum 75mm on those *Streets* classified as arterials. Temporary pavement repairs must be in accordance with *Standard Detail Drawings G5.1* to *G5.6*.

The utility company is obligated to maintain the temporary patch for a term of 90 calendar days from the date the work was completed, including monitoring the performance of the patch during this term. After 90 calendar days have expired, the *City* will assume responsibility for the maintenance of the temporary patch. In the event that a temporary patch fails before the 90 calendar days has expired, the *City* will, when possible, notify the utility company to repair the patch. However, in many circumstances, patch failures pose potential dangers to the public and in those situations the repair must be made immediately by City forces. All costs incurred by the *City* due to these incidents will be the responsibility of the utility company. Furthermore, the utility company will be held responsible for the performance of the backfill material during the life of its plant within the *Street*. This includes that period of time when utility plant has been abandoned and expires at the end of the two-year *Warranty Period* following restoration, after the plant has been removed.

Following the completion of the utility installation, the Utilities Inspector will issue a cut-sheet and calculate the total area damaged by the utility construction project, type of pavement repair required, and provide a unit cost for that repair. The utility company will subsequently be billed for those costs. The *City* will schedule permanent repair of the temporary patch during its routine maintenance operations.

Add 3.9.4 Permanent Pavement:

When a utility company elects to undertake permanent pavement repair but is unable to complete the repair on the same day as the utility installation, they must ensure the construction site is safe until the following day, when the repair must be completed. If there is more than a one-day delay, the *City* requires the utility company to install a temporary patch on all damaged or excavated street surfaces.

The City Utilities Inspector must be notified following backfill operations to allow for inspection of the backfill. Following the inspection, the utility company may complete the permanent restoration in accordance with the *Street Utilities Bylaw*, as well as *Section 32 15 01S Surface Restoration*. This includes submitting a list of approved materials, mix design and test results for materials used, and a letter of certification that the work conforms to *City* standards, signed by a professional engineer or other approved materials testing professional. All permanent pavement repairs will be inspected by the City Utilities Inspector. If any deficiencies occur within the two-year period following the completion of the permanent restoration, the Utility Company will be responsible for all costs incurred in the reinstatement of the permanent restoration.

Add 3.9.5 Pavement Degradation and Restoration:

As utility *Cuts* diminish the lifespan and increase the need for maintenance of the pavement structure, utility companies will be charged a pavement degradation fee based upon the age of the surface and area of excavation. In addition, utility companies that have excavated, broken up, or otherwise disturbed the *Street*, are responsible for restoring the surface of a *Street* to a condition as near as possible to or better than that which existed before construction. Utility companies, regardless of whether they elected to have City forces complete the restoration or perform the restoration themselves, are required to:

- Grind and overlay the full width of the pavement from curb to curb in the service corridor, if the pavement has been repaved or overlaid during the two-year period immediately prior to the utility permit approval date;
- Grind and overlay the full lane width of pavement in the service corridor, if the pavement has been repaved or overlaid during the five-year period immediately prior to the utility permit approval date;
- Apportion the cost of grind and overlay, if another utility has also excavated and disturbed the pavement in the subject area.

3.10 Sewer Cleaning Costs

Add 3.10.1 All costs associated with the removal of construction debris from a City sewer catchbasin will be the responsibility of the utility company. Appropriate precautions to prevent debris from entering into the City sewer system must be in place during construction.

END OF SECTION 33 50 01S

Section 34 41 13 Traffic Signals

1.0 GENERAL

1.4	**Electrical Energy Supply**	Add 1.4.4	The *Contractor* shall coil and install wire markers indicating signal phase on conductors out of the weather head. Utility company shall complete electrical service connections.
1.10	**Inspection**	Add 1.10.2	Required field tests are to be confirmed with the *City Engineer*, including, but not limited to: • Concrete testing. • Flashing out of traffic signal wiring. • Arc flash test results. • Pole fabrication test reports. • Powder coat test reports. Set-up testing and commissioning reports may also be required for, but not limited to: • Traffic controllers. • Cameras. • UPS.

2.0 PRODUCTS

2.1	**General**	Delete 2.1.2 and replace with	All products supplied to be new, and in accordance with the *Contract Documents*. All products must bear evidence of either a mark or a label of a certification agency accredited by CSA or have an approved label issued by the BC Safety Authority.
		Delete 2.1.3 and replace with	All products shall be in accordance with the Approved Materials and Products List which may be shown on the *Drawings*. Where the list is not on the *Drawings*, contact the *Contract Administrator* for a current list.
2.2	**Conduits**	Add 2.2.6	Any 53mm diameter conduit used for street lighting and traffic signal purposes shall be terminated to a junction box as shown on the *Drawings*. Any 103mm diameter conduit used for Communication purposes shall be terminated to a junction box as shown on the *Drawings*.
		Add 2.2.7	Street lighting / traffic signal conduits and communications conduits cannot be terminated or passed through the same junction box. Separate boxes are required.
		Add 2.2.8	Any conduit which is not used shall be stubbed out and capped off by CSA CEC approved means.

2.4	**Plastic Junction Boxes**	Add 2.4.2	Unless otherwise directed in the *Contract Documents*, plastic boxes are not allowed unless approved in advance by the *City Engineer*.
2.5	**Concrete Junction Boxes**	Delete 2.5.1 and replace with	The *City* utilizes polymer concrete (Synertech or *Approved Equal*) junction boxes in varying standard box sizes. Refer to *Standard Detail Drawings E2.3* and *E2.4* for junction box details. Refer to the *Drawings* for type and size. Boxes shall: • be Tier 22 load rated. • have 64mm long (with 18 thread) stainless steel hex head bolts and washer lid hold bolts. • be labelled with the "COV" logo.
2.6	**Poles and Anchor Bolts**	Add 2.6.9	Poles shall have galvanized and powder coat finish. Colour is specific to area. Contact the *City Engineer* for specific RAL colour number for the given area.
		Add 2.6.10	Combination signal / trolley poles (Coast Mountain Bus Company (CMBC) trolley poles with signal arm) are to conform to CMBC requirements. Combination trolley / signal poles shall be designed by the pole supplier's *Engineer*, shall have an upper and lower hand hole access, shall have a pole rake as shown on the *Drawings* and shall meet all other requirements for approval by Coast Mountain Bus Company.
		Add 2.6.11	Pole bottom hand hole rings shall be 305mm (H) x 127mm (W) with a cover of 346mm (H) x 171mm (W).
2.7	**Conductors and Cables**	Delete 2.7.1 and replace with	Single Conductors: 600V, conductor size (AWG) as noted on the *Drawings*, stranded copper type with RW90 polyethylene insulation, to conform to *CSA C22.2 No. 38*, 90˚C, and colour coded as per *CEC* or, in the case of signal wiring, as per *Standard Detail Drawing E7.13*.
		Add 2.7.5	Signal cable and colour coding shall be as defined on *Standard Detail Drawing E7.13*.
2.9	**Conductor Connectors**	Add 2.9.1.3	Wire connectors in underground boxes shall be silicon-filled wire nuts or approved waterproof method of split bolts for bigger wire sizes.
2.11	**Service Panels**	Delete 2.11.1 and replace with	Typical service panels, kiosks and cabinets are defined on *Standard Detail Drawings E7.7* to *E7.9C*. Kiosks and cabinets shall be fabricated in accordance with *Section 26 56 01 Roadway Lighting* and *Section 26 56 02S Service Kiosks and Cabinets*. The specific panel, kiosk or cabinet and internal breakers, contactors, transformer and metering shall be defined on the *Contract Drawings*.
		Delete 2.11.2 and replace with	Kiosks and cabinets shall have a powder coat finish. Colour is specific to area (contact the *City Engineer* for specific RAL colour number for the given area).
		Delete 2.11.3	Delete 2.11.3

		Delete 2.11.4	Delete 2.11.4
2.16	**Traffic and Pedestrian Signals**	Delete 2.16.1 and replace with	Traffic signal heads shall be polycarbonate and pedestrian signal heads shall be aluminum and conform to the latest TAC and ITE standards and specifications. Housing and visor colour shall be yellow. Tunnel or cowl visor shall be provided as defined. Each pedestrian signal head shall be designed for a 450mm bi-modal LED display with countdown display. All primary and tertiary signal heads shall have yellow polycarbonate backboards with 75mm border of yellow prismatic retro-reflective sheeting (3M™ Scotchlite™ Diamond Grade™ VIP Reflective Sheeting Series 3990 or *Approved Equal*).
		Delete 2.16.2 and replace with	Fire signal heads shall have special yellow backboards as shown on *Standard Detail Drawing E5.17*. All fire signal backboards shall have a 75mm border of white prismatic retro-reflective sheeting (3M™ Scotchlite™ Diamond Grade™ VIP Reflective Sheeting Series 3990 or *Approved Equal*).
2.19	**Signal Mounting Hardware**	Delete 2.19.1 and replace with	Refer to *Standard Detail Drawings E5.2* and *E5.9A* to *E5.9B* for signal mounting hardware.
		Delete 2.19.2	Delete 2.19.2
2.21	**Pedestrian / Cyclist Pushbuttons**	Add 2.21.9	Where noted on the *Drawings*, pedestrian pushbuttons shall be Polara APS or Novax type.
		Add 2.21.10	Cyclist pushbuttons shall have white background and black raised characters. Button mechanism is to be raised style with mounting fully external to the pole (recessed button will not be accepted).
2.22	**Luminaires**	Delete 2.22.1 and replace with	All luminaires shall be LED. Refer to *Section 26 56 01 Roadway Lighting*.
		Delete 2.22.2	Delete 2.22.2
		Delete 2.22.3	Delete 2.22.3
		Delete 2.22.4	Delete 2.22.4
		Delete 2.22.5	Delete 2.22.5
2.26	**NEMA Traffic Controllers**	Delete 2.26.1	Delete 2.26.1
		Delete 2.26.2	Delete 2.26.2
		Delete 2.26.3	Delete 2.26.3
		Delete 2.26.4	Delete 2.26.4
		Delete 2.26.5	Delete 2.26.5

2.28	**Uninterrupt-able Power Supply**	Delete 2.28.1 and replace with	Refer to *Standard Detail Drawing E7.9A and E1.4* for uninterruptable power supply cabinet and base.
2.29	**Illuminated Crosswalk Signs**	Delete 2.29.1 and replace with	Crosswalk internal illumination and downlight shall be LED.
2.33	**Powder Coat Finish**	Add 2.33.5	Powder coat colours (RAL number) shall be specified on the *Drawings*.
2.34	**Advance Warning Signs**	Add 2.34.1	Advance warning signs shall have illustration details in yellow prismatic retro-reflective sheeting (3M™ Scotchlite™ Diamond Grade™ VIP Reflective Sheeting Series 3990 or *Approved Equal*). Signal heads shall be 200mm, or 300mm if determined necessary, yellow aluminum or polycarbonate with amber LED's and cowl visors.
2.35	**Emergency Vehicle Pre-emption**	Add 2.35.1	The *Contractor* shall install, as required by the *Drawings*, emergency vehicle pre-emption on signal pole arms as per manufacturer's instructions and as directed by the *City Engineer*. The *Contractor* shall also provide all required aiming, testing and commissioning of this equipment required for correct operation.
2.36	**PTZ Cameras**	Add 2.36.1	The *Contractor* shall install, as required by the *Drawings*, PTZ Cameras on signal pole arms or other suitable locations as per manufacturer's instructions and as directed by the *City Engineer*. The *Contractor* shall also provide all required aiming, testing and commissioning of this equipment required for correct operation. The *City*'s Electrical department and IT department will be required for final commissioning of equipment.
2.37	**Street Name Signs**	Add 2.37.1	Street name, restriction, mandatory, or other specified signs shall be safety cabled to the pole arm using 2.4mm galvanized steel aircraft cable or galvanized safety chain (5mm galvanized regular link grade 30) on both ends of the sign which shall be looped through small holes in the street name sign and fastened at both ends of sign to the signal arm.
2.38	**Traffic Controllers**	Add 2.38.1	Controllers are supplied by the *City*.
3.0	**EXECUTION**		
3.1	**General**	Add 3.1.5	When tying into or upgrading an existing installation, maintain the existing traffic signal(s) in operation at all times. Where the signal operation can't be maintained, the *Contractor* shall provide traffic control and flagging to meet *City* requirements and to maintain safe and efficient traffic flow. The *City*'s Electrical Operations shall make all connections and terminations to existing *City* installations

			and infrastructure; a minimum of 5 *Days* advanced notice is required.
3.3	**Concrete Bases**	Delete 3.3.1 and replace with	Refer to *Standard Detail Drawings CE1.1* to *CE1.7* for poured-in-place concrete base details. All concrete bases shall be poured-in-place type, unless approved by the *City Engineer*.
3.4	**Junction Boxes and Vaults**	Delete 3.4.1 and replace with	Refer to *Standard Detail Drawings E2.3* and *E2.4* for junction box details.
3.5	**Underground Conduit**	Delete 3.5.2 and replace with	Minimum cover over conduits shall be 600mm for all street lighting and signal conduits and 900mm for communications conduits. The number of bends in a conduit run shall not exceed 360°. Pull strings shall be tied together inside JB. Main run (backbone) communications conduit shall be concrete-encased in road crossings.
3.6	**Pole and Related Equipment**	Add 3.6.13	The *Contractor* shall place specific pole number labels (reflective white decal) on poles after installation as per the *Drawings*. The *Contract Administrator* will supply number labels. Pole number shall be placed 45° on pole shaft facing traffic flow for arterial and collector roads and on the front face of pole shafts for residential areas at 1.8m minimum above grade.
3.7	**Traffic and Pedestrian Signal Head Mounting**	Delete 3.7.1 and replace with	Install signal and pedestrian heads as per *Standard Detail Drawings E5.2* and *E5.9A* to *E5.9B*.
		Delete 3.7.4 and replace with	Traffic signal heads and pedestrian signal heads shall be completely obscured with proper signal head covers designed for the purpose from the time of installation until the system is in operation. Traffic signal head lenses and pedestrian signal head lenses and reflectors shall be cleaned prior to signal start-up.
		Add 3.7.5	Primary traffic signal heads shall be minimum 5.0m and maximum 6.0m from the bottom of the primary traffic signal head backboard to the finished road grade below and have galvanized safety cable or chain installed.
		Add 3.7.6	Secondary traffic signal heads shall be minimum 2.3m from finished grade to the bottom of the signal head.
		Add 3.7.7	Use Traffic Signal Yellow touch-up paint to repair any spots where the original finish is scratched.
		Add 3.7.8	Secondary and pedestrian signal head mounting arms at skewed intersections are to be drilled in the field to achieve optimum viewing angles.

		Add 3.7.9	Where signal heads are single-point attached to the signal arm with spring cushion type hangers, the back of primary heads shall have a C-channel bolted to the head to attach the safety cable or chain to the signal arm.. Chains shall be bolted to the arm.
3.10	**Luminaires and Photocells**	Add 3.10.4	NEMA wattage labels shall be visible at the bottom of the luminaire on all fixtures. Place label on the underside of the luminaire for Cobra heads and on the neck or top of pole for post tops.
		Add 3.10.5	Photocell eye to face north direction. Photocell shall be installed away from tree branches or other obstructions that may impede its function.
		Add 3.10.6	Luminaires shall be securely fastened with appropriate torque recommended by the luminaire installation instructions to the luminaire arm, leveled and cleaned after pole erection and plumbing is complete.
3.13	**Electrical Service Panel**	Delete 3.13.1 and replace with	Refer to *Standard Detail Drawing E1.4* for service cabinet concrete base details. Refer to *Standard Detail Drawings E7.7* to *E7.9C* for service panel and cabinet details.
3.14	**Wiring**	Delete 3.14.4 and replace with	Refer to *Standard Detail Drawing E7.13* for signal cable colour coding.
		Delete 3.14.8 and replace with	All individual signal head displays on each pole shall be wired separately with single conductors from the junction box nearest the signal pole including a separate neutral; multi-head displays from the pole hand hole including a separate neutral and bond for each signal pole.
		Add 3.14.14	Prior to capping or pulling conductors, conduits shall be blown out with compressed air, from both ends, then swabbed out to remove stones, dirt, water and other material which may have entered during installation. All cut ends of conduits shall be trimmed to remove rough edges.
		Add 3.14.15	All field wiring terminations shall be installed using a Thomas and Betts Sta-Kon Comfort Crimp™ Terminal Tool or *Approved Equal*.
		Add 3.14.16	Looping of feeder conductors with “T” taps shall not be permitted.
		Add 3.14.17	Cables and wires shall have 1.0m of spare length in all junction boxes and 0.3m minimum of spare length out from pole hand hole cover.
3.16	**Traffic Controller**	Delete 3.16.1 and replace with	Traffic signal cabinet shall be mounted on the concrete base as per *Standard Detail Drawing E1.4.* Seal conduits in traffic controller base after conductors are installed with approved duct seal.

		Add 3.16.8	Approved silicone sealant shall be used between the traffic signal cabinet and concrete base to ensure a weather-tight seal.
		Add 3.16.9	Approved duct-seal shall be placed over / in all underground conduits entering traffic signal cabinet. All unused conduits shall be capped by PVC.
		Add 3.16.10	The *Contract Administrator* will supply one electrical service panel padlock and service panel decal sticker for the *Contractor* to install.
		Add 3.16.11	Traffic signal cabinet interior must be kept dry during inclement weather.
3.17	**Detector Loops**	Add 3.17.3	Detector loops shall be installed in the final base lift of asphalt when possible and the conductor colours shall conform to the *City* loop conductor colour chart shown on *Standard Detail Drawings E8.2, E8.7* and *E8.11* and to the specified off-sets from the final road markings. Loop junction boxes and stub conduits are to be placed in a manner that the loop tails will not cut through or cross any specialty road surface treatments (i.e. bike holding bays, and green or red conflict area treatments).
		Add 3.17.4	Loops in adjacent lanes shall be wound in opposite directions (i.e. clockwise and counter clockwise).
		Add 3.17.5	Each shielded cable shall have twisted pair conductors and shall run continuously with no splices from the traffic signal cabinet to the junction box. Splices between the detector loop and the shielded cable shall be soldered and connected with 3M DBR/Y-6 silicone-filled splice connectors.
3.19	**Advance Warning Signs**	Add 3.19.2	Advance warning signs shall be completely covered and secured with burlap sacking from the time they are installed until the system is turned on for full operation. Plastic garbage bags are not acceptable.
3.20	**Grounding & Bonding**	Add 3.20.5	Additional to common bonding conductor, all poles shall be connected to a ground plate. Refer to *Standard Detail Drawing E7.10* for details; however, plate shall be located 300mm on the side of the concrete base with native soil separating the base and the ground plate.
3.21	**Pole Finish Application**	Add 3.21.5	Pole refinishing (touch-up): The *Contractor* shall clean and wire brush galvanized surfaces, touch up scratches and abrasions with prime coat (General Paint META Prime (vinyl wash)), and apply finish coat of non-alkyds color base paint. Poles must be free from moisture (rain, dew, frost, fog). No pole refinishing shall be undertaken if frost is predicted within 24 hours of the *Work*.

END OF SECTION 34 41 13