

# DISTRICT OF LAKE COUNTRY

## SUBDIVISION AND DEVELOPMENT SERVICING BYLAW 1121, 2020

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## DISTRICT OF LAKE COUNTRY

### BYLAW 1121

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#### A BYLAW TO REGULATE THE PROVISION OF WORKS FOR SUBDIVISION AND DEVELOPMENT OF LAND

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The Council of the District of Lake Country, in open meeting, enacts as follows:

##### 1. APPLICATION OF BYLAW

- 1.1. This Bylaw applies to all land, buildings and structures within the geographical area incorporated as the District of Lake Country.
- 1.2. All works required in this bylaw apply to all **Owners** who make an application for **Subdivision** or **Development** unless the **District** determines that the proposed Subdivision or **Development** does not require works.
- 1.3. All works required in this Bylaw shall be designed and constructed in accordance with the provisions of this Bylaw.

##### 2. GRAMMATICAL

- 2.1. In this Bylaw the singular shall also include the plural, and the masculine shall also include the feminine.

##### 3. SEVERABILITY

- 3.1. If any part of this Bylaw is for any reason held invalid by any court of competent jurisdiction, the invalid portion shall be severed and the severance shall not affect the validity of the remainder of this Bylaw.

##### 4. ENACTMENT

- 4.1. Any enactment referred to herein is a reference to an enactment of British Columbia and regulations thereto, as amended, revised, consolidated or replaced from time to time.
- 4.2. Any Bylaw referred to herein is a reference to an enactment of the **Council** of the **District** of Lake Country, as amended, revised, consolidated or replaced from time to time.

##### 5. SCHEDULES

- 5.1. Schedules A through T are attached to and form part of this bylaw and are enforceable in the same manner as this bylaw.

##### 6. COSTS BORNE BY OWNER

- 6.1. The **Owner** shall bear sole responsibility for all costs related to documentation, design, provision of works and fees or charges required under this Bylaw.

**7. DELEGATION**

7.1. The **District Engineer** is hereby delegated the powers to execute and amend all forms related to this Bylaw, including:

- (a) Statutory Right of Way;
- (b) Subdivision and **Development** Servicing Agreement;
- (c) Maintenance Agreement;
- (d) Section 219 Covenant for Onsite Water Treatment;
- (e) Section 219 Covenant for Onsite Sewerage system;
- (f) Drawing Standards Policy; and
- (g) Latecomer Agreements.

7.2. Delegation contained with this Bylaw includes the successor, lawful deputy, and any person designated to act in his place.

**8. APPLICATION PROCEDURES**

8.1. Under the procedures set out in this Bylaw, if an Owner of land intends:

- (a) to subdivide a parcel of land; or  
to develop a parcel of land the **Owner** must make application to the **District** for **subdivision or development**.

8.2. An application must:

- (a) be signed by the Owner of each parcel of land that is the subject of the application or by a person authorized in writing by the Owner to act as his or her agent for the purpose of making the application;
- (b) be made in writing on the application forms prescribed by the **District**;
- (c) include the information required under this Bylaw; and
- (d) be accompanied by the applicable fees.

**9. OWNER'S ENGINEER**

9.1. Unless exempted by the **District Engineer** the **Owner** must retain, at the **Owner's** sole expense, a Professional Engineer who shall:

- (a) prepare engineering design drawings in accordance with the provision of this bylaw.
- (b) be responsible for the design, layout, approval of materials, field reviews of installation, information for and certification of as-built drawings and documents, for all services that are the responsibility of the **Owner** under this Bylaw;
- (c) be responsible for coordinating communication between the **District** and the **Owner**, the **Owner's Engineer**, and the **Contractor**.
- (d) ensure that the work is performed in accordance with all applicable laws, ordinances, rules, regulations, codes, Bylaws, and orders of the **District** or other authorities having jurisdiction.
- (e) ensure all permits, licenses, approvals and certificates required for the performance of the work are obtained

9.2. The **District Engineer** may permit alternative works, specification and standards proposed by the **Owner's Engineer** not prescribed in this Bylaw if, in their opinion, such works and specifications or standards would be equivalent to or exceed the requirements prescribed in this Bylaw. Notwithstanding

any permission granted by the **District Engineer** under this section, the **Owner** and the **Owner's Engineer** retain full responsibility for the alternative works, specifications and standards.

10. **MMCD**

10.1. **MMCD** Specifications are hereby incorporated by reference into and form part of this Bylaw.

10.2. **MMCD** Specification provisions shall apply to all works constructed within the **District**. Where the provisions contained in this Bylaw are in conflict with the **MMCD** Specifications, this Bylaw shall supplement or supersede the **MMCD** Specifications.

11. **DUTY OF CARE**

11.1. This Bylaw does not create any duty at law on the part of the **District**, its **Council**, **District Engineer**, officers, employees or other representatives concerning anything contained in this Bylaw. All works, services, improvements and all matters required pursuant to this Bylaw are the responsibility of the **Owner** and **Applicant** and all persons acting on their behalf. No approval of any kind, certificate, permit, review, inspection, or other act or omission by the **District** or any of its representatives, including any enforcement, or lack of enforcement of the provisions of this Bylaw shall relieve the **Owner** and **Applicant** and all persons acting on their behalf from this duty pursuant to this Bylaw and shall not create any cause of action in favour of any person against the **District**, its **Council**, **District Engineer**, officers, employees or other representatives concerning anything contained in this Bylaw.

12. **COMPLIANCE**

12.1. No parcel may be subdivided or **developed** unless the subdivision or **development** conforms to the provisions set out in this Bylaw.

12.2. The **District Engineer** or the **Building Inspector** may issue a compliance order to the **Owner** or any other person found to be in contravention of this Bylaw, which may:

- (a) require a person who contravenes this Bylaw to comply with the Bylaw within a time limit specified in the order;
- (b) include an order to Stop Work or otherwise cease construction or **development** of works;
- (c) require tests and evidence of proof of materials, equipment devices, construction methods, assemblies or soil conditions meet the requirements of this Bylaw;

12.3. If a compliance order is issued, approval may not proceed until the **District Engineer** or **Building Inspector** is satisfied that the required actions or repairs and any required fees or charges have been paid;

12.4. All costs associated with rectifying non-compliance issues shall be the sole responsibility of the **Owner**.

12.5. If the required actions or repairs, or any part thereof, are not completed in accordance with the provisions of this Bylaw the **District** may draw funds from the Letter of Credit and may complete the works at the expense of the **Owner**. If there is insufficient security, then the **Owner** will pay such deficiency to the **District** immediately upon receipt of an invoice from the **District**. The **District** may do such work either by itself, or by **contractors** employed by the **District**.

13. **OFFENCE AND PENALTY**

13.1. Any person who violates any provision of this Bylaw or who suffers or permits any act or thing to be done in contravention or in violation of any of the provisions of this Bylaw or who neglects to do or refrains from doing anything required to be done by any of the provisions of this Bylaw, commits an offence and is liable on summary conviction to a penalty not exceeding Fifty Thousand Dollars (\$50,000.00) plus the cost of prosecution.

13.2. Each day that the violation continues to exist shall constitute a separate offence

14. **RIGHT TO ENTER**

14.1. The **District Engineer, Approving Officer, and the Building Inspector** or their designates shall have the right to enter upon the property of any **Owner** or occupier at all reasonable times and in a reasonable manner for the purposes of inspecting property and declaring whether the property is otherwise not in compliance with the provisions of this Bylaw

15. **REPEALS**

15.1. Subdivision and Development Servicing Bylaw 985, 2016, and all amendments thereto, are hereby repealed in their entirety.

16. **CITATION**

16.1. This bylaw may be cited as "Subdivision and Development Servicing Bylaw 1121, 2020".

READ A FIRST TIME this 5<sup>th</sup> day of May, 2020.

READ A SECOND TIME this 5<sup>th</sup> day of May, 2020.

READ A THIRD TIME this day of, 2020.

ADOPTED this 20<sup>th</sup> day of October, 2020.

[Redacted Signature]

Mayor

[Redacted Signature]

Corporate Officer

I hereby certify the foregoing to be a true and correct copy of the Bylaw cited as "Subdivision and Development Servicing Bylaw 1121, 2020", as adopted by the Municipal Council on the 20<sup>th</sup> day of October, 2020.

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Dated at Lake Country, B. C.

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Corporate Officer

## SCHEDULE A DEFINITIONS

A.1.1 Unless otherwise defined in this Bylaw, a word or expression in this Bylaw has the meaning assigned to it in the *Local Government Act*, *Interpretation Act*, *Community Charter*, *Transportation Act* or *Land Title Act* or any of successor legislation.

(a) In this Bylaw:

**"Applicant"** means an **Owner** of land or his agent duly authorized in writing, who applies for approval to subdivide or develop that land.

**"Approving Officer"** means the person appointed as the Approving Officer of the District of Lake Country, or his designate, appointed pursuant to the provisions of the *Land Title Act*.

**"arterial highway"** means a highway where the primary use is to provide connection from collector highways to other collector highways with limited access from local highways.

**"boulevard"** means that portion of highway between:

- (a) the curb and the adjoining property,
- (b) the curb and a separate sidewalk,
- (c) the road boundary and the adjoining property, and
- (d) the curb lines on the median strips or islands.

does not include curbs, sidewalks, ditches, or driveways.

**"Building Inspector"** means the person appointed by the District as the Chief Building Inspector or his designate.

**"Certificate of Total Performance"** means documentation signed by the District Engineer indicating that total performance has been achieved and approved in accordance with this Bylaw.

**"collector highway"** means a highway where the primary use is to provide connection from local highways to other collector highways and arterial highways while providing limited access to properties.

**"community sewer system"** means a system of works for the collection, treatment, and disposal of sewage that is owned, operated, and maintained by the District.

**"community water system"** means a system of works for the distribution of water and connection to a system of water works as referred to in Part 2 of the *Drinking Water Protection Act* which is owned, operated, and maintained by the District, or a private water utility.

**"contractor"** means the person, firm or corporation retained by the Owner, directly or indirectly to construct, erect, or install the works.

**"Council"** means the elected Council of the District of Lake Country.

**"cul-de-sac"** means a highway which has only one point of intersection with another highway except for access by way of emergency access, and that terminates in a vehicle turning area that is to be permanently closed.

**"designated integrator"** means the company or individual designated by the District to carryout PLC, HMI, and SCADA programming.

**“development” or “developed”** means the construction, alteration, or extension of buildings and/or structures for any use authorized by the Zoning Bylaw that requires issuance of a Building Permit or through an approved Development Permit, but does not include internal alterations of a building and/or structure where the principal use of the building and/or structure, or part thereof, is not changing. The altering of land for any use authorized under the Zoning Bylaw or through an approved Development Permit is considered to be Development.

**“District”** means the municipality of the District of Lake Country.

**“District Engineer”** means the Director of Engineering and Environmental Services for the District of Lake Country or his designate.

**“engineer”** means a person who is registered, or duly licensed as such, under the provisions of the *Engineers and Geoscientists Act of British Columbia*.

**“field reviews”** mean such reviews of the *works*:

- (a) at the site of subdivision or development to which the subdivision application or building permit relates, and
- (b) where applicable, at the fabrication site where components of the required works are fabricated,

that the Owner’s Engineer, in his or her professional discretion, considers to be necessary in order to ascertain that the *work* conforms in all material respects to the design drawings and supporting documents prepared by the Owner’s Engineer and marked, “Reviewed for Construction” by the District Engineer. This will include keeping record of all site visits and any corrective actions taken as a result thereof.

**“final approval”** with respect to subdivision, means approval of a subdivision pursuant the *Land Title Act* and; with respect to development, means issuance of a Certificate of **Substantial Completion**.

**“frontage”** means the width of a parcel measured along the shortest parcel boundary which immediately adjoins a highway other than a lane or a walkway.

**“geoscientist”** means a person who is registered, or duly licensed as such, under the provisions of the *Engineers and Geoscientists Act of British Columbia*.

**“highway”** means a public street, road, trail, lane, bridge, trestle, tunnel any other public way or any other land or improvement that becomes or has become a highway by any of the following:

- (a) deposit of a subdivision, reference or explanatory plan in a land title office under section 107 of the Land Title Act;
- (b) a public expenditure to which section 42 applies;
- (c) a common law dedication made by the government or any other person;
- (d) declaration, by notice in the Gazette, made before December 24, 1987;
- (e) in the case of a road, colouring, outlining or designating the road on a record in such a way that section 13 or 57 of the Land Act applies to that road;
- (f) an order under section 56 (2) of this Act;
- (g) any other prescribed means;

**“local highway”** means a highway where the primary use is to provide access to properties while providing limited access to other local highways and collector highways.



**"lane"** means a highway intended to provide secondary access to parcels of land.

**"minimum building elevation"** means the elevation of the underside of the lowest floor in a building or if lower, the lowest floor elevation in a crawl space.

**"MMCD"** means the Master Municipal Construction Specifications, 2009 Platinum Edition Volume II, prepared by the Master Municipal Construction Document Association as amended from time to time.

**"offsite"** means located on public highway, public land, or statutory right-of-way at final approval of the subdivision or development as the case maybe.

**"onsite"** means located on private property during development at final approval but prior to substantial completion of the subdivision or development.

**"Overhead wiring"** means the installation of above ground electrical and communication wiring usually installed from pole to pole.

**"Owner"** means, in respect of real property, the person registered as an Owner of an estate in fee simple, the tenant for life under a registered life estate, or the registered holder of the last registered agreement for sale, and includes his agent duly authorized in writing.

**"Owner's Engineer"** means the engineer or firm of engineers engaged by the Owner to design and prepare engineering drawings for a subdivision or development and to co-ordinate all design work and quality assurance/quality control required for the works under the provisions of this Bylaw.

**"parcel"** means any lot, block, or other area in which land is held or into which land is subdivided but does not include a highway.

**"Preliminary Layout Review"** means a review of drawings, plans, information and documents by the Approving Officer to determine, on a preliminary basis: (a) whether the proposed subdivision would be against the public interest or otherwise unsuitable for subdivision; and (b) if not against the public interest or otherwise unsuitable for Subdivision, what the Owner must include in the application for subdivision or development.

**"private water utility"** means a water utility operated under the authority of the Comptroller of Water Rights.

**"repair(s)"** means restore to original or new condition.

**"reviewed for construction"** means documents, including construction drawings that have been reviewed by the District and stamped as such.

**"road"** means the portion of the highway that is improved, designed, or ordinarily used for vehicular traffic and excludes the road shoulder.

**"sewerage system"** means a system for treating domestic sewage that uses one or more treatment methods and a discharge area, an area used to receive effluent discharged from a treatment method, but does not include a holding tank or a privy.

**"sidewalk"** means a concrete-surfaced pedestrian walkway.

**“steep slopes”** means lands in their natural state that have a slope angle of 20% or greater for a minimum horizontal distance of 10 meters, or adjacent areas where existing or potential sloughing or stability warrants concern. The definition applies to all properties which are 0.5 hectares or greater in size, and where 10% or greater of the parent property contains slope of more than 20%.

**“storm drainage system”** means a system of works designed and constructed for the collection, direction, storage, treatment and disposal of **stormwater**, snow melt and/or ground water.

**“stormwater”** means water resulting from natural precipitation, groundwater that has surfaced, and water from street cleaning.

**“street lighting”** means single or double davit or ornamental streetlights serviced by underground or overhead wiring.

**“subdivision”** means a subdivision as described in the *Land Title Act*.

**“substantial performance”** means the stage of completion of works, certified by the Owner’s Engineer when:

- (a) all portions of the works are ready for use or are being used for the intended purpose; and
- (b) the total of the incomplete, defective and deficient works can be completed at an estimated cost of no more than 3% of the total value of the works.

**“surveyor”** means a person entitled to practise as a land surveyor under the *Land Surveyors Act* in the province of British Columbia.

**“total performance”** means the stage of completion of the works, certified by the District Engineer when all works including deficiencies have been completed in accordance with this Bylaw.

**“Transportation for Tomorrow”** means the District’s Transportation for Tomorrow Plan as adopted by Council and amended from time to time.

**“underground wiring”** means electrical and communications wiring installed underground in ducts or by direct bury with an alignment approved by the service provider.

**“walkway”** means a highway intended for pedestrian and non-motor traffic save and except for maintenance vehicles, emergency vehicles, and conveyances used by persons with disabilities.

**“water distribution system”** means a domestic water distribution system and includes allowance for fire flows and storage as required in this Bylaw.

**“water source”** means a water supply located on each parcel or connection to a community water system.

**“water supply”** means a supply of water that conforms to the provisions of Schedule I and that at the time of subdivision or development, is available from an onsite groundwater source, a surface source requiring a domestic water license issued pursuant to the *Water Sustainability Act*, or a community water system.

**“work(s)”** means infrastructure and services and includes highways, sidewalks, boulevard, boulevard crossings, transit bays, street lighting, wiring, water distribution systems, walkways, roads, sewage collection and disposal systems, drainage collection and disposal systems, paving, curbs and gutters, and such other infrastructure, systems and any other improvements required to be constructed, erected, or installed, both onsite and offsite, under the provisions of this Bylaw.

**“zone”** means an area created by the District Zoning Bylaw.

## **SCHEDULE B APPLICATION REQUIREMENTS**

### **B.1 General**

- B.1.1 An **Applicant** for a **subdivision** or **development** may request a pre-application meeting prior to submitting an application under this Bylaw.
- B.1.2 The **works** required for **subdivision** under this Bylaw must be completed prior to final **subdivision** approval unless the **Applicant** enters into a **Subdivision and Development Servicing Agreement** in a form prescribed in this Bylaw.
- B.1.3 The **works** required for **development** under this Bylaw must be completed prior to issuance of a building permit except as provided for in Clause B.4.5.
- B.1.4 The **Owner's Engineer** shall ensure that all inspections and testing are carried out in accordance with the provisions of this Bylaw.
- B.1.5 It is the **Applicant's** responsibility to ensure that the requirements, regulations, and approval procedures of all agencies are met. Where the standards and specifications of other agencies having jurisdiction conflict with this Bylaw, the more stringent standards and specifications shall apply.

### **B.2 Preliminary Layout Review**

- B.2.1 An **Applicant** wishing to **subdivide** land including by lot line adjustment and applying for a **Preliminary Layout Review** of the **subdivision**, must pay the applicable fees set out in the **District Fees Bylaws**.
- B.2.2 Subject to legislation changes, a **Preliminary Layout Review** issued by the **Approving Officer** is valid for a period of one year. Upon expiration of the one-year time period the **Owner** must make a new application for **subdivision**.
- B.2.3 The **Owner** may apply for one, six-month extension if the **Owner's Engineer** submits a letter to the **District Engineer** and the Ministry of Transportation and Infrastructure (if applicable) certifying at least sixty percent (60%) of the **works** required under this Bylaw (based on the estimated total capital cost of constructing and installing the **work(s)** have been completed.

### **B.3 Phased Strata or Strata Conversion**

- B.3.1 Applications for approval of a phased strata plan declaration or strata conversion must be accompanied by applicable fees in accordance with **District Bylaws**.

### **B.4 Building Permit**

- B.4.1 An **Owner** of a **parcel** who applies to develop land must submit a Building Permit application in accordance with the Building Bylaw.
- B.4.2 The **Building Inspector** may impose conditions on the approval of a Building Permit required in connection with the **development**, including, but not limited to a **Subdivision and Development Servicing Agreement**.

B.4.3 If **works** are required for a Building Permit application:

- (a) on a **highway** immediately adjacent to any **parcel** being **developed** up to the centre line of the **highway** and
  - (b) on the **parcel** itself,
- the **Owner** must provide the **works** that are required to be provided under this Bylaw.

B.4.4 If required, a grant or charge over land on which the **works** are located shall be provided to the **District** in a form required, in priority over liens, charges and encumbrances, and executed in registerable form. The grant or charge may include a **highway** dedication, statutory right of way, **highway** reservation, permit or license, as required by the **District**.

B.4.5 The **District Engineer**, in their sole discretion, may approve the issuance of a building permit in advance of the **offsite work** having been completed provided that a valid servicing agreement, with security for **works**, is in place and that the signatories to the servicing agreement and building permit are one and the same.

B.4.6 For a partial or phased **development**, the **Owner** shall:

- (a) construct a percentage of the **offsite work** proportional to the percentage of the site being **developed**, or
- (b) provide cash in lieu in accordance with this Bylaw

B.4.7 In addition to design drawings required by the Building Bylaw, the **Owner** must submit design drawings prepared by an **engineer** to the **District Engineer** for approval, identifying:

- (a) the **works** to be constructed on the **parcel** being **developed**; and on the **highway** abutting the **parcel**; and
- (b) the intended connection of **onsite works** to **offsite works**.

B.4.8 The construction, installation, and connection of all **works** must conform to:

- (a) the design drawings marked, "Reviewed for Construction", and initialed by the **District Engineer**; and
- (b) the provisions of this Bylaw and all other Bylaws of the **District**.

## B.5 Subdivision

B.5.1 An **Owner** of a **parcel** who applies for **subdivision**:

- (a) on a **highway** immediately adjacent to the **parcel** up to the centre line of the **highway**, and
  - (b) on the **parcel** itself,
- must provide the **works** that are required to be provided under this Bylaw.

B.5.2 No **works** shall be required on **highways** immediately adjacent to the **frontage** of a proposed remainder **parcel** that has potential for further **subdivision** under the existing **zoning** designation.

B.5.3 The construction, installation, and connection of all **works** must conform to:

- (a) the design drawings marked, "Reviewed for Construction" and initialed by the **District Engineer**, and
- (b) the provisions of this and all other **District Bylaws**.

## B.6 Exemptions

### B.6.1 Boundary Adjustment Subdivisions involving lands that have been:

- (a) **developed** with a permitted use;
- (b) appropriately serviced; and
- (c) do not create additional **parcels**,  
shall not be subject to the requirements of this Bylaw except:
  - (i) unprotected or existing services shall be protected by way of easement or statutory right-of-way, or relocated as required by the **District Engineer**;
  - (ii) **parcels** currently serviced with on-site sewage disposal shall provide confirmation from a qualified professional that the existing system is satisfactory for its intended purpose;
  - (iii) lots served by other than a **water distribution system** shall adhere to the applicable **water source** design and construction requirements of this Bylaw;
  - (iv) where connection to a community sanitary sewer, storm sewer, and/or **water distribution system**, which in the **District Engineer's** opinion can be achieved cost effectively without a main extension, each adjusted **parcel** shall be connected to the applicable system.

### B.6.2 If a Building Permit is issued for the:

- (a) construction, renovation or addition to a single-family dwelling or two-family building, or
  - (b) construction of an accessory building,  
the **Owner** shall not be required to:
    - (i) construct, install or pay monies in lieu of **highways, walkways, curb, gutter, sidewalk, street lighting, and underground wiring**;
    - (ii) connect to a **water distribution system** unless, in the opinion of the **District Engineer**, the connection can be achieved with a cost-effective main extension;
    - (iii) connect to the **District's community sewer system** unless;
      - A. the proposed renovation or addition does not increase the number of bedrooms;
      - B. connection can, in the opinion of the **District Engineer**, be achieved with a cost-effective main extension or;
      - C. the proposed construction, renovation, or addition complies with the applicable **onsite sewerage system** design and construction requirements of this bylaw.
- If the proposed construction, renovation or addition does not comply with the applicable **onsite sewerage system** design and construction requirements then a connection to the **District community sewer system** is required.

### B.6.3 In simple servicing cases where a standard drawing contained in **District** policy is deemed by the **District Engineer** to be sufficient for construction purposes, the **District Engineer** may, in his sole discretion, where a **District** approved **contractor** is being used, waive the requirement for engineering design drawings.

## B.7 Statutory Rights of Way

### B.7.1 Works under this Bylaw must be located within dedicated **highways** or statutory rights of way in favour of the **District**.

### B.7.2 Where the **District Engineer** requires rights of way to allow for eventual construction or installation of a system of water, sewer, or drainage **works** constructed and installed under this Bylaw must be located within dedicated **highways** or within statutory rights of way granted by the **Owner** in favour of the **District** or other agencies having jurisdiction.

B.7.3 Where **works** are not required to be constructed or installed under this Bylaw, the **District** may require rights of way to be granted by the **Owner**, in favour of the **District**, to allow for the eventual construction or installation of a system of water, sewer, or drainage **works**.

B.7.4 Where the **Owner** is required to grant rights of way in favour of the **District**, the **Owner** must enter into and register in the Land Title Office a Statutory Right of Way pursuant to Section 218 of the *Land Title Act* in a form acceptable to the **District Engineer** registered in priority to all financial and other charges as required by the **District**. All right of way agreements and plans must be signed by the **District**.

B.7.5 Upon registration of the rights of way and before release of any security being held by the **District**, the **Owner** must submit a copy of the registered right of way plan and agreement to the **District**.

B.7.6 All costs pertaining to the acquisition, surveying, and registration of all rights of ways shall be at the expense of the **Owner**.

B.7.7 For **District works**, the minimum width for a statutory right of way shall be 4.5 m for the first system of **works**, plus 1.5 m for each additional system of **works**. For deep sewers, the **Owner** may be required to provide additional width in order to comply with WorkSafeBC regulations and additional right of way may be required to accommodate appurtenances.

B.7.8 At **substantial performance**, **works** installed under this Bylaw in public rights of way or in a statutory right of way in favour of the **District** become the property of the **District** or if in favour of another agency having jurisdiction become the property of that agency subject to no encumbrances.

## **B.8 Construction Contractors**

B.8.1 The **Owner** shall demonstrate to the satisfaction of the **District Engineer** that the **Owner** has or shall retain the services of one or more qualified **contractors** to undertake the construction of the **works**. The **Owner** shall provide the **District** with the name and address of its **contractor(s)** together with a summary of the projects that the **contractor(s)** has undertaken that are similar in scope, nature, and value to the **works** prior to awarding the contract(s) to the **contractor(s)**.

B.8.2 In the case where the **contractor** has not performed similar **works** within the Regional **District** of Central Okanagan, the **District** may require that the **Owner** provide a list of projects and references from other municipalities that demonstrates that the **contractor(s)** is qualified to undertake the **works**.

B.8.3 The **Owner** shall ensure that its **contractor(s)** constructs the **works** in accordance with the design, drawings, plans, and specifications reviewed for construction by the District Engineer and the provisions of this Bylaw.

## SCHEDULE C SERVICING REQUIREMENTS

C.1.1 Works required for a **subdivision** or **development** is based on the **zone** in which the land is located.

C.1.2 The **works** indicated by a checkmark (✓) in the corresponding column must be constructed and installed in accordance with the provisions set out in this Bylaw.

C.1.3 The required **works** must be constructed and installed prior to obtaining **final approval**.

TABLE C-1 SERVICING REQUIREMENTS														
TYPE OF WORKS		Highways and Walkways	Sidewalks	Curb & Gutter	Boulevard & Landscaping <sup>3</sup>	Water Distribution System	Water Source	Community Sewer <sup>2</sup>	Onsite Sewerage system	Storm Drain System	Drainage, Sediment & Erosion Control	Street lighting	Overhead wiring	Underground Utilities
See Schedule		G	H	H	H	I	J	K	L	M	N	O	P	P
Zone														
C	ALL COMMERCIAL ZONES	✓	✓	✓	✓	✓		✓		✓	✓	✓		✓
DC	(Direct Control) zones	✓	✓	✓	✓	✓		✓		✓	✓	✓		✓
DC10	Pixie Beach Resort	✓				✓			✓		✓		✓	
I-1	General Industrial	✓	✓	✓		✓		✓		✓	✓	✓		✓
I-3	Heavy Industrial	✓	✓	✓		✓		✓		✓	✓	✓		✓
I-5	Gravel/Soil Extraction	✓	✓			✓			✓	✓	✓		✓	
P-1	Public Park/Open Space	✓	✓	✓	✓	✓		✓			✓	✓		✓
P-2	Administration, Public Service and Assembly	✓	✓	✓	✓	✓		✓		✓	✓	✓		✓
P-3 <sup>1</sup>	Minor Utilities													
P-4 <sup>1</sup>	Utilities	✓	✓	✓		✓		✓		✓	✓	✓		✓
RU	ALL RU ZONING	✓	✓	✓	✓	✓		✓		✓	✓	✓		✓
RM	ALL RM ZONING	✓	✓	✓	✓	✓		✓		✓	✓	✓		✓
A	ALL A ZONING	✓					✓		✓	✓	✓		✓	
RLP	ALL RLP ZONING	✓					✓		✓	✓	✓		✓	
RR1	Rural Residential	✓					✓		✓		✓		✓	
RR2	Rural Residential	✓				✓			✓		✓		✓	
RR3	Rural Residential	✓				✓		✓		✓	✓		✓	

<sup>1</sup> The **District Engineer** may recommend **Council** vary the servicing standard, having regard to the **development** proposed.

<sup>2</sup> **Community sewer system** is required for new lots or on new secondary suites in detached buildings on lots that are less than 1.0 hectare (2.47 acres) in area.

<sup>3</sup> **Boulevard** and landscaping required where included in design submission.

## **SCHEDULE D GENERAL REQUIREMENTS**

### **D.1 Geotechnical Requirements**

**D.1.1** The **Owner** shall engage a qualified geotechnical **Engineer** to investigate and provide a pre- and post-construction report on surface and subsurface conditions within the proposed **subdivision** or **development**. The geotechnical **Engineer** shall prepare a report outlining his findings and shall provide clear, definitive recommendations on the geometry and placement of fill sections, compaction requirements unique to the project, cut slope geometry and recommendations for surface treatments (in consultation with the **Owner's** Qualified Landscape Professional) required to prevent erosion, pavement structures for roads, and any other geotechnical issues affecting construction within the proposed **subdivision** or **development**.

**D.1.2** Pursuant to Section 86 of the Land Title Act, the **Approving Officer** may at their sole discretion, require a report certified by a professional engineer or geoscientist experienced in geotechnical engineering stating that the land may be used safely for the use intended; and/or require one or more covenants under Section 219 of the Land Title Act in respect to any of the parcels that are being created by the **subdivision**.

### **D.2 Removal of Accumulated Soils**

**D.2.1** Where soil accumulates on public roads, sidewalks, or in drainage systems as a result of construction activity in the **subdivision** or **development**, the **Owner** must remove and dispose of the accumulated soil. The **District** may remove and dispose of the accumulated soil at the expense of the **Owner** if it has not been completed within 72 hours of notification from the **District Engineer**.

### **D.3 Systems Modelling**

**D.3.1** Where modelling of infrastructure systems including, but not limited to, water, sanitary sewer, storm water and transportation networks is required, the modelling will be done by the **District** at the **Owner's** expense.

### **D.4 Test Procedures**

**D.4.1** For the following test procedures:

- (a) pressure testing,
- (b) leakage testing,
- (c) flushing and cleaning,
- (d) video inspection,
- (e) disinfection, and
- (f) inspection chamber water test.

The following requirements must be adhered to.

- (i) The **Owner's Engineer** must be present for the results to be accepted by the **District Engineer**.
- (ii) The **Owner** must notify the **District Engineer** as specified in the **District New Watermain Connection Policy** or at least twenty-four (24) hours in advance of the procedure.
- (iii) If 24 hours has elapsed since proper notification was provided, the **Owner's Engineer** may instruct the test procedure to proceed.



- (iv) Proceeding without proper notification to the **District Engineer** may require the procedure to be performed again in the presence of the **District Engineer**.

#### **D.5 Existing Structure or Utility**

- D.5.1 Where an existing structure or utility may be affected by the **works** the **Owner's Engineer** must provide sufficient advance notification to the **District Engineer** and the **Owner** of the structure or utility so that inspection and protective measures can be identified and implemented.
- D.5.2 Where alignment of an existing structure or utility conflicts with the **works**, the **Owner** must relocate the existing structure or utility in accordance with Standard Drawings at the **Owner's** sole expense and responsibility.
- D.5.3 When existing water, sanitary sewer, or storm drainage alignments conflict with the offsets shown on Standard Drawings or when community sewer is not required pursuant to this Bylaw, alternative alignments may be submitted for approval.

#### **D.6 Obstructions and Repair**

- D.6.1 Where an unforeseen or other obstruction is encountered and interferes with the **works**, construction must cease until revised proposals are approved by the **District Engineer**. The **Owner** must **repair** all items damaged or destroyed.
- D.6.2 The **Owner** is responsible for **repairing** all **highways, lanes, driveways, boulevards**, other areas traversed by trenches or damaged during construction and any damage to unforeseen obstructions.

#### **D.7 Protection from Damage**

- D.7.1 The **Owner** must ensure that due care is taken in order to protect the **work**, existing underground utilities and structures, and other person's property from damage. Any damage must be **repaired** at the expense of the **Owner**.
- D.7.2 The **Owner** must ensure the provision of the necessary safety devices and supervision to protect the public.

#### **D.8 Connection to or use of Existing Works**

- D.8.1 The **Owner** must not use any of the existing **works** until a Certificate of Substantial Performance has been issued by the **District Engineer**.

#### **D.9 Flushing**

- D.9.1 No flushing water shall be discharged into any sanitary sewer or storm sewer without the approval of the **District Engineer**.

**SCHEDULE E SUPPLEMENTALS TO THE MMCD SPECIFICATIONS****E.1 General**

E.1.1 This Schedule provides supplemental requirements that are to be applied in conjunction with the **MMCD Specifications**. Where the provisions contained in this Bylaw are in conflict with the **MMCD** provisions, this Bylaw shall supplement or supersede the **MMCD**.

E.1.2 References to the following within the **MMCD Specifications** shall be as follows:

- (a) Contract Administrator shall mean **Owner's Engineer**
- (b) Contract Drawings shall mean Design Drawings marked "Reviewed for Construction" and signed by the **District Engineer**.
- (c) **Contractor** shall mean **Owner**

<b>TABLE E-1 SUPPLEMENTAL MMCD SPECIFICATIONS</b>		
<b>MMCD SECTION</b>	<b>SUB SECTION</b>	<b>SUPPLEMENTARY SPECIFICATIONS</b>
01 57 01 Environmental Protection	1.4 Environmental Protection .3 Pollution Control	Delete and replace .1 with Maintain drainage, sediment, and erosion control features in accordance with the Drainage, Sediment and Erosion Control Plan submitted to the <b>District</b> .
03 30 53 Cast-In-Place Concrete	1.6 Inspection and Testing	Delete and replace .1 with The <b>Owner</b> must retain an independent materials testing firm to carry out comprehensive testing of concrete which must include unit weight determination, slump test, air test, and casting of test cylinders. One test consisting of three test cylinders must be made for every 175 meters of curb, gutter, and <b>sidewalk</b> . In no case shall there be less than one test on any given day which concrete is poured.
31 05 17 Aggregates and Granular Materials	1.0 GENERAL	Add .2 Maximum aggregate particle size to be no more than 50% of total thickness of sub-base layer.
31 05 17 Aggregates and Granular Materials	2.1 Materials – General	Add .3 The physical properties of the materials for granular sub-base and crushed granular base course shall meet the specifications set out in <b>TABLE E-3</b>
31 05 17 Aggregates and Granular Materials	2.7 Granular Pipe Bedding and Surround Material	Delete and replace .2 with Pit run sand as specified in Section 31 05 17 (2.4) may also be used unless other specified by the <b>Owner's Engineer</b>  Add .3 Other permissible materials: only where shown on Design Drawings Marked <b>reviewed for construction</b> or directed by the <b>Owner's Engineer</b> shall drain rock or approved native materials be used for bedding and pipe surround.
31 05 17 Aggregates and Granular Materials	2.8 Select Granular Sub-base	Delete and replace the table with <b>TABLE E-4</b>
31 05 17 Aggregates and Granular Materials	2.10 Granular Base	Delete and replace .1 with to be 25 mm crushed gravel conforming to the gradations referenced in <b>TABLE E-5</b>
31 05 17 Aggregates and Granular Materials	2.11 Recycle Aggregate Material	Amended .1 by deleting and replacing the third sentence with: Recycled material should consist only of crushed portland cement concrete and asphaltic pavements; other construction demolition materials such as bricks, plaster, etc. are not acceptable.

**TABLE E-1 SUPPLEMENTAL MMCD SPECIFICATIONS**

MMCD SECTION	SUB SECTION	SUPPLEMENTARY SPECIFICATIONS
		<p>Add .2 Material retained on the 4.75 mm sieve to be not more than 20% recycled material. Minimum size of processed recycled material is to be retained on the 4.75 mm sieve.</p> <p>Add .3 Recycled material and granular sub-base material is to be mechanically blended to produce a homogeneous mixture prior to delivery to site. Blending on site will not be permitted.</p> <p>Add .4 Acceptable recycled material to be used in sub-base material only.</p>
31 22 01 Site Grading	3.2 Grading	Delete and replace .1 with Rough grade to levels, profiles and contours in accordance with the Sediment and Erosion Control Plan submitted to the <b>District</b> .
31 23 01 Excavating, Trenching and Backfilling	3.6 Surface Restoration .7 Permanent pavement restoration	<p>Delete and replace .5, with the following new sections:</p> <p>.1 Restore pavement as detailed on District Standard Detail Drawing DLC R14. If thickness of existing permits, grind 50 mm depth along edge of pavement. Dry if necessary and paint clean, dry edge with asphalt emulsion (tack coat).</p> <p>.2 All asphalt shall be saw cut 500 mm wider and longer than the surface dimensions of the actual trench excavation. This saw cut must extend cleanly through the existing asphalt to the base material prior to asphalt removal.</p> <p>.3 If the thickness of the existing asphalt is greater than 75 mm, grind it to a depth of 50 mm and a width of 400 mm along the saw cut edge. This can be done just prior to the final asphalt restoration.</p> <p>.4 Where the edge of the saw cut or milled asphalt, whichever is wider, extends into the travel <b>lane or bike lane</b>, it must be extended to the full width of that <b>lane</b>.</p> <p>.5 Where the edge of the saw cut or milled asphalt, whichever is wider, is less than 1.5 m from the lip of gutter or edge of paved shoulder, it must be extended to the lip of gutter or edge of paved shoulder.</p> <p>.6 When an area of existing asphalt between two transverse trenches is less than 5 metres in width, the existing asphalt shall be removed and the area paved in conjunction with the paving of the two trenches.</p> <p>.7 Regardless of 7.5.5, if the longitudinal distance between two trenches is less than three (3) meters it shall be removed and the area paved in conjunction with the paving of the two trenches.</p> <p>.8 Longitudinal trenches must be paved with a paving machine.</p> <p>.9 Hot-mix paving shall meet the thickness of the existing pavement or that shown on the design drawings, whichever is greater. If the thickness of the hot-mix paving is 75 mm or less, it shall be placed in one</p>

**TABLE E-1 SUPPLEMENTAL MMCD SPECIFICATIONS**

MMCD SECTION	SUB SECTION	SUPPLEMENTARY SPECIFICATIONS
		<p>lift. If the thickness of the hot-mix paving is greater than 75 mm it shall be placed in two lifts as shown on Drawing G5</p> <p>.10 Vertical faces and the surface of the bottom lift of asphalt must be painted with bituminous material prior to hot mix paving.</p>
31 24 13 Roadway Excavation, Embankment and Compaction	3.3 Inspection of Native Surface	Add .2 Top 150 mm of Native Surface to be scarified, moisture conditioned to optimum moisture content and compacted to a minimum of 95% of Modified Proctor density in compliance with ASTM D1557, before placing of embankment or sub-base material.
31 32 19 Geosynthetics	2.1 Geosynthetic	<p>Add .6 Woven Geotextile Fabric Products providing plant and root barriers shall conform to the following Woven Geotextile Fabric Products providing plant and root barriers shall conform to the following:</p> <ul style="list-style-type: none"> <li>*Minimum Tensile Strength - 900 N /m</li> <li>*Maximum elongation at break - 22%</li> <li>*Minimum Tear Strength - 500 N /m</li> <li>*Minimum Bursting Strength (Mullen) - 2200 kPa</li> <li>*Maximum Equivalent opening size - 300 um</li> </ul>
31 32 19 Geosynthetics	3.1 Installation	<p>Add .5 Installation of geotextile fabric which provides plant and root barriers, shall conform to the following:</p> <ul style="list-style-type: none"> <li>*Geotextile fabric shall be installed in accordance with the manufacturer's recommendations.</li> <li>*Fabric shall be placed by unrolling into place and not by dragging across the subgrade.</li> <li>*The fabric shall be inspected for punctures or tears prior to any materials being placed upon it and any such defects shall be <b>repaired</b> by overlapping new material or replacement.</li> <li>*The entire fabric roll shall be placed and rolled out as smoothly as possible. Wrinkles and folds in the fabric shall be removed by stretching and staking, as required.</li> <li>*Overlap at roll ends shall be a minimum of 1 meter and the overlaps shall be stapled or pinned to maintain them during construction activities.</li> </ul> <p>*No vehicles shall be permitted to pass over the fabric.</p>
32 12 16 Hot-Mix Asphalt Concrete Paving	2.1 Materials	<p>Delete and replace .2 with Gradations to be within limits specified when tested to ASTM C136 and ASTM C117. See <b>TABLE E-6</b></p> <p>Delete and replace .6 with Sand Equivalent: to ASTM D2419. Min: 50 (New Arterial), Min: 40 (All other street classifications).</p> <p>Delete and replace .10 with Lightweight particles: to ASTM C123. Maximum % by mass less than 1.95 relative density: Surface course: 1.0 % Lower course: 1.5%</p> <p>Delete and replace .11 Flat and elongated particles: (with length to thickness ratio greater than 5): Maximum % by mass: Coarse aggregate, surface course: 10% Coarse aggregate, lower course: 10%</p> <p>Delete and replace .12 Crushed Particles (fraction retained on 4.75 mm sieve), 2 faces, % minimum:</p>

TABLE E-1 SUPPLEMENTAL MMCD SPECIFICATIONS

MMCD SECTION	SUB SECTION	SUPPLEMENTARY SPECIFICATIONS
		New arterial streets: 85% All other street classifications: 70%
32 12 16 Hot-Mix Asphalt Concrete Paving	2.2 Mix Design	<p>Delete and replace .1 The <b>Owner</b>, at their cost, must retain an independent testing consultant to perform trial mix designs and to submit the job mix formula. The trial mix design must be performed in accordance with ASTM D1559 (75 blows per face) and must include five (5) separate trial values of asphalt content. <b>Contractor</b> must pay for trial mix designs and submissions.</p> <p>Delete and replace .2 Mixes for construction of asphalt base course may contain up to 20% of RAP, provided that the properties of RAP material are considered in the trial mix design. Submissions for RAP mixes must contain all data relevant to RAP utilized in the mix design.</p> <p>Delete and replace .3 with Design of Mix: Include the following data with the trial mix design submission:</p> <ul style="list-style-type: none"> <li>• Aggregate bulk specific gravity and water absorption.</li> <li>• Sand equivalent values.</li> <li>• Asphalt cement properties including mixing and compaction temperatures, based on temperature viscosity properties of asphalt cement.</li> <li>• Aggregate gradations and blending proportions.</li> <li>• Maximum theoretical density of trial mixes.</li> <li>• Asphalt absorption values.</li> </ul> <p>Delete and replace .2 with Mix Physical requirements to meet <b>TABLE E-7</b>. Do not change job-mix without prior approval of <b>Owner's Engineer</b>. Should change in material source be proposed, new job-mix formula to be submitted to <b>Owner's Engineer</b> for review and approval.</p>
32 12 16 Hot-Mix Asphalt Concrete Paving	3.1 Plant and Mixing Requirements .1 Batch and continuous mixing plants	Delete and replace .3 with Before mixing, dry aggregates to a moisture content not greater than 1% by mass or to a lesser moisture content if required to meet mix design requirements.
32 12 16 Hot-Mix Asphalt Concrete Paving	3.1 Plant and Mixing Requirements .9 Where RAP is to be incorporated into mix:	Delete and replace .3 with RAP must not be fed through the aggregate dryer system.
32 12 16 Hot-Mix Asphalt Concrete Paving	3.1 Plant and Mixing Requirements .11 Mixing time:	Add .3 Mixing period and temperature to produce a uniform mixture in which particulates are thoroughly coated, and moisture content of material as it leaves mixer to be less than 0.2%.
32 12 16 Hot-Mix Asphalt Concrete Paving	3.1 Plant and Mixing Requirements .4 Mixing Tolerances	Delete and replace .1 with Permissible variation in aggregate gradation from job mix (percent of total mass) see TABLE E-8
32 12 16 Hot-Mix Asphalt Concrete Paving	3.2 Equipment .1 Pavers	<p>Add .1 Paving equipment must be capable of placing a standard mat width not less than 3 m and must be capable of paving wider widths in 150 mm and 300 mm increments by means of equipment supplied by the manufacturer of the equipment. The screed must include a tamping bar or strike-off device.</p> <p>Add .2 Control of the screed must be by automatic sensing devices. Longitudinal control must be by a sensor that follows a string-line, ski or other reference. The grade sensor must be movable and mounts provided so that grade control can be established on either side of the</p>

TABLE E-1 SUPPLEMENTAL MMCD SPECIFICATIONS

MMCD SECTION	SUB SECTION	SUPPLEMENTARY SPECIFICATIONS
		paver. A slope control sensor must be provided to maintain the proper transverse slope of the screed.
32 12 16 Hot-Mix Asphalt Concrete Paving	3.6 Compaction .2 General	Delete and replace .1 with Provide sufficient compaction equipment to ensure that the compaction rate meets or exceeds the placement rate and to ensure that specified density is achieved before the temperature of the mat falls below 100 degrees C.
32 12 16 Hot-Mix Asphalt Concrete Paving	3.7 Joints .1 General	Add .4 When placing final pavement layer against concrete curbing, compacted pavement must meet the gutter at the same elevation or a maximum of 10 mm above and along the entire lip of the gutter.
33 01 30.1 CCTV Inspection of Pipelines	3.0 Execution	<p>Delete and replace with Immediately upon completion of the <b>works</b>, including all backfilling and compaction and prior to paving, the <b>Owner</b> must video inspect a completed sewer.</p> <p>Prior to any video inspection, the sewer must be thoroughly flushed to remove all deleterious materials so that defects can be observed.</p> <p>Immediately prior to the video inspection, water must be introduced into all sewers with slopes of less than 1% in sufficient quantities to flow the entire length of the section being videoed. Once the water has been added, the water shall be turned off. Video inspection must not take place while the water is running.</p> <p>Picture quality shall be such to produce a continuous 500-line resolution picture showing the entire periphery of the pipe. Picture quality and definition shall be to the satisfaction of the <b>District Engineer</b>.</p> <p>Video inspection must be continuous between manholes.</p> <p>A measuring device shall be provided to measure depth of ponding and shall be continuously visible from the video camera. The measuring device must be capable of measuring ponding to a depth of 100 mm and to an accuracy of 10 mm increments.</p> <p>Upon completion of the video inspection, a report must be submitted to the <b>District Engineer</b>. The report must include the following information:</p> <ul style="list-style-type: none"> <li>(d) Title page with video company's name, address and phone number, <b>contractor's</b> name, <b>engineer's</b> name, location, date, and report number.</li> <li>(e) A schematic plan showing manholes, sewer mains, <b>road</b> names and manhole numbers. Manhole numbers must correspond to the as-constructed drawings.</li> <li>(f) Summary page with upstream and downstream manhole number and corresponding inspection report page number.</li> </ul>



**TABLE E-1 SUPPLEMENTAL MMCD SPECIFICATIONS**

MMCD SECTION	SUB SECTION	SUPPLEMENTARY SPECIFICATIONS
		<p>(g) Individual inspection report for each pipe section with street name or location, upstream manhole number, downstream manhole number, direction of video, length of pipe section, type of material, pipe use, diameter of pipe, grade of pipe, technician's name, and a section for notes. In addition, the inspection report shall include:</p> <p>(i) A log of distances to pertinent information such as services, defects, ponding, and debris.</p> <p>(ii) A description of the pertinent information including length and depth of ponding.</p> <p>(iii) The tape count to each occurrence of pertinent information.</p> <p>Upon completion of the video inspection a video must be submitted to the <b>District Engineer</b>. The video must conform to the following:</p> <p>(h) Type of video must be digital in full colour.</p> <p>(i) Videos must be numbered and cross referenced to inspection report with labels located on all media.</p> <p>(j) Date and running distance in meters to an accuracy of two decimal places. The date and distance must be displayed continuously.</p> <p>(k) Direct voice communication at the start of each section identifying test section, manhole numbers, location, and any other information required to describe section being videoed.</p> <p>(l) Direct voice communication at all service locations, defects, ponding and deleterious materials. Communication shall be factual information only. (i.e. type of defect, depth of ponding, length of ponding, and type of obstruction).</p>
33 11 01 Waterworks	2.0 Products	Only materials listed in E -2 are approved for installation in any water systems owned and operated by the <b>District</b> .
33 30 01 Sanitary Sewers	2.2 Plastic Pipe, Mainline Smooth Profile	Add to .1 Ribbed piping shall not be permitted.
33 30 01 Sanitary Sewers	3.0 Execution	<p>Add New Subsection 3.21 Inspection Chamber Water Test</p> <p>Add .1 Prior to paving, the <b>contractor</b> must introduce a minimum of 20 liters of water in each inspection chamber to visually inspect for ponding.</p>

TABLE E-2-WATERWORKS APPROVED MATERIALS (MMCD 33 11 01 Section 2.0)			
MANUFACTURER	MAKE/MODEL	SIZE	COMMENT
<b>Pipe</b>			
Ipex, Royal Pipe	PVC to C900	100 mm-300 mm	Only SDR 18, class 150 or better as required
	PVC to C905	350 mm- 900 mm	
Canada Pipe	Ductile Iron	100 mm – 900 mm	Pressure Class 350
<b>Service Pipe</b>			
Wolverine	Type K Copper	min. 19 mm (3/4")	Must conform to CSA HC.7.6 and ASTM B88
Poly Tubes/Ipex	Polyethylene	Min. 19 mm (3/4") up to 50mm (2")	Only series 200 conforming to CAN/CSA- B137.1-M
<b>Fittings &amp; Appurtenances</b>			
Terminal City	Iron Fittings	100 mm- 600 mm	All fittings must be properly thrust blocked
Sigma	Iron Fittings	100 mm-600 mm	All fittings must be properly thrust blocked
Ipex	PVC Fittings	150 mm- 200 mm	Shall be AWWA C-907 approved
<b>Restraining Joints</b>			
Clow	Series 1200 & 1350	100 mm – 600 mm	Subject to Owner Engineer's design and District Engineer's approval
Smith Blair	Model 982	100 mm – 600 mm	Subject to Owner Engineer's design and District Engineer's approval
Uniflange	Series 1300, 1390 & 1400	100 mm – 600 mm	Subject to Owner Engineer's design and District Engineer's approval
Ebba	1500- 15PF	100 mm – 600 mm	Subject to Owner Engineer's design and District Engineer's approval
<b>Service/Tapping Saddles</b>			
Robar	2616 DS		Full stainless steel up to 25 mm (1")
Robar	2506 DS		Double strap bronze body over 25 mm (1")
Cambridge	812		38 mm to 50 mm (1.5" X 2")
Canada Pipeline	SC-2 & CD-2		19 mm-25mm only (¾" – 1")
<b>Clamps &amp; Couplers</b>			
Robar	1506 & 1509R	100 mm-600 mm	Epoxy coated complete with stainless steel bolts
Hymax		100 mm – 600 mm	
Smith Blair	411, 413 415, 611, 525	100 mm-600 mm	Epoxy coated complete with stainless steel bolts
Smith Blair	Top Bolt 441		
<b>Gate Valves</b>			
Clow	Clow Resilient	50 mm – 300 mm	Resilient seat gate valves to C-509
Mueller	Super-Seal	50 mm – 300 mm	Resilient seat gate valves to C-509
<b>Butterfly Valves-AWWA C504</b>			



**TABLE E-2-WATERWORKS APPROVED MATERIALS (MMCD 33 11 01 Section 2.0)**

MANUFACTURER	MAKE/MODEL	SIZE	COMMENT
Centerline	Series 200 350 mm+	350 mm +	For installation in chamber only
Pratt	Groundhop	350 mm +	For buried service
Mueller	Lineseal III	350 mm +	For buried service
Valmatic	Series 2000	350 mm +	
Kflow	Series 500 or 47	350 mm +	
<b>Air Valves</b>			
Apco	143C, 145C, 147C, 149C, 150C	25 mm-150 mm	
Valmatic	201C, 202C, 203C, 204C	25 mm- 150 mm	
<b>Fire Hydrant</b>			
Canada Valve	Century EM		2 ½ ports: BC Fire Thread Centre Ports – 100 mm (4") Storz Cap Painted Black
<b>Sampling Station</b>			
Kupferle Foundry	Eclipse 88		
<b>Service Brass</b>			
Mueller	13 mm - 50 mm		
Cambridge	13 mm – 50 mm		
<b>Service Boxes</b>			
Trojan			Stainless Steel Rods and Pins

## E.2 Supplemental MMCD Tables

**TABLE E-3-PHYSICAL PROPERTIES FOR GRANULAR SUB-BASE AND CRUSHED GRANULAR BASE COURSE**

Physical Property	Test Designation	Granular Sub-base	Granular Base
MgSO <sub>4</sub> Loss %	ASTM C88	20	20
Course Ag (Max) Fine Ag (Max)	ASTM C88	25	25
Sand Equivalent % (Min)	ASTM D2419	25	35
Plasticity Index % (Max)	ASTM D4318	6.0	6.0
Crushed Particles (one face) % (Min)	MoT I-11 (A)		60
California Bearing Ratio (Soaked) % (Min)	ASTM D1883	20	80

**TABLE E-4-SELECT GRANULAR SUB-BASE GRADATION**

Sieve Designation	Percent Passing
150 mm	100
100 mm	85 -100
50 mm	65 -100
19 mm	40 – 100
4.75 mm	20 – 70
0.150 mm	0 - 20
0.075 mm	0 - 8

**TABLE E-5-GRANULAR BASE GRADUATIONS**

Sieve Designation	Percent Passing
25 mm	100
19 mm	80 – 100
9.5 mm	60 – 90
4.75mm	35 - 70
2.36 mm	25 – 50
1.18 mm	15 – 35
0.300 mm	5 – 20
0.075 mm	2 -8

**TABLE E-6-HOT-MIX ASPHALT AGGREGATE GRADATION SPECIFICATION**

Sieve Designation	Percent Passing	
	Lower Course	Surface Course
25 mm	100	-
19 mm	80-100	100
12.5 mm	-	84-95
9.5 mm	50-84	73-90
4.75 mm	25-55	50-75
2.36 mm	20-45	35-57
1.18 mm	15-35	25-45
0.600 mm	-	18-34
0.300 mm	5-20	10-26
0.150 mm	-	6-17
0.075 mm	3-7	3-7

**TABLE E-7-SPECIFIED PHYSICAL REQUIREMENTS OF HOT-MIX ASPHALT**

Property	Mix Type	
	Lower Course <sup>1</sup>	Surface Course
Stability @ 60°C, kN (min)	8.0	9.0
Flow Index, 0.25 mm units	8-14	8-14
Voids in Mineral Aggregate % (min)	12.0	14.0
Air Voids, % <sup>2</sup>	3-6	3-5
Index of Retained Stability after Immersion in Water for 24 hrs @ 60°C, % (min)	75	85

<sup>1</sup> If lower course mix is used in staged construction, i.e. exposed for at least one winter, specified properties for surface course mix must apply.

<sup>2</sup> Percent air voids in compacted trial mixes must be determined in accordance with ASTM D3203, with asphalt cement absorbed into the aggregate compensated for in the calculation.

**TABLE E-8-MIXING TOLERANCES**

4.75 mm and larger	<u>+ 4.5</u>
2.36 and 1.18 mm	<u>+ 4.0</u>
0.600 mm	<u>+ 3.5</u>
0.300 mm	<u>+ 2.5</u>
0.150 mm	<u>+ 1.5</u>
0.075 mm	<u>+ 1.0"</u>

## **SCHEDULE F QUALITY CONTROL AND QUALITY ASSURANCE**

### **F.1 Administration and Design Requirements**

#### **F.1.1 Design Submission Requirements**

**F.1.2** Each design submission to the District Engineer shall include a project Design Brief which, at a minimum, shall include the following elements where applicable:

- (a) Title page
- (b) Table of contents
- (c) Introduction
- (d) Objectives and Policies
- (e) Description of the proposed subdivision or development
- (f) Methodology /rationale
- (g) Assumptions
- (h) Description of Infrastructure requirements
- (i) Constraints
- (j) Operations and Maintenance (O & M) requirements
- (k) Schedule
- (l) Modelling and Analysis
- (m) Geotechnical considerations
- (n) Environmental considerations
- (o) Risks/Benefits
- (p) Planned Solutions
- (q) Sketches
- (r) Synopsis
- (s) Conclusion/Summary

#### **F.1.3**

- (a) Prior to submission of design drawings for review by the **District Engineer**, the **Owner** must:
  - (i) provide documentation that the **Owner** has retained as the **Owner's Engineer**, an **Engineer** to coordinate all design **work** and **field reviews** of the registered professionals required for the **subdivision or development**;
  - (ii) submit to the **District Engineer** a letter of Commitment by **Owner** and **Engineer** and a letter of Commitment to Design and Field Review as contained in Schedule S.1 and S.2;
  - (iii) confirm in writing in the form of Schedule S, to the satisfaction of the **District Engineer** that the **Owner** has or shall retain the services of a qualified **engineer** to undertake the design, inspection, testing and record-keeping for the **works**;
  - (iv) complete and provide the **District Engineer** with the following information in Schedule S to demonstrate that the **Owner's Engineer** is qualified to undertake the **works** and more particularly, that it has successfully undertaken projects similar in scope, nature and value to the **works**:
    - A. the name and address of the **Owner's Engineer** and a summary of the projects that the **Owner's Engineer** has undertaken that are similar in scope, nature, and value to the works.
    - B. the names of the individual engineers assigned to various aspects of the project by the **Owner's Engineer** together with a summary of the projects that the individual engineers have undertaken that are similar in scope, nature, and value to the works.

- C. the names and the curriculum vitae for the person(s) that the Owner's Engineer proposes/has retained to undertake the inspections and testing on its behalf during the construction of the works together with a summary of the projects that the person(s) has completed that are similar in scope, nature, and value to the works.
- D. the names and addresses of all sub-consultants that the Owner's Engineer has/proposes to retain and a summary of the projects that the sub-consultants have completed that are similar in scope, nature, and value to the works.
- (v) ensure that the **Owner's Engineer** designs all **works** in accordance with this Bylaw.
- (vi) confirm that the **Owner's Engineer** will provide the Design and Construction and Record-keeping Quality Control and Assurance Plans described herein.

#### F.1.4 Quality Control and Assurance Plans

##### (a) Design Quality Control and Assurance Plan

- (i) The **Owner's Engineer** shall submit a Design Quality Control and Assurance Plan to the **District Engineer** for approval at the time of submitting the first design drawing to the **District**.
- (ii) The proposed Design Quality Control and Assurance Plan must detail the procedures that will be used to ensure and verify that the design for the **works**: including all plans, drawings and specifications, shall be completed in accordance with the minimum design standards set out in this Bylaw.
- (iii) In the case of design items related to pump stations, structures, structural fills, geotechnical or hydro-geotechnical items, or any item not described herein the Design Quality Control and Assurance Plan shall identify, by name, such specialist and/or sub-consultants with suitable experience in these **works**.

##### (b) Construction Quality Control and Assurance Plan

- (i) The **Owner's Engineer** shall submit a Construction Quality Control and Assurance Plan to the **District Engineer** at the time of submitting the first design drawing to the **District**.
- (ii) The proposed Construction Quality Control and Assurance Plan must detail the procedures that will be used to ensure and verify that the **works** shall be constructed in accordance with the **Owner's Engineer's** design, plans, drawings and specifications. The Construction Quality Control and Assurance Plan must identify the:
  - A. proposed Construction Schedule showing milestone dates and the dates of Substantial and Total Performance of the **works**,
  - B. nature and frequency (periodic or full-time resident) of the proposed site inspections during construction to ensure that all **works** constructed satisfy the intent of the design and conform with the drawings, plans and specifications,
  - C. nature and frequency of the proposed field and laboratory testing requirements for the **works** including what materials and equipment are to be tested, what types of tests will be performed and when these tests are to take place, and
  - D. such information as the **District Engineer** may stipulate from time to time.

##### (c) Record-keeping Quality Control and Assurance Plan

- (i) The **Owner's Engineer** shall submit a Record-keeping Quality Control and Assurance Plan to the **District Engineer** for approval at the time of submitting the first design drawing to the **District**.
- (ii) The proposed Record-keeping Quality Control and Assurance Plan must detail the procedures that will be used to ensure and verify that proper records will be kept and maintained throughout the design, construction and warranty phases of the **Development**. The Record-keeping Quality and Assurance Control Plan must ensure that the following records are kept as a minimum:

- A. quality manual and standards;
  - B. details of any field design or construction changes to the drawings, plans and specifications which have been submitted to the **District Engineer** in writing and have been **reviewed for construction** by the **District Engineer**;
  - C. deficiency identification forms (items of the **works** that are either not supplied or constructed in accordance with the design (drawings, plans and specifications) or that require remedial or corrective action);
  - D. deficiency disposition/verification Forms (List of the foregoing items of the **works** that have been corrected);
  - E. inspection and test records; and
  - F. field measurement records of **works** completed that have been used by the **Owner's Engineer** to accurately prepare reproducible as-built drawings that are filed with the **District**.
- (iii) Notwithstanding the generality of the foregoing, the **Owner's Engineer** shall provide the **District Engineer** with the following at the times and in the manner set out below:
- A. For proposed asphalt cuts for installation of **works**, at the time of submission of design drawings for approval, provide a strategy for removal and replacement of asphalt paving that considers:
    - The requirements of the **District's** Highways and Traffic Regulation Bylaw 98-186 and subsequent amendments with respect to "Extraordinary Traffic" and "Uses Requiring Permission";
    - The condition of surrounding pavement and the potential for an extended area of asphalt replacement at either the **Owner's** or the **District's** expense in accordance with the provisions of this bylaw;
    - Expected conditions at the time of asphalt replacement or placement of new asphalt and a strategy for maintaining asphalt quality through monitoring of pertinent parameters such as asphalt delivery, placing and rolling temperatures, applicable compaction effort, air temperature, and ground conditions.
  - B. certification prior to paving that it has inspected those items of the **works** that are below areas to be paved such as **roads, walkways, driveways, and parking lots** and; that same comply with the design (drawings, plans, and specifications) and the provisions of this Bylaw. Such certification shall be accompanied by all test and inspection reports and video reports on pipe lines; and
  - C. certification prior to acceptance by the **District** that surface **works** including paving, drainage, curbs and gutters, **sidewalks, streetlights, etc.** have been constructed in accordance with the design (drawings, plans, and specifications) and the provisions of this Bylaw.

## SCHEDULE G DESIGN AND CONSTRUCTION OF HIGHWAYS AND WALKWAYS

### G.1 General

G.1.1 All **highways** and **walkways** must be constructed in accordance with this Bylaw. It is recommended that Local **highways** and **walkways** within strata **subdivisions** or **developments** shall be designed and constructed in accordance with this Bylaw.

G.1.2 A **highway** proposed to be dedicated by a plan of **subdivision** must not be shown on the plan of **subdivision**, dedicated, laid out, or constructed unless the dimensions, locations, alignment and gradient meet the requirements for **highways** prescribed in this Bylaw.

G.1.3 **Developments** may require **frontage roads**, double **frontage** lots, deep lots with rear service **lanes** or such other treatment as may be necessary in the public interest for the separation of through and local traffic.

G.1.4 Where the **Approving Officer** believes that, due to terrain and soil conditions, a **highway** of a specified width under this Bylaw cannot be supported, protected, or drained, he may determine that the **Owner** provide, at the **Owner's** expense, land of a width that, in the **Approving Officer's** opinion, would permit the **highway** to be supported, protected, or drained pursuant to the *Local Government Act*.

G.1.5 In reviewing engineering plans, the **District Engineer** must consider the sufficiency and suitability of the proposed **road** system, the arrangement, width, grade, and location of all **roads** in relation to existing and planned **roads**, to topographical features, to public convenience and safety, and to the proposed uses of the land to be serviced by such **roads**.

G.1.6 In the preparation of engineering plans for **highways**, the **Owner's Engineer** shall take into account the following general design considerations:

(a) Continuation of existing **roads**

- (i) The design and arrangement of **highways** within a **subdivision** shall provide for the continuation or projection of existing **roads** in the surrounding area. In no case shall the arrangement of **highways** within a proposed **subdivision** make impractical the extension of **roads** and the **subdivision** of adjoining **parcels**.
- (ii) The design and arrangement of **highways** must consider the impact of new development on the surrounding road network. Traffic calming measures must be implemented if the following conditions are expected:
  - A. Potential for short-cutting due to the new connections having a shorter route to a main road;
  - B. Geometric conditions that may facilitate speeding (e.g., high operating speeds and straight roadways; and
  - C. Unsafe conditions due to geometric conditions.

(b) Topography to be taken into account

- (i) The design and arrangement of **highways** shall be suited to the topography of the land proposed to be **subdivided** or **developed**.

G.1.7 Driveways, retaining walls, vegetation and other private or municipal improvements on private or municipal property or **highways** affected by the **road** construction shall be restored at minimum to the condition existing prior to construction and to the satisfaction of the **District Engineer**.

G.1.8 Paving shall not be undertaken until all underground utilities have been constructed in accordance with this Bylaw nor during snow, heavy rain, temperatures below 5 degrees C, or other unsuitable conditions. Asphaltic concrete shall not be placed on a frozen, muddy or rutted base.

G.1.9 Tie-ins to existing pavement shall be made in accordance with Standard Drawings. The existing pavement shall be cut back to produce a neat vertical face with a straight edge as described in Table E-1 Supplemental MMCD Specification 31 23 01.

G.1.10 The timing for the installation of the top lift of asphalt shall be at the **District Engineer's** discretion and dependent on District requirements with respect to ensuring **stormwater** is able to enter catch basins on steeper sections of road.

## G.2 Classification of Highways

G.2.1 Prior to design of the road system, the **Owner's Engineer** shall consult with the **District Engineer**, to classify each road proposed adjacent to and within the **subdivision**.

## G.3 Transportation Requirement Assessment

G.3.1 The **District Engineer** may, in his sole discretion, direct the **Owner's Engineer** to prepare a transportation requirement assessment that considers the following requirements and amenities:

- (a) Criteria set out in **TABLE G-1**;
- (b) traffic volumes and expected speeds;
- (c) the need for and applicability of alternate intersection configurations, including roundabouts;
- (d) the need to accommodate normal traffic, emergency vehicles, transit, pedestrians, cyclists, and parking;
- (e) drainage constraints/options;
- (f) street or intersection lighting;
- (g) traffic calming;
- (h) snow storage;
- (i) hillside slope/width restrictions;
- (j) right of way width availability;
- (k) desire to encourage use of certain routes for varying types of traffic (e.g. truck, farm, and commercial traffic);
- (l) minimize capital costs as well as future maintenance and rehabilitation costs; and
- (m) the **District's** standard drawing road cross sections.



**TABLE G-1-HIGHWAY CROSS SECTION REQUIREMENTS AND AMENITIES**

	Lane		Urban-Undivided				Rural-Undivided			Urban Divided
	Residential	Commercial	Local Hillside	Local	Collector	Arterial	Local	Collector	Arterial	Arterial
Lane Width	6	7.5	3.2	3.2	3.5	3.5	3.2	3.5	3.5	3.5
Bike Lane <sup>6</sup>	n/a	n/a	1.5	1.5	1.5	1.8	1.5	1.5	1.8	1.8
Parking	No	No	2.4 <sup>1</sup>	2.4 <sup>1</sup>	2.4 <sup>1</sup>	2.4 <sup>1</sup>	None	None	None	2.4 <sup>1</sup>
Shoulder	n/a	n/a	n/a	n/a	n/a	n/a	1.5	1.5	2.0	n/a
Ditch	n/a	n/a	n/a	n/a	n/a	n/a	2.5	2.5	2.5	n/a
Curb & Gutter (type)	n/a <sup>8</sup>	n/a <sup>8</sup>	Barrier	Barrier	Barrier	Barrier	None	None	None	Barrier
Sidewalk	n/a	n/a	One side <sup>2</sup>	One side <sup>2</sup>	Two sides	Two sides	None	None	None	Two sides
Pathway <sup>6</sup>	n/a	n/a	None	None	None	None	None	2.0 <sup>3</sup>	2.0 <sup>3</sup>	None
# of Lanes	n/a	n/a	2	2	2-4	4	2	2	2-4	4
Pavement Width	5	7.5	9.4 <sup>4, 5, 9</sup>	9.4 <sup>4, 5, 9</sup>	12.4 <sup>4, 5, 9</sup>	20 <sup>9</sup>	9.4	10	10-17 <sup>9</sup>	18 <sup>9</sup>
R/W width	6	7.5	18 20 <sup>5</sup>	18 <sup>9</sup>	22	30	20	20	28	25-35 <sup>1, 7</sup>
Standard Dwg #	DLC R2	DLC R3	DLC R4	DLC R5	DLC R6	DLC R7	DLC R8	DLC R9	DLC R10	DLC R11

- 1 Parking is not required in **developments** where there are no fronting lots except in areas of parks, schools, recreational facilities, or green space.
- 2 **Sidewalk** required one side where more than 20 homes are accessed from the **road** and both sides where more than 40 homes are accessed. **Sidewalk** is required on at least one side where the **road** is part of a walking route shown in the **Transportation for Tomorrow Plan**. Barrier curb is required wherever curb and gutter is required.
- 3 Trail/bike path to be asphalt surface.
- 4 Pavement width is measured from back of curb to back of curb except for rural **roads** where it is measured to edge of asphalt.
- 5 Pavement is widened to accommodate parking where required. Alternate locations for parking that are not in the **road** carriage way may be considered by the **District Engineer** at a rate of one space per home where **road** right of way width is available.
- 6 Bike **lanes** or trail/bike paths are not required where fewer than 40 housing units are served.
- 7 Parking is required where **development** has **frontage** lots.
- 8 Curb may be required for drainage.
- 9 Pavement width and right of way width may vary depending on configuration of driving, bike and parking **lanes**.

G.3.2 In cases where parts of the proposed **subdivision** or **development** front on an existing **road**, the configuration of the improvements will take into consideration the existing **road** setting and existing and proposed cross section improvements as shown in the **District's "Transportation for Tomorrow Road Improvement Plan"** as amended from time to time.

G.3.3 Where reasonably practical, driveway access will be from local **roads** rather than from collector and/or **arterial highways**.

G.3.4 The transportation requirement assessment will be used to determine typical **road** cross sections in consultation with and subject to the approval of the **District Engineer**.

**G.4 Consistency with Official Community Plan**

G.4.1 The location, classification, and standards all **highways** proposed within a **subdivision** shall take into account the proposed use of the land and shall conform to the provisions of the **District of Lake Country Official Community Plan**.

**G.5 Local highways**

G.5.1 Local **highways** within a proposed **subdivision** shall be arranged so that their use by through traffic will be discouraged.

**G.6 Culs-de-sac**

G.6.1 Cul-de-sac streets shall not exceed 300 metres in length and shall be provided with a turning area of not less than 12.5 m radius designed to permit safe and adequate space for the turning of emergency and motor vehicles at the terminus of the cul-de-sac.

G.6.2 Where circumstances are such that a cul-de-sac bulb is impractical, the **District Engineer** may, at his discretion, permit a hammerhead configuration in accordance with Standard Drawings.

G.6.3 Turning areas in all culs-de-sac shall be designated as no parking areas with signs and pavement markings in conformance with G.13.

G.6.4 For culs-de-sac greater than 200 metres and less than 300 metres, an emergency access route is required. The emergency access route must be within 50 metres of the terminus of the cul-de-sac and must provide connection to another public **highway**. The emergency access route shall be designed in accordance with Standard Drawing DLC R2 – Residential lane. The maximum grade of the emergency access shall be no greater than 12 %. The minimum width of the emergency access route shall be 6.0 metres with a 5.0 metre drive aisle. The emergency access route must be paved and closed to vehicle traffic with a suitable traffic control device approved by the **District Engineer**.

G.6.5 Where a cul-de-sac abuts adjacent developable lands, the Approving Officer may require that the cul-de-sac be configured such that it does not preclude future continuation of the road.

**G.7 Lanes**

G.7.1 Lanes, meeting the standards set out in this Bylaw, shall be provided where the **District Engineer** deems them to be necessary. Lanes are permitted for access, subject to approval by the **District Engineer**, where access from the street is not practical.

## **G.8 Walkways**

G.8.1 Walkways shall be provided where the **District Engineer** deems them to be necessary to provide access through a **subdivision** to schools, parks, playgrounds, commercial areas or other community facilities, or for the safe and efficient circulation of pedestrian traffic.

G.8.2 Walkways shall be provided with chain link fencing in accordance with **MMCD 32 31 13**, on both sides of the **walkway**. The height shall be 1.0 m in the set back area of the adjacent property and 1.8 m for the remaining length.

## **G.9 Transit Bays**

G.9.1 Transit bays shall be provided where the **District Engineer** deems them necessary.

## **G.10 Intersections**

G.10.1 Intersections shall be designed as follows:

- (a) intersecting **highways** shall meet substantially at right angles (between 70 degrees and 110 degrees);
- (b) jogs in **highway** alignment at intersections shall be avoided except where the distance between centrelines is sufficient to ensure traffic safety. The minimum spacing between tee intersections along a street shall be 60 m;
- (c) intersections having more than four intersecting legs shall not be permitted;
- (d) intersections shall provide adequate crossing sight distances and stopping sight distances, whichever is greater.

## **G.11 Reverse Curves**

G.11.1 If reverse curves are required in a **highway** alignment, the **District Engineer** may require that they be separated by means of tangents of sufficient length to prevent superelevation rotation.

## **G.12 Mailboxes**

G.12.1 Where required by Canada Post, the **Owner** shall indicate the Canada Post approved locations of the mailboxes on the engineering drawings. The **Owner** is referred to Canada Post for location guidelines and approval.

## **G.13 Road Names, Traffic Signs, and Pavement Markings**

G.13.1 Road names shall be approved by the **District** in accordance with current policies and Bylaws. Road name signs, traffic signs, and pavement markings required as a result of constructing or improving roads shall be supplied and installed by the **Owner** at the **Owner's** expense.

G.13.2 Road name signs (street blades) shall be produced using FHWA series C2001 CA font on engineering grade green background. Strata road name signs shall be on a blue background. Signs shall be produced on 2 mm. (0.08 inch) flat Aluminum stock.

G.13.3 Pavement markings and all traffic signs shall conform to the Transportation Association of Canada Manual of Uniform Traffic Devices for Canada.

G.13.4 Pavement marking layout must be inspected by the **District Engineer** prior to painting. 48 hours notice must be provided.

G.13.5 Thermoplastic markings shall be used at all stop bars and cross walks.

#### G.14 Appurtenances

G.14.1 The **Owner's Engineer** shall detail, on the design drawings, the location of all proposed traffic islands, retaining walls, guardrails, and permanent barricades. These structures shall be designed in accordance with Transportation Association of Canada Guidelines and with good engineering practice.

G.14.2 The design shall show the location of all traffic signs, street signs, pavement markings and other traffic control devices.

G.14.3 Drawings must show all utility poles, ducts, junction boxes, and pipelines. The **Owner's Engineer** shall indicate those utilities which require relocation prior to **road** construction and shall confirm with the utility the feasibility of their relocation prior to design completion. For underground systems, design drawings shall show the location of **underground wiring** and appurtenances including the connections to properties.

#### G.15 Vertical Alignment

G.15.1 The vertical alignment of **highways** and **walkways** shall be set so the grades of driveways to adjacent properties will comply with the **District Highway Access Bylaw**.

G.15.2 The minimum longitudinal gradient at the gutter line shall be 0.50% for all classifications of streets. The minimum longitudinal gradient around **culs-de-sac** and curb returns shall be 0.80%.

#### G.16 Design Speeds

G.16.1 The design speeds to be used for design of Highways shall be as per TABLE G-2

TABLE G-2-DESIGN SPEED	
Arterial (A)	70 km/h
Collector (C)	60 km/h
Local (L), Recommended for Bare Land Strata	50 km/h
Strata	30 km/h

#### G.17 Road Crossfall

G.17.1 Minimum **road** crossfall shall be 3%; maximum crossfall shall be 4%.

#### G.18 Road Grades

G.18.1 Minimum and maximum **road** centre line grades shall conform to TABLE G-3 based on the **road** classification.

G.18.2 Maximum grades are to be reduced by 1% for each (or part of each) 30 metres that the centre line radius is less than 150 metres.

**TABLE G-3-HIGHWAY GRADES**

Road Classification	Min Grade	Max Grade
Arterial	0.5%	9%
Collector	0.5%	9%
Local and recommended for Bare Land Strata	0.5%	8%
<b>Cul-de-sac</b> , (entry downhill)	0.5%	8%
<b>Cul-de-sac</b> (entry uphill)	0.5%	8%
<b>Cul-de-sac</b> (bulbs)	0.5%	6%
Lane	0.5%	9%
Walkway	0.5%	12%

**G.19 Vertical Curves**

G.19.1 Vertical curves shall be designed to provide safe stopping sight distances. Minimum stopping sight distance is the least distance required to bring the vehicle to a stop under prevailing vehicle and climatic conditions. Vertical curves shall be provided at the following grade changes:

- Greater than 0.5% for Arterials
- Greater than 1.0% for Collectors
- Greater than 2.0% for Locals and Lanes
- Vertical curve length is calculated by the equation  $L = KA$  where:  
 L is the length of the vertical curve (Minimum L = 15 m)  
 K is a constant related to lines and geometry of the vertical curve  
 A is the algebraic difference in grades in percent

G.19.2 Minimum K values for vertical curve design shall be as set out in TABLE G-4

**TABLE G-4-MINIMUM K VALUES FOR VERTICAL CURVE DESIGN (METRES)**

Road Classification	Crest Curve	Sag Curve	
	Minimum	Lighting	No Lighting
Arterial	22	15	25
Collector	15	10	20
Local, Recommended for Bare Land Strata	7	6	11

**G.20 Horizontal Alignment****G.20.1 Centre Line Radii**

- The minimum required centreline radius for various super elevation rates for each classification of roadways are set out in TABLE G-5

**TABLE G-5-MINIMUM CENTRE LINE RADIUS**

Road Classification	Horizontal Curve Centreline Radii (m)			
Superelevation (m/m)	None	0.02	0.04	0.06
Arterial	n/a	230	200	190
Collector	160	140	130	n/a
Local, Recommended for Bare Land Strata <sup>1</sup>	95	n/a	n/a	n/a
Strata	12	n/a	n/a	n/a

<sup>1</sup> Radius may be reduced at the discretion of the District Engineer.

**G.20.2 Curb Return Radii**

- (a) Curb return radii shall conform to TABLE G-6 and be based on the lesser classified **Highway**.

TABLE G-6-CURB RETURN RADII	
Road Classification	
Arterial	11.0 m
Collector	11.0 m
Local, Recommended for Bare Land Strata	9.0 m
Cul-de-sac	11.5 m connecting radii to tangent =16.0 m
Industrial	11.0 m
Strata	6.0 m roadway – 9.0 m 7.3 m roadway –7.5 m

## G.21 Intersection Design

- G.21.1 Unless indicated elsewhere herein, all intersection design standards shall conform to those outlined in the latest edition of "Geometric Design Guide for Canadian Roads" as published by the Transportation Association of Canada (TAC).

## G.22 Intersection Grades

- G.22.1 Approach grades of minor streets at intersections to major streets shall not exceed 75% of the maximum grade allowed for that street classification. The minor street shall be designed to intersect the major street with a vertical curve of minimum length required for that street classification. The vertical curve shall terminate at the curb line using the K values set out in TABLE G-7.

TABLE G-7-INTERSECTION CURVES MINIMUM K VALUES		
Intersecting Street	Minimum K Value	
	Crest Curve	Sag Curve
Arterial	17	15
Collector	7	6
Local, Recommended for Bare Land Strata	4	4

- G.22.2 Under limited adverse access conditions, the **District Engineer** may allow the criteria listed in TABLE G-8 while considering factors such as length of grade, amount of lower grade approach, amount of direct **road** access, **road** width, and drainage requirements.

TABLE G-8-DESIGN CRITERIA FOR LIMITED ADVERSE TOPOGRAPHIC CONDITIONS		
	COLLECTOR	LOCAL ROAD
Design Speed (km/h)	50	50
Curvature (m)	95	85
Grade (%)	11	12
K Sag Curve	6	4
K Crest Curve	6	4

- G.22.3 Crossfalling a **road** at an intersection will be permitted where required because of topographical features in keeping with good engineering practices.

- G.22.4 The transition length from a normal cross-sectioned **road** to a section of **road** where there is superelevation shall be calculated based on 15 m for every 1% change in grade. If these conditions

are to be used the **Owner** must submit a preliminary design showing a centre line profile with existing ground line and the proposed grade for all streets and intersections affected for adverse topography. If prior approval has not been given by the **District Engineer**, then any design submitted will not be approved.

#### **G.23 Subgrade Preparation**

G.23.1 The **road** right of way shall be cleared of all trees, stumps, logs, roots, and any other objectionable material likely to cause settlement for the full width of the **highway**, and for such additional width as may be required to contain cut and fill slopes. In addition, buildings, fences, superfluous culverts, or any other structures within the **highway** shall also be removed. Trees may be left within the **highway** only where they do not conflict with utility services and where they are not deemed a hazard at the discretion of the **District Engineer**.

G.23.2 Prior to placing of any granular aggregate on the **highway**, all existing topsoil or other deleterious matter shall be removed from the full width of the **road** right of way and the **road** surface graded to the desired cross section. Those areas not supporting structural portions of the **road**, curb, gutter, or **sidewalks** do not need to be stripped.

G.23.3 Embankments shall be constructed by placing, shaping, and compacting approved materials as classified in this Bylaw. All material placed in embankments shall be bladed smooth in level layers not exceeding 300 mm uncompacted depth over the entire embankment area and placed in successive uniform layers.

G.23.4 When embankments are to be made on hillsides or where a new fill is to be applied upon an existing embankment, the slopes of the original ground or embankment (except rock embankments) shall be terraced or stepped before filling is commenced.

G.23.5 Each layer shall be compacted to 95% Standard Proctor Density.

G.23.6 The embankment shall be constructed to provide adequate drainage. Should the embankment material become damaged or saturated by rain, flooding, or other effects, **repair**, scarification, or whatever other measures required to restore the embankment to the moisture and compaction requirements this Bylaw shall be undertaken. Unsuitable materials encountered in the excavation areas or at the subgrade elevation shall be excavated and wasted.

G.23.7 Over excavations shall be rebuilt to grade with an approved compacted material.

G.23.8 At transition sections where the profile grade changes from embankment to cut, the natural slope shall be excavated to a depth of 1 meter and replaced with suitable material for a distance of 15 meters in order to prevent abrupt future differential grade changes. These parameters may be varied on the recommendation of a geotechnical **engineer**.

G.23.9 The upper 300 mm of the subgrade shall be compacted to 100% of Standard Proctor density. Subgrade preparation shall extend a minimum of 600 mm out from back of curb, **sidewalk** or edge of asphalt on either side of the **road**.

G.23.10 Subgrade preparation shall be considered integral to the construction of new **roads**.

G.23.11 Frost Susceptible Soils (ML): The susceptibility of soils to frost heave is commonly classified using the US Corp of Army Engineers four categories, as shown in Table 15.2 of the "Canadian Foundation Engineering Manual", 3rd edition, 1992. All geotechnical reports shall address the frost susceptibility of the subgrade soil.

G.23.12 Swelling Soils (CH): Pockets of soils known to change volume with variation of moisture content are known to exist in several locations within the **District**. These soils are typically identified as highly plastic clays (CH) using the Unified Soil Classification System and Atterberg Limits index test (ASTM D4318). Where these soils are encountered as subgrade, special subgrade preparation considerations are required, as outlined below.

G.23.13 Scarification should render the subgrade to cohesive pieces of a maximum size of 20 mm to allow adequate moisture conditioning of the soil. The soil should be moisture conditioned to achieve a homogeneous moisture content between 0 and 3% over optimum. Following moisture conditioning, the subgrade soil should be compacted to a minimum of 95% of Modified Proctor density, as determined by ASTM D1557. The subgrade should be covered with granular sub-base as soon as practical to minimize the variation of the moisture content in the subgrade. Additional moisture conditioning and compaction may be required, should the moisture content be allowed to vary significantly from optimum prior to placing the sub-base.

**G.23.14 Proof Rolling**

- (a) Upon completion of the subgrade preparation, the subgrade shall be proof rolled with a loaded single axle truck with a minimum rear axle load of 8,000 Kg.
- (b) Any areas found to be soft or wet shall be excavated and back filled with select granular sub base, granular material, and compacted to 100% Standard Proctor density.

**G.24 New Pavement Design**

G.24.1 The following four primary factors shall be considered in undertaking a specific design:

- (a) Subgrade support quality (geotechnical report)
- (b) Design life (20 years)
- (c) Traffic loading (expressed in ESALs)
- (d) Climate

G.24.2 New pavement structures shall be designed in accordance with the methodologies presented in "AASHTO Guide for Design of Pavement Structures", 1993. The pavement structure shall be designed for a twenty (20) year design life.

G.24.3 The American Association of State Highway and Transportation Officials (AASHTO) design method is based on a Structural Number (SN) for the entire pavement structure (i.e. hot mix asphalt, granular base and granular sub-base). The method incorporates the subgrade strength expressed as the Subgrade Resilient Modulus ( $M_r$ ), and design loading measured in equivalent single axle loads (ESALs). Each component of the pavement structure is assigned a layer coefficient.

G.24.4 Subgrade strength is frequently characterized utilizing the California Bearing Ratio (CBR) test procedure (ASTM D1883). This test should be performed on soaked subgrade soil specimens compacted to 95% of Modified Proctor density as determined by ASTM D1557. The Resilient Modulus may be approximated from the soaked CBR test values using the following relationships:



$$\begin{aligned} \text{Mr (MPa)} &= 10.3 \text{ CBR, or} \\ \text{Mr (psi)} &= 1500 \text{ CBR} \end{aligned}$$

G.24.5 The soaked CBR properties of subgrade soil should be determined for each major soil type encountered. Where more than one test is required, the tests should be evenly spaced, unless otherwise directed by the geotechnical **engineer**.

G.24.6 The required SN for the pavement structure is the sum of the product of the layer coefficient, the component thickness, and a drainage coefficient for each component:

$$\text{eq'n (1) SN} = a_{ac}D_{ac} + a_bD_bM_b + a_{sb}D_{sb}M_{sb} \text{ where:}$$

SN	= structural number for pavement structure
$a_{ac}$	= layer coefficient for hot mix asphalt (0.4)
$a_b$	= layer coefficient for granular base (0.14)
$a_{sb}$	= layer coefficient for granular sub-base (0.10)
$D_{ac}$	= thickness of hot mix asphalt (mm)
$D_b$	= thickness of granular base (mm)
$D_{sb}$	= thickness of granular sub-base (mm)
$M_b$ & $M_{sb}$	= layer drainage coefficient (1.0 for Lake Country)

G.24.7 Road classifications, design traffic values and minimum depths of hot mix asphalt and granular base components of the total pavement structure are as per TABLE G-9.

**TABLE G-9-MINIMUM ASPHALT AND GRANULAR BASE DEPTH VS DESIGN TRAFFIC**

Road Classification	Design Traffic (ESALs) <sup>1</sup>	Minimum Depth of Hot Mix Asphalt (mm)	Minimum Depth of Granular Base (mm)
Walkways	n/a	50	75
Local, Lanes & Access Roads	$2.8 \times 10^4$ (28,000)	50	75
Collector	$2.8 \times 10^5$ (280,000)	100	100
Arterial <sup>2</sup>	$1.0 \times 10^6$ (1,000,000)	100	100

<sup>1</sup> See Part 1 – Chapter 1 of AASHTO for definition of an Equivalent Single Axle Load (ESAL).

<sup>2</sup> Special design reviews may be requested by the **District Engineer**

## G.25 Standard Pavement Structures

G.25.1 Standard pavement structures, including required SN values, are provided on in TABLE G-10 for three strengths of subgrade. The standard pavement structures incorporate the minimum depths of hot mix asphalt and granular base shown.

TABLE G-10-STANDARD PAVEMENT STRUCTURES				
Street Classification	Structure Component	Thickness is mm for Soaked CBR <sup>1</sup> of		
		3.0 <sup>4</sup> CBR 5	5.0 CBR 10	CBR 10
Walkways	Asphalt – Surface Course	50	50	50
	Granular Base	75	75	75
	Granular Sub-base <sup>3</sup>	150	150	150
	Required SN Value	n/a	n/a	n/a
Local, Lanes & Access Roads	Asphalt – Surface Course	50	50	50
	Granular Base	75	75	110 <sup>2</sup>
	Granular Sub-base <sup>3</sup>	275	165	0
	Required SN Value	58	47	35
Collector	Asphalt – Surface Course	40	40	40
	Asphalt – Base Course	60	60	60
	Granular Base	75	75	100 <sup>2</sup>
	Granular Sub-base	335	185 <sup>3</sup>	0
	Required SN Value	84	69	53
Arterial	Asphalt – Surface Course	40	40	40
	Asphalt – Base Course	60	60	60
	Granular Base	75	75	75
	Granular Sub-base	535	355	155 <sup>(3)</sup>
	Required SN Value	104	86	66

<sup>1</sup> Soaked CBR value shall be at 95% of Modified Proctor maximum dry density and optimum moisture content, as determined by ASTM D1557.

<sup>2</sup> Placement of equivalent sub-base layer is not practical and shall be replaced with additional granular base.

<sup>3</sup> Maximum aggregate size of sub-base material to be no more than 50% of total depth of sub-base.

<sup>4</sup> Where the top 1 m of subgrade has a soaked CBR value of less than 3, then the subgrade strength should be supplemented with an additional thickness of granular sub-base material in order to achieve a soaked CBR value of 3 or greater. The thickness of the supplemental sub-base and the corresponding composite CBR value for the top 1 m of composite subgrade can be determined by the following formula:

$$\text{CBR Composite} = ((t_{ssb} \times \text{CBR}_{ssb})^{0.33} + (100 - t_{ssb}) \times \text{CBR}_{sg})^{0.33} / 100^3$$

Where CBR Composite is 3 or greater.

$t_{ssb}$  = thickness of supplemental sub-base (cm).

$\text{CBR}_{ssb}$  = CBR value of supplemental sub-base.

$\text{CBR}_{sg}$  = CBR value of subgrade soil.

G.25.2 Granular base and granular sub-base to have a minimum soaked CBR value of 80 and 20, respectively.

G.25.3 For design purposes, the maximum subgrade soaked CBR value shall not exceed 10.

G.25.4 Staged construction may be considered by the **District Engineer** when a road is to be constructed and to be widened at a later date.

TABLE G-10 provides standard pavement structures for roads constructed on only three strengths of subgrade. Alternate pavement structures may be designed based on the SN determined using

G.25.5 **FIGURE G-1.** For example, for a Collector Road with soaked subgrade CBR value of 4, then the corresponding pavement structure requires a SN of 75. Using eq'n (1), and the specified layer coefficients, a suitable pavement structure alternative may be determined as shown TABLE G-11.

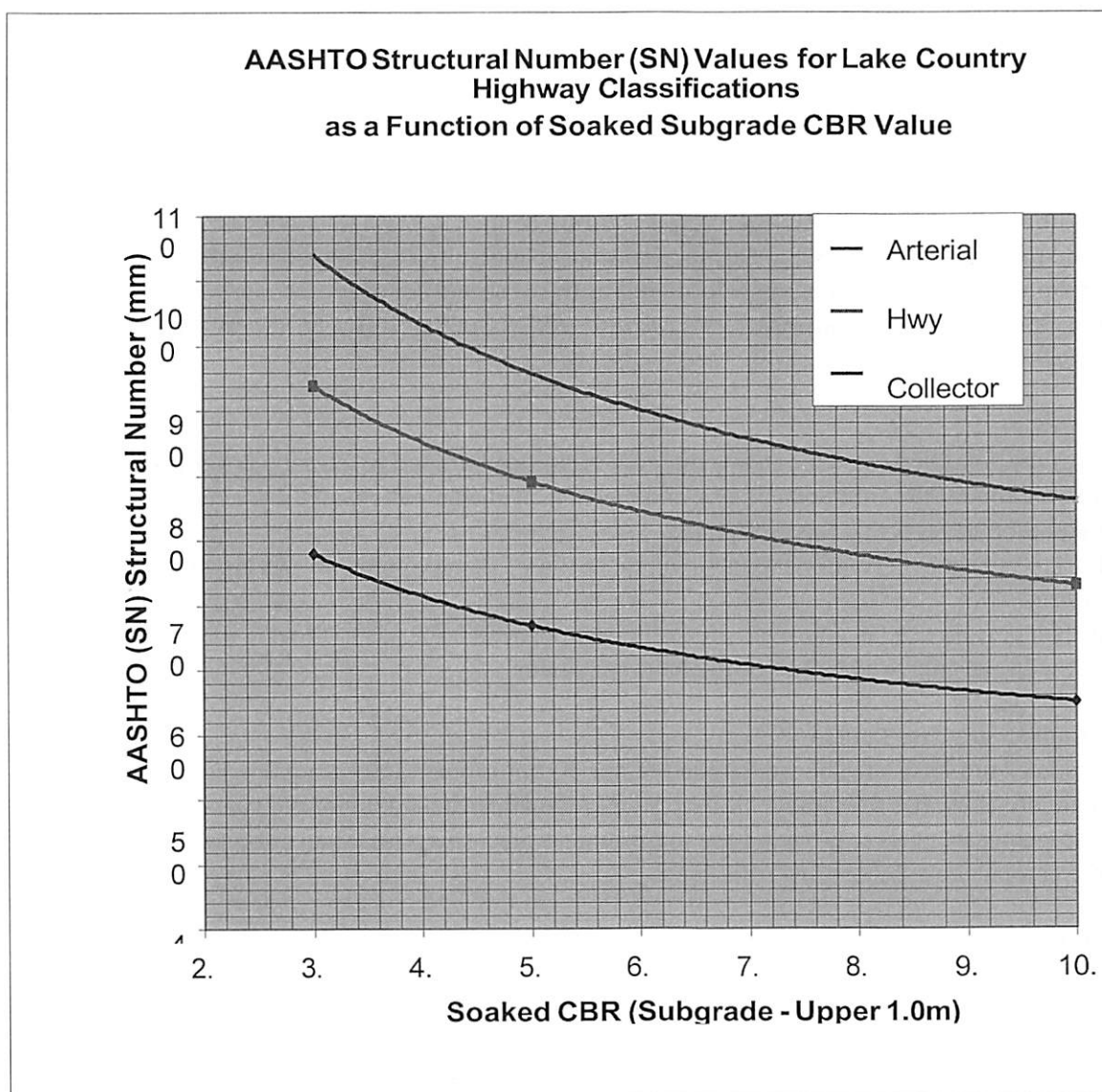
**TABLE G-11-EXAMPLE PAVEMENT STRUCTURE <sup>1</sup>**

Pavement Structure Component	Thickness, D (mm)	Layer Coefficient, a	SN
Hot Mix Asphalt	100	0.40	40
Granular Base	100	0.14	14
Granular Sub-base	210	0.10	21
Total SN			75

<sup>1</sup>The minimum depths of hot mix asphalt and granular base shown, and the required SN have been met.

**FIGURE G-1**

Curves shown are derived from the methodologies presented in AASHTO. A description of all variables used to derive the curves is presented in the Ministry of Transportation Technical Circular T-9/95, "Pavement Design Standards".



**G.26 Design of Overlays for Existing Pavements**

G.26.1 Design criteria for overlays are based on the limiting Benkelman Beam deflections as per TABLE G-12

- (a) The design Benkelman Beam rebound ( $x + 2\sigma$ ) should be determined on the basis of at least 10 uniformly spaced readings per two-lane kilometre (one half in each lane).
- (b) The summary rebound statistic for a pavement section should be seasonally adjusted to the spring peak rebound value.

TABLE G-12-BENKELMAN BEAM CRITERIA FOR OVERLAYS	
Road Classification	Maximum Deflection (mm)
Arterial highways	1.00
Collector highways	1.25
All Other Highway Classifications	1.50

**G.27 Materials****G.27.1 Subgrade Fill Material**

- (a) Subgrade fill material shall be free of rock detrimental to proper compaction and free of organic or other deleterious matter. Fill material shall be compacted to a minimum of 95% Standard Proctor density (ASTM 0698). Fill material shall be moisture conditioned to within 3% of its optimum moisture content, as determined by the Standard Test Methods for Moisture-Density Relations of Soils and Soils-Aggregate Mixtures ASTM D698 or ASTM D1557, at the time compaction is undertaken.

**G.27.2 Rock Fill**

- (a) Rock, by definition, shall mean any material excepting hardpan or glacial till over 0.75 cu.m. in volume requiring continuous drilling and blasting. It shall mean masonry or concrete as well as natural boulders fitting this definition.
- (b) Rock fill shall be any material containing more than 15% by volume of rock larger than 150 mm in size.
- (c) It shall only be used in approved areas and by approved methods to provide maximum stability of the fill, as approved by the geotechnical engineer.

**G.27.3 Granular Sub-base Course**

- (a) Granular sub-base shall be well-graded material conforming to the gradation limits as shown on Standard Drawings or suitable blast rock designed and installed under the supervision of a Geotechnical Engineer provided the maximum nominal size is less than or equal to 50 percent of the compacted sub-base layer thickness.

**G.27.4 Crushed Granular Base Course**

- (a) Crushed base course shall be composed of inert, durable aggregate, reasonably uniform in quality, and free from soft or disintegrated pieces, wood wastes, roots, organic material or other deleterious materials.
- (b) The gradation shall be within the limits set out in **TABLE G-13** when tested to ASTM C 136 and C 117, using the designated sieve sizes, and to have a smooth curve without sharp breaks when plotted on a semi log grading chart.

<b>TABLE G-13-CRUSHED GRANULAR SUB-BASE LIMITS</b>	
<b>USBC Sieve Size</b>	<b>Percent by Weight Passing</b>
25.00 mm (1")	100%
19.00 mm (3/4")	80-100%
9.50 mm (3/8")	50-80%
4.75 mm (# 4)	35-65%
2.36 mm (# 8)	25-50%
1.18 mm (# 16)	15-35%
0.300 mm (# 50)	5-20%
0.075 mm (#200)	3-8%

- (c) A minimum of 60% of the material retained on 4.75 mm sieve shall have at least two fractured faces as determined by particle count.

#### G.27.5 Crushed Granular Aggregate for Asphaltic Concrete

- (a) Crushed granular aggregate for asphaltic concrete shall be composed of hard, durable, crushed gravel free from shale, clay, silt, loose coatings, and other deleterious materials.
- (b) The gradation of aggregates, when blended to meet the job mix formula shall be within the limits shown in **TABLE G-14** when tested to ASTM C 136 and C 117, using the designated sieve sizes, and to have a smooth curve without sharp breaks when plotted on a semi log grading chart.

<b>TABLE G-14-GRADATION OF CRUSHED GRANULAR AGGREGATE FOR ASPHALTIC CONCRETE</b>			
<b>USBC Sieve Size</b>	<b>Arterial, Industrial and Collector Streets</b>		<b>Residential, Lanes, walkways</b>
	<b>Percent Passing by Weight</b>		<b>Percent Passing by Weight</b>
	<b>Lower Course</b>	<b>Surface Course</b>	
25 mm (1")	100		
19 mm (3/4")	85 - 100	100	
12.5 mm (1/2")	65 - 85	85 - 95	100
9.5 mm (3/8")		70 - 85	70 - 90
4.75mm (#4)	40 - 65	50 - 70	45 - 80
2.36mm (#8)		38 - 55	32 - 64
1.18mm (#16)	20 - 38	28 - 44	24 - 51
0.600mm(#30)		20 - 34	17 - 40
0.300mm(#50)	10 - 20	12 - 26	13 - 29
0.150mm(#100)	8 - 15	8 - 16	7 - 18
0.075mm(#200)	3 - 8	3 - 7	3 - 8

- (c) A minimum of 60% of the material retained on 4.75 mm to 25 mm sieve shall have at least two freshly fractured faces as determined by particle count.

#### G.27.6 Spreading and Compaction of Granular Aggregate

- (a) Granular aggregate shall be placed in maximum 150 mm lifts and shall be spread in an approved manner such that the aggregate is neither segregated nor contaminated with foreign material. Segregated materials shall be remixed until uniform. Immediately following spreading, granular aggregate shall be compacted to 100% Standard Proctor density. The finished surfaces shall be within +/- 15 mm of the design grade and cross section.

- (b) The tolerance limits are in relation to the design aggregate gradation submitted with the Marshall mix design. Aggregate short of material passing the 0.075 mm sieve shall have approved mineral filler added. Mineral filler shall be material passing the 0.075 mm sieve and shall be non-plastic when tested in accordance with ASTM D424. The moisture content of the aggregate after leaving the drier and before mixing shall be not more than 0.5% by weight.

TABLE G-15-TOLERANCE LIMITS	
Max Size	Percent Passing by Weight
4.75 mm	5.0%
2.36 mm	4.0%
1.18 mm	4.0%
0.600 mm	3.0%
0.300 mm	3.0%
0.150 mm	2.0%
0.075 mm	1.5%

**G.27.7 Placing and Compacting Asphaltic Concrete**

- (a) A self-propelled mechanical paver shall be used to spread the mixture. Compaction shall commence immediately. Compaction methods shall be carried out as specified in the Asphalt Paving Manual published by the Asphalt Institute and the MMCD

**G.27.8 Asphalt primer shall be:**

- (a) Anionic emulsified asphalt, slow setting (SS 1) and shall be diluted with clean water at two (2) parts emulsion to one (1) part water for application, and thoroughly mixed by pumping. The diluted asphalt emulsion shall be applied at a rate of 2 litres per square metre, or as approved by the **District Engineer**. The prepared granular base shall be clean and free of "float" prior to application of prime. Allow prime to absorb and cure for 24 hours prior to paving, unless otherwise approved by the **District Engineer**. Traffic shall not be permitted onto primed areas. Or;
- (b) Cutback Asphalt Primer RM20 meeting the requirements, and to application rates, stipulated in the Standard Specifications for Highway Construction (latest edition) of the Province of British Columbia Ministry of Transportation and Infrastructure.

**G.27.9 Tack coat:**

- (a) Bituminous tack coat shall be undiluted SS 1H or SS 1 asphalt emulsion and shall be applied at a rate not greater than 0.5 litres per square metre to a clean pavement surface, and provide for adequate curing time prior to placing asphalt paving mixtures. The temperature of the material shall be maintained between 30°C and 40°C at the time of application.

## G.27.10 Asphaltic cement:

- (a) shall be homogenous, free from water, shall not foam when heated to 175 °C, and meet the requirement of TABLE G-16.

TABLE G-16-ASPHALTIC CEMENT		
REQUIREMENTS	MIN.	MAX.
Viscosity @ 60° (Pa/s)	65	
Min. Penetration @ 25°C	80	
% Ret. Pen. after T.F.O.T. @ 25°C - 100 g/5 s	55	
Solubility in Trichloroethylene (%)	99.0	
Flash Point, C.O.C. minimum (°C)	235	
Ductility at 25°C, 5 cm/min.cm	100	
Water (%)		0.5

## G.27.11 Asphaltic concrete:

- (a) shall conform to **TABLE G-17**
- (b) The **Owner** shall supply the **District Engineer** with a current 5-point Marshall mix design, performed in accordance with ASTM D 1559, under the signature of a geotechnical **Engineer**. The design asphalt content shall be specified to comply with the requirements of this section.
- (c) The asphalt content of hot mix asphalt which is produced in accordance with the approved Marshall design shall be maintained within plus or minus 0.3% of the approved design asphalt content.

TABLE G-17-ASPHALTIC CONCRETE			
Property	Arterial & Collector Streets		Residential
	Lower Course	Surface Course	Surface Course
Marshall blows per face	75	75	50
Marshall Stability @ 60°C (kN)	8 min.	8 min.	5.5 min.
Marshall Flow (0.25 mm units)	8 – 14	8 - 14	8 - 15
Voids in Mineral Aggregate (%)	13.0 – 16.5	14.0 - 17.0	14.0 - 17.5
Air Voids in Mixture (%)			
- at design A.C.	4.0 + 0.2 3 - 5	4.0 + 0.2 3 - 5	3.5 + 0.3 3 - 5
- Allowable production range			
Index of Retained Stability after water immersion for 24 hours @ 60°C	80% min.	80% min.	80% min.

- (d) Density of Completed Asphaltic Concrete Pavement
- (i) The minimum allowable density of the completed pavement shall be not less than 97% of the laboratory compacted Marshall Density.
- (ii) Flaws in the pavement surface shall be corrected by removal of the complete area and the full lift involved. Pavement which is unsatisfactory in the opinion of the **District Engineer** by reason of faulty materials or methods of placement shall be **repaired**, to the original condition or better, removed, replaced, or otherwise corrected.



- (e) Asphaltic concrete shall be constructed in lifts of compacted thickness as per TABLE G-18:

TABLE G-18-ASPHALTIC CONCRETE CONSTRUCTION		
Course	Permissible Compacted Lift Thickness (mm)	
	Minimum	Maximum
Lower Course	50	100
Surface Course	40	75

## G.28 Testing

- G.28.1 The **Owner** shall retain an independent materials testing firm to carry out comprehensive testing to frequencies defined below, for each stage of construction of **roads** and streets. The materials testing firm must employ a full time, qualified Engineer within the office from which the testing services are provided. He shall review all test data and provide to the **District**, on a daily basis and in summary form at the completion of each stage of the **work**, test data at the following minimum frequencies:
- (a) For subgrade construction:
    - (i) Moisture density relationship (Standard Proctor) – ASTM D698; - one test for each soil type incorporated into the subgrade.
    - (ii) Moisture and density test
    - (iii) Subgrade construction and preparation three tests per 150 lineal metres of **road** per lift, to include dry density and moisture content.
  - (b) For trench backfill
    - (i) one test per lift per 50 lineal metres of trench and one test per lift around manholes, valves, catch basins, etc.
  - (c) For sub base and base course construction (including subgrade enhancement using sub-base material):
    - (i) Gradation analysis - one test per 500 m<sup>3</sup> or 1100 tonnes of material delivered to the site with a minimum of 1 test per day of placement.
    - (ii) Moisture density relationship (Standard Proctor) ASTM D698; one test per class of material for each 5000 m<sup>3</sup>, or 11000 tonnes delivered to site.
    - (iii) Compaction testing three tests per 150 lineal metres of **road** per lift, to include dry density and moisture content.
  - (d) For hot mix asphalt pavement production and placement:
    - (i) Asphalt content and gradation of extracted aggregate - one test per production period, where a production period is defined as that part of the working day either before or after 12:00 Noon local time. In a full working day, the times of test shall be not less than two hours apart.
    - (ii) Marshall Analysis of hot mix asphalt - one per work week per mix type; additional tests shall be performed when any of the specified Marshall properties are not met in the initial analysis.
    - (iii) Asphalt cement tests one complete analysis per project or one every two work weeks, whichever is the lesser in timing; plus one penetration (ASTM D5) test per work week from product obtained from the **contractor's** asphalt cement storage tanks.
    - (iv) Density, air voids and pavement thickness tests 3 cores (100 mm dia.) per 1500 m<sup>2</sup> of paved area per lift, with a minimum of 3 cores for each production day. Air void tests shall be performed in accordance with ASTM D3203.
    - (v) Tests on prime and tack coat products - one test per product per project.



G.28.2 The **District** shall be provided with copies of all compaction test results pertaining to subgrade, granular base and pavement structure.

## G.29 Notification

G.29.1 Prior to undertaking **roadworks**, adequate notice shall be given to the **District Engineer** by the **Owner** in accordance with TABLE G-19. The **Owner** shall not proceed from one stage to another stage without the approval of the **District Engineer**.

TABLE G-19-CONSTRUCTION NOTIFICATION REQUIREMENTS	
Stage	Minimum Notice Required
Prior to construction of fills or doing subgrade preparation	24 hours
Prior to placement of sub-base materials	24 hours
Prior to placement of concrete for curbs and <b>sidewalks</b>	48 hours
Prior to placement of base course (19 mm crushed gravel)	24 hours
Prior to paving	48 hours
Prior to top soiling <b>boulevards</b>	24 hours

## G.30 Testing Frequency and Procedures

### G.30.1 Aggregate Gradation and Asphalt Cement Content

One test per production period as defined in G.33.1 Asphalt content shall be determined in accordance with ASTM D2172 or D6307. Gradation analysis of extracted aggregate shall be performed in accordance with ASTM C136 and C117.

### G.30.2 Thickness

- The actual pavement thickness, for each unit of **work** area, will be determined on the basis of the average thickness of three (3) cores. The cores shall be spaced at intervals of 150 m of paved **lane** width or less. If the deficiency of any individual core exceeds 10 mm, three (3) additional cores may be extracted in proximity to the location of the core of excessive deficiency, to identify the extremities of the pavement area to be removed and replaced. The **Owner** will initiate and pay for such additional coring.
- A unit of **work** area is defined as  $1,500 \text{ m}^2$  or fraction thereof, representing pavement placed in an individual placement day.
- Sampling and testing for thickness determination shall be in accordance with ASTM D3549.

### G.30.3 Density

- Density of compacted pavement shall be determined on the basis of tests on core samples taken at a maximum interval of 150 m of paved **lane** width. A test area shall be that area lying between longitudinal joints and between transverse lines located midway between test cores or between such transverse lines and the beginning or end of placement.
- With prior approval of the **District Engineer**, the in-situ density of a compacted layer of pavement may also be determined by nuclear methods in accordance with ASTM D 2950. Spacing of tests shall be as stated above, and tests shall be taken in the vicinity of the core samples extracted for testing of the thickness of the pavement layer. In a situation where the in-situ density of the lift does not meet specification, according to D 2950, then the density of the extracted cores shall be determined and will take precedent over the in-situ density. Where the specified compaction has not been met, as confirmed by the direct measurement of

the core, then an additional three cores shall be taken in the immediate area and the average of the three cores shall be used.

### G.31 Non-Compliance with Specifications

#### G.31.1 General

G.31.2 If the **Owner** fails to ensure that his **contractor** complies with the paving and construction specifications as set out in this Bylaw, the following shall apply. Any penalty for deficiencies will be in the form of a reduction in the amount of security for **works** returned to the **Owner**.

#### G.31.3 Hot Mix Asphalt Concrete

- (a) A Marshall analysis will be performed from a sample obtained at the paving site on a frequency of one analysis per day, with at least one analysis required per project or 700 tonnes of asphalt.
- (b) When analysis identifies non-conformance with specified properties, remedial measures must be immediately initiated. Evidence that compliance exists with the approved mix design must be provided. Failure to do so must result in suspension of paving operations.

#### G.31.4 Aggregate Gradation

- (a) When the aggregate fails to comply with tolerances set forth in this Bylaw, the **Owner's Engineer** will initiate the following action:
- (b) When two (2) consecutive gradation analyses identify non-compliance with the specified tolerances, the **contractor** must be served notice and a third test will be initiated.
- (c) If continued non-compliance is indicated from the third test, the **Contractor/Owner** must suspend production. It must not commence construction again until it has demonstrated that corrective action has been taken and that the aggregate gradation is within the specified tolerance limits.

#### G.31.5 Asphalt Cement

TABLE G-20 -PAYMENT ADJUSTMENT FOR NON-COMPLIANCE WITH TOLERANCE	
Asphalt Content Deviation from Design %	Payment Adjustment Factor
0.30 OR LESS	0.00
0.31 TO 0.40	0.20
0.41 TO 0.50	0.75
0.50 OR GREATER	Remove and replace

G.31.6 Penalty will be applied for asphalt cement content non-compliance where the amount of penalty for Hot Mix Asphalt Paving equals the unit bid price times the payment adjustment factor times the quantity to which the factor is to be applied, i.e.:

$$A_c = P (F_c) (Q_n)$$

where:

$A_c$  = Adjustment for asphalt cement content non-compliance

$P$  = Unit bid price

$F_c$  = Payment adjustment factor for Asphalt Cement Content non-compliance

$Q_n$  = Asphalt measured for payment which was produced during the production period to which a test applies

### G.32 Penalty for Non-Compliance

## G.32.1 Pavement Thickness

- (a) Pavement of any type found to be deficient in thickness by more than 10 mm must be removed and replaced by pavement, of specified thickness, at the **Owner's** expense.
- (b) Pavement of any type found to be deficient by less than 10 percent of its specified compacted thickness will not be subject to payment adjustment for thickness non-compliance.
- (c) Pavement of any type found to be deficient in thickness by more than 10 percent of its specified thickness but not more than 10 mm shall give rise to an adjustment in the amount of penalty. The penalty shall be calculated as follows:

$$A_t = \frac{T_d}{T_s} \times P \times Q_t$$

Where:

$A_t$  = Adjustment for thickness deficiency

$T_d$  = Deficiency in thickness measured in mm and being greater than 10% of specified thickness but not greater than 10 mm.

$T_s$  = Specified thickness in mm.

$Q_t$  = Asphalt measured for payment lying within a unit of **work** area defined in G.39.2 (b) where the thickness deficiency has been identified.

$P$  = Unit Bid Price.

NOTE: No allowance will be made for the tolerance provided for in G.36.2

- (d) The adjusted price will be applied to all asphalt measured for payment which lies within a unit of **work** area defined in G.39.2 (b) where the thickness deficiency had been identified, or to such lesser area as may be defined in accordance with the provisions G.39.2(b).

## G.32.2 Density

- (a) The minimum specified density for acceptance, without penalty adjustment, must be 97% of the 75 blow Marshall density as most recently determined by the appointed testing agency.

**TABLE G-21-PAYMENT ADJUSTMENT FOR DENSITY NON-COMPLIANCE**

Density (% of 75 blow Marshall)	Payment adjustment factor
97 and greater	0.0
95.0 to 96.9	As per Density Payment Adjustment Factor Chart (see Standard Drawing)
Less than 95.0	No payment (subject to removal and replacement after review by the Engineer)

(b) Adjustment for density specification non-compliance shall be determined as follows:

$$AD = P (FD) (QnD)$$

where:

AD = Adjustment for density non-compliance

P = Unit Bid Price for Hot Mix Asphalt Cement paving

FD = Payment Adjustment Factor for density non-compliance

QnD = Asphalt measured for payment within a unit of test area as defined in G.39.3.

#### G.32.3 Adjusted Payments

(a) The total penalty arising from pavement deficiencies identified in the foregoing shall be determined as follows:

$$Ar = Ac + At + AD$$

where:

Ar = Total Adjustment

Ac = Adjustment for asphalt cement content non-compliance

At = Adjustment for thickness deficiency

AD = Adjustment for density non-compliance

The total adjustment ( $A_r$ ) shall be paid by the **Owner** to the **District** and may be withheld by the **District** from any securities held for the **subdivision or development**.

## **SCHEDULE H DESIGN AND CONSTRUCTION OF SIDEWALKS, CURBS, GUTTERS, BOULEVARDS AND LANDSCAPING**

### **H.1 General**

H.1.1 All curbs, **sidewalks**, gutter, **boulevard**, and landscaping must be designed and constructed in accordance with this Bylaw.

H.1.2 The minimum width of sidewalks shall be 1.5 metres. The **District Engineer** may in his sole discretion, direct that a sidewalk width be increased.

H.1.3 The location of **sidewalks** shall be as follows:

- (a) **Arterial highways - sidewalks** are required on both sides of **highway**;
- (b) **Collector highways - sidewalks** are required on one side of **highway** as directed by the **District Engineer**;
- (c) **Local highways - sidewalks** are required on one side of the **highway**, where the **highway** will be used to provide the public with safe and efficient access to educational facilities, government facilities, parks, recreation sites, hiking trails, pedestrian corridors, shopping centers, entertainment centers, health institutions, religious institutions, or where identified as per Standard Drawings for the **road** class. The location shall be as directed by the **District Engineer**.

H.1.4 In accordance with **District** Bylaws and policies, upon completion of **highway**, curb, gutter, and **sidewalk** construction, **boulevards** must be shaped and graded to match and blend with surrounding areas.

H.1.5 Trees, shrubs, dry land grass as well as turf or mulch complete with irrigation must be in accordance with Schedule C-1 and **District** irrigation standards.

H.1.6 In areas of rural cross sections without curb, gutter, or **sidewalk**; **boulevards** must be shaped and graded to match and blend with surrounding areas seeded with coarse grasses (Okanagan Dryland Grass Mix).

### **H.2 Driveway Access**

H.2.1 Maximum slope on a driveway access must be in accordance with the Highway Access and Driveway Regulation Bylaw.

### **H.3 Wheelchair Ramps**

H.3.1 Wheelchair ramps must be provided at all intersections on **roadways** that are being provided with **sidewalks** and constructed in accordance with Standard Drawings.

### **H.4 Barrier Curb Crossing**

H.4.1 Barrier Curb Crossings must be provided at all access locations and must be constructed in accordance with Standard Drawings.

## H.5 Landscaping

### H.5.1 Landscape Plan Requirements:

For landscape Works that will be owned and maintained by the District, a Qualified Professional with expertise in landscaping, engaged by the Owner, is required to submit landscape drawings for review by the District.

The following information shall be shown on the Landscape Drawings:

- (a) property lines and easements.
- (b) buildings, edge of pavement, curb lines and curbs, sidewalks, lighting fixture locations, surface utilities and related service boxes or other elements that would affect the landscape and street tree location.
- (c) Location of all existing vegetation to remain.
- (d) Location of retaining walls and existing or proposed slopes that exceed 3:1 vertical.
- (e) Location of all proposed trees, shrubs, ground cover and lawn areas.
- (f) Indication of which areas will be seeded grass vs sodded lawn.
- (g) Plant list showing botanical name, common name, size at planting, quantity, typical spacing, and root zone volume of supplied growing medium for trees.
- (h) Landscape features, if applicable.
- (i) Type of mulch and application depth.
- (j) Growing medium depths for each planting type.

### H.5.2 Boulevard Landscaping:

Unless specified otherwise, boulevards shall be vegetated with sodded lawn or densely planted groundcover. Rough grass and/or wildflower seeding may be used on boulevards and side slopes that are visually backing onto natural or rural areas, or for temporary boulevard treatments, subject to the approval of the District Engineer.

- (a) For the boulevards of arterial and collector roads within the Town Centre DP area, the treatment shall be as per the streetscape improvement plan for that area.
- (b) For boulevards adjacent to commercial property and locations outside the Town Centre DP area, or where no plan is in place, subject to development permit requirements, the boulevard treatment shall generally be turf or hard-surfaced, and shall include street trees and irrigation, serviced and maintained by the **Owner** of the parcel with the boulevard frontage. Acceptable surface materials for the boulevard include:
  - I. unit pavers
  - II. exposed aggregate concrete;
  - III. stamped and coloured concrete;
  - IV. irrigated turf; or
  - V. xeriscape or dryland landscaping
- (c) For boulevards where the land use of the adjacent property is industrial, institutional or multi-family the boulevard treatment shall generally be street trees and turf or xeriscape landscaping, serviced and maintained by the **Owner** of the parcel with the boulevard frontage.
- (d) For boulevards where the land use of the adjacent property is one, two or four-family residential, and where the boulevard is accessible for maintenance mowing and watering from the adjacent property, the boulevard treatment shall generally be street trees and turf or xeriscape landscaping, serviced and maintained by the Owner of the parcel with the boulevard frontage.
- (e) For boulevards where it is unlikely that the adjacent property owner will be able to adequately maintain the boulevard due to geographical constraints, the **District** may accept ownership and maintenance of the boulevard, subject to the approval of the **District Engineer**.

**H.5.3 Median and Roundabout Landscaping:**

- (a) Landscaped medians are generally discouraged within arterial or collector roads due to difficulty of service and maintenance.
- (b) In locations approved by the **District Engineer**, medians shall be vegetated with sodded lawn or densely planted groundcover and irrigated street trees.
- (c) The landscaping of roundabouts and cul-de-sac islands shall have a hard surface material or landscaping with low shrubs or groundcovers at the discretion of the **District Engineer**, and should feature:
  - (i) a single specimen tree;
  - (ii) a group of like trees; or
  - (iii) public art if the roundabout or cul-de-sac is in the Town Centre area. The selection, design and placement of public art shall be made in cooperation with the Public Art Advisory Commission.

**H.5.4 Utilities Coordination:**

- (a) Placement of landscape features shall be coordinated with the location of underground utilities and shall be, as much as is practical, aligned and buried to provide a continuous 1.0m deep utility-free trench beneath tree planting locations.
- (b) Planting and paving design shall be co-coordinated with the design and construction of surface utility boxes, such that boxes fall entirely within either a paved surface or entirely within a planted surface but not partly in paving and partly in planting and that grades and alignment of boxes match the final design and construction of all elements to create a co-coordinated and orderly appearance, free of trips and hazards.

**H.5.5 Plant Materials:**

- (a) Plants shall have the ability to withstand adverse conditions such as airborne pollutants, maximum sun exposure and reflected heat from pavements, high winds and abrasive forces, occasional snow loading and exposure to salt from road clearing operations, and limited root zone soil volumes.
- (b) Plant hardiness requirements vary by elevation. Plants shall be hardy to Canadian Plant Hardiness Zone 5A to 1A as site conditions dictate.
- (c) Plants shall be capable of reduced water demand following a one-year establishment period.
- (d) Plants shall have relatively low maintenance attributes including: fine to medium leaf size and canopy density; non-fruit bearing or having only berry-sized non-staining and non-toxic fruits; low susceptibility to disfiguring or fatal diseases and infestations; infrequent demands for pruning, fertilizing and other cultural requirements.
- (e) Plants shall be of appropriate size and form at maturity to meet criteria listed in this bylaw.

**H.5.6 Tree Planting:**

- (a) Street Tree plantings shall be required on streets and **highways** in all subdivisions where new roads (including culs-de-sac) or road extensions are required.
- (b) Minimum number of boulevard trees shall be calculated as follows:
  - (i) Medium trees ( $\pm$  10 - 20m ht. at maturity) greater of 1 per lot or 15m.
  - (ii) Small trees (Under 10m ht. at maturity) greater of 1 per lot or 10m.
  - (iii) Plantings of trees closer than 6m on centre shall require the written concurrence of the District Engineer.

- (iv) Locate trees fronting on single family lots in locations that avoid all utility service alignments and driveways. Generally, this will lead to tree placement in the half of the lot frontage away from the driveway side, and not at either the lot centerline or at a lot line.
- (c) Boulevard or 'street' trees shall be of a single species/cultivar on either side of the street within a given block. Centre median tree species may vary.
- (d) Street tree species shall vary between intersecting streets. Street tree selection will be made with consideration of maintaining a diverse and varied street tree distribution across a neighbourhood to minimize disease risks.
- (e) All street trees shall have:
  - (i) A compact or upward branching structure.
  - (ii) Ability to withstand pruning for pedestrian, vehicle and/or building clearance without compromise to tree health or form.
  - (iii) Absence of species/variatal characteristics of structural weakness, susceptibility to wind damage, or thin, easily damaged bark.
- (f) Trees shall be minimum 5 cm caliper measured at 300mm above the root ball at the time of planting, and of uniform size if planted in a boulevard row.
- (g) Tree branch clearance requirements are 5m over the traveled portion of road and 2.25m over the sidewalk.
- (h) Trees directly under electrical power lines must meet the following selection and soil volume requirements:
  - i. Minimum allowable soil volume per tree is 4 cu.m. with 1m depth pit.
  - ii. Mature height not greater than 7.5m.
- (i) Trees beside hydro lines must meet the following selection and soil volume requirements:
  - i. Minimum lateral distance from nearest line 2.75m.
  - ii. Minimum allowable soil volume per tree is 4 cu.m. with 1m depth pit.
  - iii. Mature spread not greater than 5m.
- (j) Trees with limited available soil volume must meet the following selection and soil volume requirements:
  - i. Minimum allowable soil volume per tree is 4 cu.m. with 1m depth pit.
  - ii. Mature height not greater than 10m.
- (k) Trees for available soil volumes of 9 cu. m. or greater must meet the following selection and soil volume requirements:
  - i. 1m pit depth
  - ii. Mature height not greater than 20m.
- (l) Trees for a wide boulevard or wide median use only must meet the following selection and soil volume requirements:
  - i. Minimum available root zone of 20 cu. m. per tree
  - ii. Minimum boulevard or median width of 3.5m
- (m) Minimum setbacks for trees to objects in new developments shall be as follows:
 

Underground streetlight conduit or irrigation main	0.6m
Other underground utilities	3.0m
Lamp standards	6.0m
Steel and wooden utility poles	3.0m
Driveways	1.5m
Catch basins	1.5m
Manholes, valve boxes, services	3.0m
Sewer service boxes	3.0m
Fire hydrants	2.0m
Road intersection	7.0m
Curb face (see SS-L3 for Root Barriers required)	0.5m



Sidewalk	0.85m
Curb face and sidewalk with root barrier	0.60m
Buildings - fastigate (columnar) tree	2.0m
Buildings - regular crown tree	3.0-5.0m

The District Engineer may consider custom setbacks where trees are being installed in existing streets with established utilities.

- (n) Lawns/Fine Grass, Rough Grass and Wildflowers:  
Sod shall be used on all lawn/fine grass areas. Seeding, as an alternate, shall require approval of the **District Engineer**.
- (o) Rough grass and wildflower areas shall be seeded. Seeding method shall be noted on drawings.
- (p) Areas to be seeded with grades greater than 3:1 and/or highly erodible soils shall be hydroseeded with a nurse crop seed mix, a hydraulically applied erosion control mulch, or erosion control blanket. Erosion control method to be noted on drawings.

#### H.5.7 Landscape Maintenance

- (a) All landscaping must be actively maintained by the **Owner** for the entire Landscape Maintenance Period as described below. The Landscape Maintenance Period for landscape establishment shall be one year from the date of **Substantial Performance** of the landscape components of the work. All landscape areas shall be provided establishment maintenance which shall include irrigation maintenance and watering, mowing, weeding, pruning and supplemental fertilization until the end of the Landscape Maintenance Period. The Landscape Maintenance Period shall continue until a Certificate of **Total Performance** of all Landscape **Works** is issued by the **District** upon the expiration of the Landscape Maintenance Period.
- (b) The Owner's qualified professional shall submit a maintenance schedule with the **Certificate of Substantial Performance**. It shall include timing and arrangements for:
  - i. Routine inspection
  - ii. Aerating and dethatching turf areas
  - iii. Replenishing mulch
  - iv. Fertilizing
  - v. Pruning
  - vi. Weeding
- (c) is encouraged to implement sustainable or environmentally-friendly practices for overall landscape maintenance.

### H.6 Irrigation

#### H.6.1 Irrigation Plan Requirements

- (a) For irrigation **Works** that will be owned and maintained by the **District**, a Qualified Professional with expertise in landscaping, engaged by the **Owner**, is required to submit landscape drawings for review by the **District**.  
The following information shall be shown on the Irrigation Drawings:
  - i. property lines and easements
  - ii. buildings, edge of pavement, curb lines and curbs, sidewalks, lighting fixture locations, surface utilities and related service boxes or other elements that would affect the irrigation system.
  - iii. Location of all existing vegetation to remain.
  - iv. Location of retaining walls and slopes that exceed 3:1 vertical.

- v. Designate the areas irrigated by each valve (irrigation zones) and assign a number to each valve.
- vi. Clearly identify any 'temporary zones': those zones which are intended to operate for less than a two (2) year grow in period.
- vii. Schematic layout showing all points of connection, backflow prevention, water meters, electrical supply and meters, winterization facilities, timeclocks, heads, valves, piping, sleeves, sensors and other elements critical to construction and maintenance of the irrigation system.
- viii. Irrigation legend describing brand, model and size of timeclocks, heads, valves, piping, sleeves, sensors and all other elements shown on the irrigation plan.

#### H.6.2 General Irrigation Requirements

- (a) A complete and working automatic irrigation system shall be provided for all landscaped areas within a **highway** boulevard, median or roundabout. Temporary watering provisions
- (b) shall also be made for planted areas of a 'non-irrigated' variety – to allow for watering through a maximum 1-year establishment period or in severe drought.
- (c) Urban trees in pavement shall be irrigated with an automatic irrigation system that may include bubblers or drip elements.
- (d) Sleeves shall be provided under sidewalks and driveways, and to medians / islands, as required for installation and maintenance of the irrigation system without removing surface paving.
- (e) Provide a flow sensor and master valve, both connected to the controller, that will stop flow to the system or irrigation circuit in cases of an irrigation water leak. Provide an isolation gate valve upstream of all automatic sprinkler valves.
- (f) Design to water plant materials with different watering requirements (e.g. grass vs. shrub areas and high vs medium vs low water use shrub areas) on different valve circuits.
- (g) Where surface sprinklers are used, ensure unobstructed sprinkler coverage to tree bases from at least two sides.
- (h) Every drip system shall be designed with a filter, pressure regulator, flush valve and air relief valve. The drip component manufacturer's instructions for installation and maintenance shall be included in the project specifications.
- (i) The irrigation system shall perform to within 15% of the targeted application efficiency standards for irrigation systems, as determined by the Irrigation Association and the Irrigation Industry Association of British Columbia, as follows:
  - i. Spray Zones: 75% or higher;
  - ii. Rotor Zones: 80% or higher;
  - iii. Microjet Irrigation Zones: 85% or higher.
  - iv. Drip Irrigation Zones: 90% or higher.
- (j) Sprays and rotors shall be designed with head to head coverage to meet the application efficiency standards.
- (k) It is the responsibility of the Certified Irrigation Designer to identify to the **Owner** and to the **District** any landscape impediments, existing or planned, that will impede reaching the targeted efficiencies. At the discretion of the **District**, irrigation system design audits may be performed to ensure design efficiency has been met.
- (l) The irrigation system shall be designed with minimal pressure losses where possible. Pressure losses between any two sprinklers on the same zone shall be less than 10%.
- (m) Pipes shall be sized to allow for a maximum flow of 1.5m/sec.
- (n) The irrigation system shall be sized and designed to 80% of point of connection available flow and pressure; allowing for 20% growth of system or 20% reduction in operating pressure while retaining targeted operational efficiencies.
- (o) Locate point of connection or pedestal to meet the following requirements:

- i. No pedestal or point of connection locations will be permitted with medians without the explicit written consent of the **District**.
  - ii. No pedestal location shall be subject to application of irrigation watering.
  - iii. No point of connections shall be placed within a sidewalk without the explicit written consent of the **District**.
- (p) The irrigation design shall include voltage loss calculations to the electrical control valve furthest from the controller. The drawings are to include:
  - i. A chart comparing the actual voltage drop to the allowable voltage drop on common and zone signal wires;
  - ii. Voltage loss shall not exceed the maximum voltage loss as specified by the manufacturer of the irrigation controller;
  - iii. Indicate wire locations, wire gauge required, spare wires and necessary splice box locations on the Contract Drawing.
  - iv. Install one spare control wire for every five (5) electric control valves connected to the controller;
- (q) Install one spare common wire for every ten (10) electric control valves connected to the controller.
- (r) Irrigation sleeves shall be installed to route irrigation lines under hard surfaces and features. Non-metallic CSA approved electrical conduit shall be installed adjacent to irrigation sleeves.
- (s) Electric control valves used in the design of the irrigation system are to remain consistent in size and manufacturer, where possible. Renovations or additions to the irrigation system shall use the same manufacturer, model and size that exist on site. It is permissible to use an electric control valve from a different manufacturer for specialized applications. In general:
  - i. Electric control valves must be sized to the design flow;
  - ii. Drip and micro irrigation zones must include filtration and pressure regulation to manufacturers' specifications. Drip and micro zones must have an isolation valve prior to zone valve for maintenance of filtration.
  - iii. Unless it has deemed not possible, valves are to be located on the periphery of green spaces and where available, within planting beds.
  - iv. Design approval will be required to insert valve locations within hardscape surfaces.
- (t) Sprinklers specified for the irrigation system are to remain consistent in size, nozzling and manufacturer. Modifications or additions to the existing irrigation system shall use the same manufacturer, model and size that exist on site. Sprinkler choice is based upon:
  - i. Available operating pressure at the base of the sprinkler;
  - ii. Desired radius;
  - iii. Type of landscape/plant material to be irrigated.
  - iv. Preference will be given to sprinklers incorporating pressure compensating devices.
  - v. Preference will be given to sprinklers incorporating check valves to reduce low head drainage.
- (u) Sprinkler arcs, radius and alignment are to be designed and capable of adjustment to minimize overspray onto adjacent surfaces outside of landscape areas.
- (v) Drip line and emitters must incorporate technology to limit root intrusion.

#### H.6.3 Irrigation Service Connections

Except as required otherwise all landscaped areas of a **highway** boulevard, median or roundabout shall be serviced with a metered water service (50mm diameter, and a metered electrical service (120/240 volts, 60 amps minimum). Provision of water and electrical services by the Owner shall include the establishment of service accounts with the utility providers, all necessary permits, testing and certification, and all materials, labour, fees and utility costs necessary to provide the service until the end of the Landscape Maintenance Period.

## SCHEDULE I DESIGN AND CONSTRUCTION OF WATER DISTRIBUTION SYSTEMS

### I.1 General

I.1.1 If a **water distribution system** is required, **subdivision** or **development** must not be approved until:

- (a) the **Owner** provides each **parcel** within the **subdivision** or **development** with a water service connected to a **water distribution system** that is connected by trunk water mains, to an existing **community water system**. All **works** must be installed in accordance with the standards set out in **District** Bylaws and the regulations of the local water authority; and
- (b) the proposed **subdivision** or **development** is included within an established water system boundary which is either extended or established pursuant to the local improvement and local service provisions of the *Local Government Act* or *Community Charter*, as required by the authority having jurisdiction.
- (c) where the **District** does not own or operate the **community water system**, the **Owner** of the **community water system** has provided the **District Engineer** with a Certificate of Public Convenience and Necessity issued by the Comptroller of Water Rights, together with written confirmation from the water utilities **engineer**, that the system meets the requirements of this Bylaw.
- (d) new water mains must be installed and commissioned in accordance with the **District's** "Requirements for New Water Mains" policy.

I.1.2 Where the **District** does not own or operate the **community water system** and the proposed **works** do not meet the design criteria set out in this Bylaw, the **subdivision** or **development** may be approved provided that:

- (a) the **Owner** of the **community water system** has submitted a five-year capital plan prepared by an **engineer**;
- (b) the **Owner** of the **community water system** has complied with the conditions set out in the five-year capital plan; and
- (c) the subject property for the application is located within the boundaries of the capital improvement area as set out in the approved five-year capital plan submitted by the **Owner** of the **community water system**.

### I.2 Capacity of System and Sizing of Water Mains

I.2.1 Water distribution systems must be designed to deliver water in adequate quantities and at adequate pressures for domestic use under peak consumption conditions and fire flows. Mains must be sized to carry whichever is the greater of:

- (a) the peak hourly flow rate, OR;
- (b) the maximum daily flow rate plus the fire flow rate.

I.2.2 Mains must be sized using the Hazen Williams formula with the coefficient "C" equal to 120. The maximum flow velocity for peak hourly demand rate must not exceed 2.0 m/s. For maximum daily flow rate plus the fire flow rate, the maximum flow velocity must not exceed 4.0 m/s.

### I.3 Domestic Demand Criteria

I.3.1 For residential areas, the daily domestic demand criteria for the purposes of designing **water distribution systems** must be as follows:

TABLE I-I-1- DAILY DOMESTIC DEMAND CRITERIA	
Average Daily Flow	= 900 litres/capita/day
Peak Daily Flow	= 1800 litres/capita/day
Peak Hour Flow	= 4000 litres/capita/day

I.3.2 The demand criteria must be selected to suit the particular circumstances as approved by the **District Engineer**. Densities for specific **zones** are indicated in TABLE I-2.

TABLE I-2-COMMUNITY WATER SYSTEM DENSITIES		
	People/Ha.	People/Unit
Single Family	24-30	3
Multi-family Low	85	2
Multi-family Medium	(3 storey) 120	2
Multi-family High	(4-12 storey) 320-960	2
Mobile Home	45	2
Industrial	50	-
Institutional	50	-
Commercial	75	-

### I.4 Fire Demand Criteria

I.4.1 Water distribution systems must be designed to ensure that fire flows as required by the most recent Fire Underwriters Survey are available for required durations. Notwithstanding, the provisions of the Fire Underwriter's Survey, fire flows and shall not be less than:

TABLE I-3- REQUIRED FIRE FLOW	
Zone	Required Fire Flow
Single & Two Dwelling Housing	60 litres/sec
Modular/Mobile Home	60 litres/sec
Three & Four Plex Housing	90 litres/sec
Apartments & Row Housing	150 litres/sec
Commercial	150 litres/sec
Institutional	150 litres/sec
Industrial	225 litres/sec

I.4.2 Notwithstanding the above table, for all **subdivision** or **development**, with due consideration to anticipated building size, the **Owner's Engineer** must provide, detailed design calculations supporting the amount and duration of the design flows prior to final design.

### I.5 Design Pressures

I.5.1 The **water distribution systems** must be designed to provide domestic water at the probable building main floor elevation on each **parcel** as follows:

Maximum static pressure	827 Kpa	120 psi
Minimum static pressure	275 Kpa	40 psi
Minimum residual pressure at peak hour	250 Kpa	36 psi
Minimum residual pressure at fire flow conditions	140 Kpa	20 psi

#### I.5.2 Hydraulic Network Considerations

- (a) Where there is an existing hydraulic network model in place, the **District** will provide information for design calculations.
- (b) Depending on the complexity and extent of the proposed **water distribution system**, the **District** may elect to carry out a hydraulic analysis showing minimum design flows and pressures. The **Owner** will be required to pay for this analysis.
- (c) The maximum length of any permanent, non-interconnected water main must be less than 150 m. All mains exceeding 150 m, unless it is a temporary situation, must be looped.
- (d) Where the water system network is deficient, installation of supplementary mains may be required and may necessitate the provision of rights of way in favour of the **District** or the agency having jurisdiction.
- (e) The minimum pipe size for all water mains shall be 200 mm diameter. The **District Engineer** may require water mains larger than 200 mm diameter if on a distribution or transmission route. The minimum water main size for commercial or industrial areas shall be 200 mm.
- (f) In residential areas, fire hydrant leads must be 150 mm diameter minimum. Water mains 100 mm in diameter may be permitted for domestic service on dead-end **roads** where no further extension is planned. Wherever practical, water mains must be looped. Dead-end mains must not be promoted.

#### I.6 Location and Grade of Water Mains

- I.6.1 Water mains must be located in the **road** right of way as shown on Standard Drawing. (e.g. Statutory right of way).
- I.6.2 A minimum horizontal clearance of 1 meter between a water main and underground utilities must be provided, except for sanitary and storm sewer mains.
- I.6.3 A minimum three-meter clear horizontal distance between a water main and a sanitary or storm sewer main must be maintained.
- I.6.4 In special cases such as installations in rock or hardpan and subject to any provincial regulations, the horizontal clearance may be reduced with the approval of the **District Engineer** and the Interior Health Authority, provided the invert of the water main is a minimum of 450 mm above the crown of the sanitary sewer. On side hill streets the water main must be located on the cut side of the centre line of the street.
- I.6.5 Water mains must be designed to follow a straight alignment between intersections and at grades parallel to the **road** centerline unless otherwise approved by the **District Engineer**.
- I.6.6 Curved alignments may be accepted provided the pipe alignment is at a parallel offset to an established boundary. In no case shall the radius of curvature be less than 300 times the outside diameter of the pipe barrel. The design drawings must indicate the method for achieving the curvature. In no case shall curvature be established in PVC pipelines using joint deflection.
- I.6.7 Water mains must be designed at grades that minimize high points in the main. Where a high point is unavoidable, a hydrant, a service, or an air release valve must be installed at the high point as directed by the **District Engineer**.
- I.6.8 Where the slope of the water main exceeds 20%, anchorage is recommended. Slopes 30% or greater require anchorage and trench dams must be incorporated in the design.

I.6.9 Gas main, electric or telephone duct, or other utility lines may only be installed in the same trench with water mains when horizontal and vertical separation is maintained.

I.6.10 Where it is necessary for a water main to cross other underground services, the crossing must be made at an angle greater than 20 degrees and the vertical clearance between services at the crossing point must be not less than 150 mm except for sanitary sewers where clearance must be in accordance with the *Public Health Act*.

I.6.11 Design drawings must indicate whether the water main passes over or under other underground services which it is crossing.

## I.7 Services

I.7.1 The diameter of water services must be approved by the **District Engineer**.

I.7.2 The diameter of water services shall be determined considering **water distribution system** pressures, requirements for sprinklers and building size (fixture counts). In no case shall the diameter be less than 19 mm.

I.7.3 The diameter of water services for **District Parks** shall be as directed by the **District Engineer**, but in no case shall the diameter be less than 25 mm.

I.7.4 Separate water services installed in accordance with Standard Drawings must be provided to each **parcel** and installed on the same side of the **parcel** as the sanitary sewer service.

I.7.5 Tappings shall be made at an angle of  $< 30$  and  $> 10$  degrees above the horizontal centerline **plane** of the pipe.

I.7.6 Curb stops must be located 2.0 meters from the property corner pin. Where such location will conflict with other services, alternate alignments may be submitted for approval.

I.7.7 19 mm diameter service connections may be tapped directly into mains 150 mm diameter and greater. 25 mm diameter service connections may be tapped directly into mains 200 mm diameter and greater, except in the use of PVC water mains where all service connections must be made with double strap service saddles. 40 mm and 50 mm diameter service connections must be made using double strap service saddles. Multiple corporation stops must be staggered.

## I.8 Blow Offs

I.8.1 Blow offs are required at the end of all dead-end water mains and must be constructed and installed in accordance with Standard Drawings.

## I.9 Water Sampling Stations

I.9.1 The **District Engineer** may require water sampling stations to be installed. Water sampling stations shall be Kupferle Foundry Eclipse 88.

## I.10 Air Valves

- I.10.1 The general application of the three types of air valves must be:
- (a) air/vacuum valves for filling or discharging mains and preventing negative pressures,
  - (b) air release valves for small air release during normal operation, and
  - (c) combination valves for combination of air/vacuum and air release valves.
- I.10.2 Air valves are not required on water mains 200 mm diameter and smaller, except as determined by the **Owner's Engineer** or as required by the **District Engineer**.
- I.10.3 Combination air valves must be installed at the summit of all mains 250 mm diameter and larger, except where the difference in grade between the summit and valley is less than 600 mm. Where practical, with approval of the **District Engineer**, fire hydrants may be located to facilitate an air release.

## I.11 Fire Hydrants

- I.11.1 Fire hydrants must be located as specified in the most recent publication of the Fire Underwriter's Survey, "Water Supply for Public Fire Protection".
- I.11.2 Where hydrants are located other than at intersections, they must be located on the projection of the property line dividing two lots. In selecting the location of a hydrant, the probable route of the firefighting equipment must be considered in consultation with the Fire Department.
- I.11.3 A hydrant must not be located within 3 meters of a utility pole, pad mounted transformer, light standard, or any other obstructions.
- I.11.4 Legal access and clearance of 1.3 m must be maintained around the fire hydrant.
- I.11.5 Hydrants must be flow tested with results added to the hydrant service card.
- I.11.6 All hydrants must be painted in a specific colour (team green) and be colour-coded according to the **District Fire Department** standards utilizing the NFPA standard regarding expected flow rates.
- I.11.7 For hydrants located across a rural road ditch, provision for access, including a culvert and frost protection must be provided.
- I.11.8 All hydrants must be bagged until **substantial performance** is achieved.

## I.12 Valving

- I.12.1 Valves must be located as follows:
- (a) In a cluster at the pipe intersection or at the projected property line, when located in an intersection, to avoid conflicts with curbs and **sidewalks**:
    - (i) 3 valves at "X" intersection,
    - (ii) 2 valves at "T" intersection,
    - (iii) or as directed by the **District Engineer** so that specific sections of mains may be isolated.
  - (b) Not more than 200 m apart for single family residential. All other **zones** require special designs.



- (c) Not more than two hydrants are isolated.

I.12.2 Valves must be the same diameter as the main. Gate valves must be used up to and including 300 mm diameter. Gear operated butterfly valves will be allowed in mains larger than 300 mm. Valves must be installed in accordance with Standard Drawings.

### **I.13 Thrust Blocking**

I.13.1 Concrete thrust blocking and/or adequate joint restraining devices must be provided at bends, tees, wyes, reducers, plugs, caps, valves, hydrants and blow-offs.

I.13.2 Thrust blocking and/or adequate joint restraining devices are not required for bends at 5 degrees.

I.13.3 The restraining device system must take into account potential future excavations of the road in the vicinity of the water main.

I.13.4 The engineering calculations for the thrust block design, based on fitting type, water pressure and soil conditions shall be provided to the **District Engineer** if requested.

### **I.14 Reservoirs**

I.14.1 All reservoirs require a pre-design report prior to commencing detailed design.

I.14.2 Reservoirs must be designed to suit particular circumstances.

I.14.3 Reservoir designs must include:

- (a) structures to be below ground and covered unless specifically approved otherwise;
- (b) material must be reinforced concrete designed in accordance with the American Concrete Institute's manual on Environmental Engineering Concrete Structures - ACI 350 R-Current Version;
- (c) 2 cells, each containing one half of total required volume and capable of being isolated and drained and filled independently;
- (d) two lockable access openings in roof for cleaning and maintenance with easy access to any ladders. Minimum dimension to be 1-meter x 1 meter each. Overflow pipe must be visible from the access hatch;
- (e) At all access hatches, a survey mark inlaid inside showing the geodetic elevation is to be provided;
- (f) Access hatch(s) to have the following:
  - (i) Aluminum cover ½" tread plate – 300lb/ft<sup>2</sup>,
  - (ii) perimeter drain,
  - (iii) perimeter sealing gasket,
  - (iv) slam lock with aluminum removable sealing plug and opening tool,
  - (v) flush lift handle,
  - (vi) gas spring assist cylinder,
  - (vii) 90-degree hard open arm;
- (g) ventilation pipes or openings sized to handle appropriate intake and exhausting volumes of air for filling and drawing the reservoir;
- (h) floor to be sloped to the sump;
- (i) sub drain under floor to collect and drain any leakage, connected to overflow pipe;

- (j) interior stainless steel wall ladder from roof access to floor. Any exterior ladders must be vandal proof and prohibit unauthorized access;
- (k) inlet and outlet pipes to be designed to disperse water throughout the reservoir;
- (l) overflow drain to be provided and sized to transmit the maximum reservoir design inflow. The overflow drain must be connected to an acceptable point of discharge; approved by the **District Engineer**;
- (m) All entrance doors must be equipped with electric strike and fob reader system as supplied by Chubb Edwards in accordance with **District** standards;
- (n) A PLC based control system, instrumentation, and process and SCADA telemetry in accordance with **District** standards, including;
  - (i) Continuous level measurement of each reservoir cell
  - (ii) Back up high-level float alarm signals for each reservoir cell;
  - (iii) Intrusion alarming for each hatch;
  - (iv) Intrusion alarming for the reservoir valve chamber;
  - (v) Room temperature monitoring in the valve chamber;
  - (vi) Flood monitoring in the valve chamber;
  - (vii) HMI for local monitoring;
  - (viii) UPS power supply;
  - (ix) Chlorine residual or other analytical monitoring shall be included.

I.14.4 PLC, HMI, and SCADA programming shall be done by the **District's designated integrator**, in accordance with District standards at the Owner's expense.

- (a) equipment and operations manuals;
- (b) security against vandalism and theft;
- (c) landscaping acceptable to the **District** is to be provided including irrigation; and
- (d) a minimum 30 amp, 120 VAC power service

I.14.5 Reservoir capacity must be calculated by the following equation:

Total Storage Requirement = A + B + C

Where: A = Fire Storage

B = Equalization Storage (25% of maximum day demand)

C = Emergency Storage (25% of A + B)

I.14.6 Reservoir capacity must not be less than the greater of the following:

- (a) One day average annual consumption for the service area.
- (b) The sum of the peak hourly demand flow rate sustained for 6 hours plus the fire flow required to meet Fire Underwriters Survey Guidelines for the specified period of time, less the pump station capacity with the largest capacity pump out of service.

I.14.7 Reservoir valve chamber design must incorporate:

- (a) all valves associated with the reservoir;
- (b) sump in valve chamber floor, connected to overflow pipe through a check valve;
- (c) 50 mm valved outlet off supply line within valve chamber for **water supply** for cleaning reservoir; and
- (d) valves must be outside stem and yolk.

## I.15 Pump Stations

I.15.1 Pump stations must be designed to meet maximum daily demands with the largest pump out of service with balanced storage online. If equalization storage is not online, pump station capacity must meet peak hour demand with the largest pump out of service.

I.15.2 Pump station design must assess, and where appropriate incorporate, the following features:

- (a) ability to handle the ultimate flow requirements;
- (b) type of station and impact on neighbours;
- (c) construction dewatering requirements;
- (d) access for construction;
- (e) access for maintenance;
- (f) aesthetics, noise, and landscaping acceptable to the District is to be provided, including irrigation;
- (g) security against vandalism and theft;
- (h) proximity and adequacy of power supply;
- (i) minimizing energy requirements;
- (j) equipment and maintenance requirements (access, lifting equipment, etc.);
- (k) standby power and its compatibility;
- (l) soil suitability for intended purpose;
- (m) convenience of operation and maintenance.
- (n) safety for operators and public; and
- (o) capital, operation, and maintenance costs.

I.15.3 Pump Station design must include:

- (a) A PLC based control system, instrumentation, and process and SCADA telemetry in accordance with District standards, including:
  - (i) Feedback signals from and control signals to each motor starter;
  - (ii) Feedback signals from and control signals to chlorination system (if required);
  - (iii) Lead pump selection, including the option to alternate;
  - (iv) Continuous Suction Pressure monitoring and alarming;
  - (v) Continuous Discharge Pressure monitoring and alarming;
  - (vi) Continuous Flow monitoring and alarming;
  - (vii) Continuous Room Temperature monitoring and alarming;
  - (viii) Flood monitoring;
  - (ix) Intrusion monitoring;
  - (x) All entrance doors must be equipped with electric strike and fob reader system as supplied by Chubb Edwards in accordance with District standards
  - (xi) HMI for local monitoring; and
  - (xii) UPS power supply
- (b) full duplex pump sequencing;
- (c) VFDs or electronic soft starters, with ramping, to minimize starting and stopping surges;
- (d) starters in individual enclosures for each pump motor in accordance with District standards, including:
  - (i) Hand-Off-Auto selectors; Hand-Off-Auto selectors;
  - (ii) ii. Keypads mounted in the starter door for VFD's and Soft Starters;
  - (iii) iii. Hour Meters;
  - (iv) iv. Ammeters (may be part of keypad display);
  - (v) v. Phase Loss Protection; and
  - (vi) vi. Power Factor Correction to meet electrical supply utility requirements.
- (e) low discharge pressure override-start plus alarm;
- (f) low pressure or no flow override-start plus alarm;
- (g) alarms to be both audible and visible;
- (h) control valves to minimize starting and stopping surges;
- (i) duplicate control cables, without splices, between pump stations and reservoirs;

- (j) security against vandalism and theft;
- (k) energy efficient motors;
- (l) hour meters, recording flow meter and recording suction and discharge pressure gauges at each pump;
- (m) flow metering equipment;
- (n) automatic heating, ventilating and dehumidifying systems;
- (o) in-station lighting;
- (p) telemetry alarm system;
- (q) wireless (radio) telemetry between pump station and reservoir;
- (r) drainage to be provided for all areas of pump station;
- (s) chlorine injection requirements, including safety, storage and handling;
- (t) chlorine alert detection;
- (u) chlorine weigh scale;
- (v) electrical phase loss protection;
- (w) electrical drawing schematics for control panel;
- (x) reduced pressure backflow preventer;
- (y) a minimum 347/600V electrical service; and
- (z) pump motors shall operate at 575V, three-phase for motors five horsepower or greater.

I.15.4 For each design submission to the **District**, an extra set of drawings and manuals pertaining to the design of the pump station, key plan, and location plan must be submitted to the **District Engineer**.

I.15.5 PLC, HMI, and SCADA programming shall be done by the **District's designated integrator**, in accordance with District standards at the Owner's expense.

I.15.6 The **Owner** must provide three sealed sets of mechanical shop drawings, three sealed sets of electrical line diagrams, two sealed copies of design calculations for review by the **District Engineer**.

I.15.7 Factory certified pump head/capacity curves must be submitted to the District for review and pumps must not be shipped until the District has reviewed and marked the head/capacity curves as having been reviewed.

I.15.8 The **Owner** must provide two copies of an Operation and Maintenance Manual in a three-ring binder with the name of the facility embossed on the cover, prior to issuance of a **Certificate of Total Performance**. The manual must contain:

- (a) Table of contents;
- (b) Identified, plasticized, labeled section dividers;
- (c) As-constructed shop drawings;
- (d) equipment layout drawings;
- (e) electrical, control, and alarm wiring diagrams;
- (f) operating instructions for all equipment;
- (g) maintenance instructions for all equipment, including frequency of maintenance tasks
- (h) equipment data sheets;
- (i) spare circuit cards for critical components;
- (j) certified head/capacity curves for pumps;
- (k) equipment part lists; and
- (l) emergency operating procedures.

## **I.16 Pressure reducing valve (PRV) Stations**

I.16.1 PRV stations must be designed as above ground facilities in order to avoid “confined space entry” requirements. PRV stations shall be provided with a minimum 30 amp, 120 VAC power service.

(a) PRV station design must include:

- (i) Forced air ventilation, heat and light;
- (ii) External kiosk and antenna;
- (iii) All entrance doors must be equipped with electric strike and fob reader system as supplied by Chubb Edwards in accordance with **District** standards
- (iv) Parallel pressure reducing valves;
- (v) Air release valves;
- (vi) Water quality sample points;
- (vii) Sump drain to storm;
- (viii) Off road vehicle parking;
- (ix) Manuals as per “manual” section;
- (x) landscaping acceptable to the District Engineer; and

(b) A PLC based control system, instrumentation, and process and SCADA telemetry in accordance with **District** standards, including:

- A. Security switches
- B. Discharge and suction pressure transmitters
- C. temperature sensor;
- D. flowmeter;
- E. uninterruptable power supply;
- F. radio or hard wire modem;
- G. external antenna;
- H. operator interface panel.

Where necessary, in the opinion of the **District Engineer**, the criteria of this section may be modified.

## **I.17 Facility Access**

I.17.1 Paved vehicular access with turnaround and parking for up to two vehicles must be provided to all reservoirs and pump stations. The minimum standard shall be shown in the Standard Drawings, for a residential lane with curb, gutter, and drainage provisions to match surrounding neighbourhood.

## **I.18 Waterworks Approved Materials**

I.18.1 Only the materials listed in the approved products list in Schedule E unless otherwise approved by the District Engineer are approved for installation in water systems owned and operated by the **District**.

## SCHEDULE J DESIGN AND CONSTRUCTION OF A WATER SOURCE

### J.1 General

- J.1.1 If Schedule C permits a **water source**, **subdivision** or **development** must not be approved until each **parcel** in the **subdivision** or **development** is provided with its own **water source** located on said **parcel**.
- J.1.2 All **works** must be installed in accordance with the standards set out in this Bylaw and applicable provincial legislation and regulations.
- J.1.3 Notwithstanding J.1.2, if connection to a **community water system** can be achieved without a trunk main extension, the **community water system** must be used as the **water source**, unless the **subdivision** or **development** is within the Agricultural Land Reserve and the land or **development** is to be used for agricultural purposes.
- J.1.4 If the **water source** is not from a **community water system**, the **Owner** must register a Covenant pursuant to Section 219 of the *Land Title Act* in a form acceptable to the **District Engineer** in priority to all financial charges and other charges as required by the **District** against the existing land title pursuant to the *Land Title Act* confirming that the water is not from a **community water system** and verifying all quantity and quality testing meets the requirements of this bylaw.
- J.1.5 **A Water sources** must be capable of delivering water at a rate of not less than 20 liters per minute per well over a one-hour period to a minimum of 2,275 liters per day per dwelling unit.
- J.1.6 A water sample taken from the water source must be tested using a “**comprehensive test**” to determine conformity to potable drinking water standards. The comprehensive test must as a minimum include the following: Total Coliforms, E. Coli, Alkalinity, Aluminum, Antimony, Arsenic, Barium, Boron, Cadmium, Calcium, Chloride, Chromium, Copper, Conductivity, Cyanide, Fluoride, Hardness (total), Iron, Lead, Magnesium, Manganese, Mercury, Nitrate, Nitrite, pH, Potassium, Selenium, Sodium, Sulfate, Total Dissolved Solids, Turbidity, Uranium, and Zinc. The test results must be submitted to the **District Engineer**. The test results are to be registered in Land Title Office against the title of the **parcel** as a restrictive covenant, prior to issuance of a Building Permit. Any changes to the wording of the restrictive covenant are subject to the written approval of the **District Engineer**
- J.1.7 Notwithstanding J.1.4, where the **District** does not own or operate the **community water system** and the proposed **works** do not meet the requirements set out in this Bylaw the proposed **subdivision** or **development** may be approved provided that:
- (a) the **Owner** of the **community water system** has submitted a five-year capital plan acceptable to the **District**;
  - (b) the **Applicant** seeking approval of the proposed **subdivision** or **development** has complied with the conditions set out in the five-year capital plan; and
  - (c) the property that is subject to the **subdivision** or **development** application is located within the boundaries of the capital improvement area as set out in the approved five-year capital plan as submitted by the **Owner** of the appropriate **community water system**.

## **J.2 Water source**

J.2.1 The required **water source** may be a well or a surface **water source** provided that the **water source** complies with the provision of this Bylaw.

## **J.3 Requirements for Wells**

J.3.1 All wells must be drilled, cased, and flood proofed in accordance with the BC Drinking Water Protection Act.

J.3.2 All wells must be capable of delivering water at a rate of not less than 20 liters per minute per well over a one-hour period to a minimum of 2,275 liters per day per dwelling unit.

J.3.3 Each **parcel** must have its own well. Where the well is not located on the **parcel** for which the well is the **water source**, the well, water mains, and all other appurtenances must be protected by an easement, in favour of the **parcel** being supplied with water, registered with Land Title Office. A legal survey plan prepared by a **surveyor** must be provided indicating the location of all wells, water mains, and appurtenances.

J.3.4 A water sample taken from the well must be J.3.4 tested using a comprehensive test to determine conformity to potable drinking water standards. The test results must be submitted to the District Engineer. The test results are to be registered in Land Title Office against the title of the parcel as a restrictive covenant as prescribed in District Policy 09.103. Any changes to the wording of the restrictive covenant is subject to the written approval of the District Engineer

J.3.5 A report must be submitted to the **District Engineer** by a qualified professional specializing in groundwater hydrology verifying all quantity and quality testing. The report must include a plan showing the location of all wells, water mains and appurtenances.

## **J.4 Requirements for Surface Water sources**

J.4.1 A domestic water license must be obtained from the Provincial Water Stewardship Branch of the Ministry of Environment. A copy of the water license must be submitted to the **District Engineer**.

J.4.2 The quantity of water authorized to be used under the water license shall be as determined by the Comptroller of Water Rights, but shall not be less than 20 liters per minute over a one hour period to a minimum of 2,275 liters per day per dwelling unit.

J.4.3 A water sample taken from the surface water source must be tested using a comprehensive test to determine conformity to potable drinking water standards. The test results must be submitted to the District Engineer. The test results are to be registered in Land Title Office against the title of the lot as a restrictive covenant as prescribed in District Policy 09.103. Any changes to the wording of the restrictive covenant are subject to the written approval of the District Engineer.

J.4.4 All quantity and quality must be verified by a qualified professional specializing in surface water hydrology verifying all quality and quantity testing. A report must be submitted to the **District Engineer**.

**SCHEDULE K DESIGN AND CONSTRUCTION SANITARY SEWER SYSTEMS****K.1 General**

K.1.1 If community sewer is required in accordance with this Bylaw, a **subdivision** or **development** must not be approved unless the **Owner** of the **parcel** being subdivided or **developed**, provides each **parcel** in the **subdivision** or **development** with a sanitary sewer service connected to the **District** Sanitary Sewer System. All **works** must be constructed and installed in accordance with the standards as set out in this Bylaw.

**K.2 Design Flows**

K.2.1 Sanitary sewer facilities constructed in or for a **subdivision** or **development** must be designed to provide sufficient capacity to carry the required quantity of sewage flow from the full contributing area as determined by the **Owner's Engineer** and as approved by the **District Engineer**.

K.2.2 All **parcels** must be serviced by gravity flow unless otherwise approved by the **District Engineer**.

K.2.3 The sanitary sewer system must be designed based on the following criteria:

- (a) Domestic Flow Rate = 350 litres/capita/day, plus;
- (b) Infiltration rates for:
  - (i) New pipes not in water table = 5,000 l/ha/day
  - (ii) New pipes in water table = 8,000 l/ha/day
  - (iii) Old pipes = 10,000 l/ha/day
- (c) Densities per **TABLE K-1**

<b>TABLE K-1-SANITARY SEWER SYSTEM DENSITIES</b>		
	<b>People/Ha.</b>	<b>People/Unit</b>
Single Family	24-30	3
Multi-family Low	85	2
Multi-family Medium	(3 storey) 120	2
Multi-family High	(4-12 storey) 320-960	2
Mobile Home	45	2
Industrial	50	-
Institutional	50	-
Commercial	75	-



- (d) A peaking factor must be applied to the average flow. With this factor being modified to suit the areas served as follows:

$$\text{Peaking Factor} = f \left( 1 + \frac{14}{4 + \sqrt{P}} \right)$$

Where: P = Population in thousands  
f = Reduction factor, applied as follows:

New residential areas	= 0.75
Old residential areas	= 0.85
Commercial and Industrial area	= 1.00

- (e) Peak design flows must be determined by applying the peaking factor to the average daily flow, and adding inflow and infiltration (I & I) flows.
- (f) Pipes shall be designed so that the sewer flow does not exceed  $d/D=0.67$  for pipes 250 mm diameter and less, or  $d/D=0.75$  for pipes greater than 250 mm diameter. {d=flow depth and D=pipe diameter.}

### K.3 Pipe Flow Formulas

#### K.3.1 Gravity Sewers

- (a) Manning's formula must be used for gravity sewers. The roughness coefficients must be:

Concrete	=	0.013
PVC	=	0.011

#### K.3.2 Force Main Sewers

- (a) Hazen-Williams formula must be used. Friction coefficient must be  $C = 120$ .

#### K.3.3 Velocities

- (a) The minimum velocity must be 0.6 m/sec. There is no maximum velocity, however, consideration must be given to scour problems where flow exceeds 3.0 m/sec.

### K.4 Minimum Grade

K.4.1 The grade of any sewer is governed by the minimum velocity required (0.6 m/sec). However, the last section of a main that will not be extended in the future must have a minimum grade of 1.0% where 150 mm diameter pipe is proposed. Notwithstanding the above, the minimum grade for all pipes must be 1.0% unless restricted by topography or other factors approved by the **District Engineer**. There must be no change in grade between manholes.

K.4.2 Where the slope of the sewer main exceeds 20%, anchorage shall be considered by the **Owner's Engineer**. Where slope is 30% or greater, anchorage must be incorporated in the design. Anchorage must be constructed in accordance with Standard Drawings.

**K.5 Alignment of Sewer Mains**

K.5.1 Sewer mains must be designed to follow a straight alignment between manholes unless approved by the **District Engineer**. Where permitted, horizontal curves will require a constant offset and must be uniform throughout the curve. In no case shall the radius of curvature be less than 300 times the outside diameter of the pipe barrel. The design velocity must exceed 0.90 m/sec., the minimum grade must be 1.0%, and the curve midpoint and two 1/4 points are to be located by survey and shown on the as-constructed drawings with an elevation and offset of the invert at each point.

K.5.2 Routing of the sewers must be approved by the **District Engineer**.

**K.6 Service Connections**

K.6.1 Separate service connections installed in accordance with Standard Drawings must be provided to each **parcel** and must be installed, wherever possible, in a common trench with the water service. All services must enter the main at a point just above the springline.

K.6.2 Only single connections will be permitted.

K.6.3 Connections to new mains must be made using standard wye fittings; connections to existing mains shall be made using wye saddles or other pre-approved methods.

K.6.4 The minimum grade from the main to the property line shall be 2.0% for a 100 mm service and 1.0% for a 150 mm service.

K.6.5 The diameter of sewer services must be as determined by the **Owner's Engineer** but in no case shall the diameter be less than 100 mm.

K.6.6 The minimum depth of a service at the property line must be 1.2 m within a **highway** right of way and 1.0 m within a statutory right of way.

K.6.7 Inspection chambers are required for all connections and shall be installed in accordance with Standard Drawings.

K.6.8 Service connections must be installed at the downstream corner of the **parcel** at an offset of 3.0 m from the property pin.

K.6.9 Service connections may be permitted into manholes provided that:

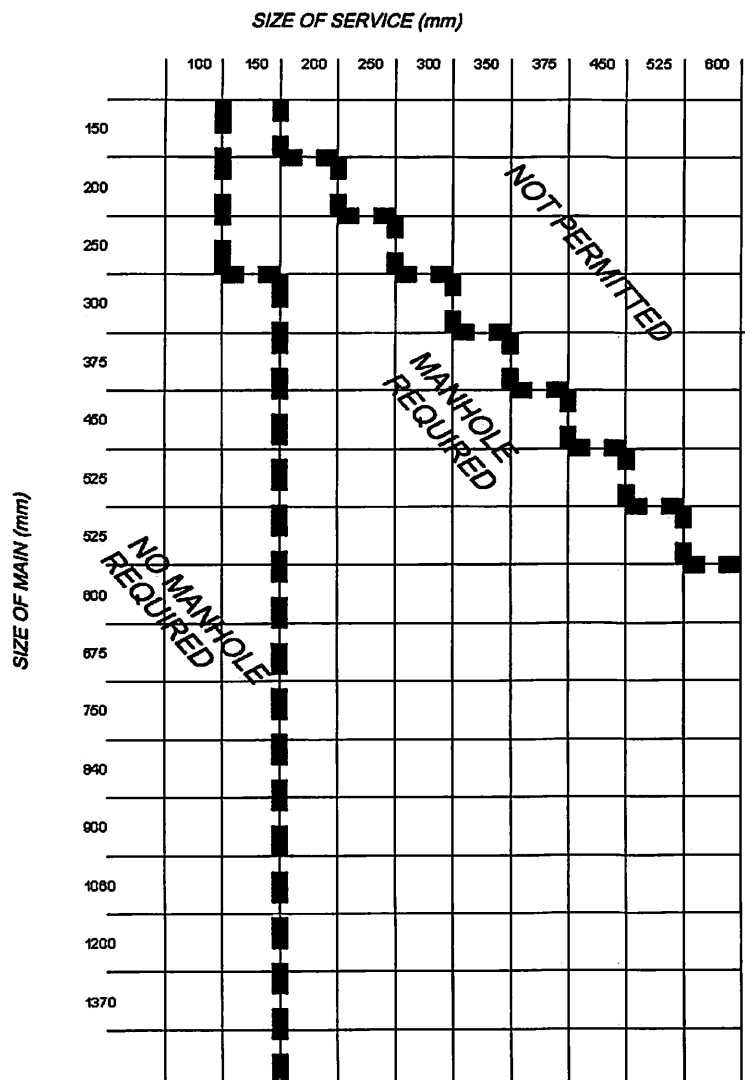
- (a) the connection is not in an adverse direction to the flow in the sewer main and
- (b) the connection enters the manhole so the service crown matches the sewer main crown.

K.6.10 Manholes are required for services relative to the size of the main as shown in **TABLE K.1**.

K.6.11 Following final grading, Brooks Boxes are to be installed on every inspection chamber.

K.6.12 Manholes are required to be installed at the intersection of the main and the service for non-residential services 150 mm and larger as shown in TABLE K-1.

TABLE K-1



#### K.7 Minimum Sewer Main Diameter

K.7.1 The minimum permitted size of pipe is 200 mm diameter.

K.7.2 Where no further extension is anticipated, the minimum pipe diameter may be reduced to:

- (a) For residential lands - 150 mm diameter with minimum 1.0% grade
- (b) For commercial and industrial - 200 mm diameter with minimum 0.60% grade

#### K.8 Depth of Cover

K.8.1 The depth of the sewer main must be sufficient to provide "gravity flow" service connections to both sides of the **highway** and must allow for future extension(s) to properly service all of the upstream tributary lands.

K.8.2 The minimum depth of cover shall be 1.2 m.

K.8.3 The maximum depth of cover is 4.5 m unless approved by the **District Engineer**.

## **K.9 Manholes**

K.9.1 Manholes must be installed at all:

- (a) changes in grade,
- (b) changes in direction, except for curvilinear sewers,
- (c) changes in pipe sizes,
- (d) intersecting sewers,
- (e) terminal sections, and
- (f) upstream and downstream end of curvilinear sewers.

K.9.2 Manholes must be placed at all locations where future extensions are anticipated and must be spaced no further than 150 m apart.

K.9.3 For sanitary manholes not located within the **road**, the rim elevation must be designed to be above:

- (a) the adjacent storm manhole rim elevation,
- (b) the surrounding ground so that infiltration from ponding will not occur, and
- (c) the 100-year return runoff event.

K.9.4 Manholes must be constructed and installed in accordance with Standard Drawings.

K.9.5 All manhole lids are to be clearly labelled Lake Country Sewer.

## **K.10 Hydraulic Losses Across Manholes**

K.10.1 The following criteria must be used:

- (a) The crown of the downstream pipe must not be higher than that of the upstream pipe.
- (b) Minimum drop in invert levels across manholes:
  - (i) Straight run - no extra drop required other than slope of pipe.
  - (ii) Deflections up to 45 degrees- 25 mm drop
  - (iii) Deflections 45 degrees to 90 degrees - 50 mm drop

K.10.2 Drop manholes and outside ramps must be installed in accordance with Standard Drawings. Where provisions are required for a future drop manhole connection, the manhole must be constructed and installed in accordance with Standard Drawings.

K.10.3 Inside ramps will only be permitted where the proposed alignment conflicts with existing utilities or where an inside ramp is required to match upstream and downstream pipe slopes. Inside ramps must not exceed 450 mm.

## **K.11 Clean-Outs**

K.11.1 Clean-outs may be provided at terminal sections of a main in lieu of a manhole where:

- (a) future extension of the main is anticipated.
- (b) the length of sewer to the downstream manhole does not exceed 45.0 m.
- (c) the depth of the pipe does not exceed 2.0 meters of cover at the terminal point.
- (d) design of the anticipated extension is completed to the next manhole to ensure the **works** will not require realignment when extended.

**K.12 Sanitary Lift Stations**

K.12.1 The use of sanitary lift stations is discouraged. Any proposed use of lift stations must receive prior approval from the **District Engineer**. Sanitary sewer lift stations should be located within a right of way outside the required **highway** dedication. Siting of lift station must be approved by the **District Engineer**.

K.12.2 The following criteria cover both dry well and submersible sewage lift stations. Larger capacity sewage lift stations or lift stations with special design or siting requirements may require additional assessment and review of criteria including but not limited to:

(a) Pre-design Report

(i) Prior to commencing detailed design of a lift station, the **Owner's Engineer** must submit to the **District Engineer** for approval a pre-design report that addresses all pertinent design considerations, including:

- A. The lift station must be designed to handle the ultimate flows of the designated catchment
- B. Type of station and impact on neighbours.
- C. Access for maintenance.
- D. Aesthetics, noise, odour control and landscaping requirements.
- E. Security against vandalism and theft.
- F. Proximity of receiving sewers, water mains and adequacy of power supply.
- G. Soils. Sub-surface investigations must be undertaken prior to site approval.
- H. Capital costs and operation and maintenance costs.
- I. Corrosion and odour control.

(b) Design Report

(i) The **Owner's Engineer** must provide three sealed sets of mechanical drawings and three sealed sets of electrical line diagrams for review by the **District Engineer**. Two sealed copies of design calculations shall be provided for documentation.

(ii) Lift station design must address the following:

- A. Construction dewatering requirements.
- B. Access for construction.
- C. Station uplift design must be based on minimum load level and maximum flood elevations.
- D. Minimizing energy requirements.
- E. Standby power and its compatibility.
- F. Convenience of operation and maintenance.
- G. Safety for operators and public.
- H. All entrance doors must be equipped with electric strike and fob reader system as supplied by Chubb Edwards in accordance with **District** standards

K.12.3 Pumps must be:

- (a) Gorman-Rupp or pre- approved equivalent
- (b) capable of passing solids up to 75 mm in size
- (c) equipped with hour meters
- (d) easily removed for maintenance
- (e) operate on a 347/600 volt electrical source (pump motors over 5 H.P. are to be 600 volt 3 phase type)
- (f) able to operate alternately and independently of each other
- (g) able to meet maximum flow condition with one pump in failure mode

- K.12.4 Factory certified pump head/capacity curves must be submitted to the District for review and pumps must not be shipped until the District has reviewed and marked the head/capacity curves as having been reviewed.
- K.12.5 Motor cables, power cables, etc., must be continuous from within the pump station to within the kiosk. In no instance shall a cable be spliced.
- K.12.6 The lift station shall include a PLC based control system, instrumentation, SCADA telemetry in accordance with **District** standards, including:
- (a) Feedback signals from and control signals to each motor starter;
  - (b) Lead pump selection, including the option to alternate;
  - (c) VFDs or electronic soft starters, with ramping, to minimize starting and stopping surges;
  - (d) Continuous level monitoring for pump control;
  - (e) Emergency high and low-level switches for back up control, independent of the PLC control system;
  - (f) Magnetic flow meter, with flood monitoring in flow meter chamber;
  - (g) Flood monitoring in valve chamber;
  - (h) Kiosk temperature monitoring;
  - (i) Power supply status from the automatic transfer switch;
  - (j) Running and fault feedback signals from the standby generator;
  - (k) HMI for local monitoring; and
  - (l) UPS power supply.
- K.12.7 Electrical and control equipment must be mounted in a three-compartment kiosk adjacent to the station, in accordance with **District** standards. The kiosk must be located a minimum of 3.0 m from the station lid as follows:
- (a) Control Panel, telemetry equipment, instrument displays, and motor starters are to be in the kiosk compartment facing the wet well;
  - (b) Electrical service and distribution equipment are to be located in the kiosk compartment facing away from the wet well;
  - (c) All cable entries into the kiosk are to be made through a sealed end compartment; and
  - (d) The kiosk shall be aluminum, insulated, heated, ventilated, with a powder-coat finish;

K.12.8 Each pump motor shall have a starter in an individual enclosure, in accordance with **District** standards, including:

- (a) Hand-Off-Auto selectors;
- (b) Keypads mounted in the starter door for VFD's and Soft Starters;
- (c) Hour Meters;
- (d) Ammeters (may be part of keypad display);
- (e) Over temperature and seal leak monitoring relays, to pump manufacturer requirements;
- (f) Phase Loss Protection; and
- (g) Power Factor Correction to meet electrical supply utility requirements.

K.12.9 Check valves must be ball lift type.

K.12.10 All stations must be equipped with an explosion-proof exhaust fan which can be activated by a manual switch and be of sufficient capacity to exchange the total volume of air inside the station with fresh air within 3 minutes of activation to meet WorkSafeBC requirements for ventilation in a confined space.

K.12.11 The entrances to all stations must be waterproof and be provided with a suitable lock. The access must be a minimum 900 mm x 900 mm in size. The access hatch must have:

- (a) an aluminum 6.4 mm tread plate
- (b) a perimeter drain
- (c) a perimeter sealing gasket
- (d) a slam lock with an aluminum removable sealing plug and opening tool
- (e) a flush lift handle
- (f) a gas spring assist cylinder
- (g) a 90 degree hold open arm
- (h) a flush fitting padlock tang
- (i) be reinforced for 1465 kgs/m<sup>2</sup>. All fasteners to be made of 316 stainless steel.

K.12.12 The entrance must be at ground level where feasible but, in no case, more than 300 mm above the ground. An explosion-proof light with a protective cover should be located in a suitable location in the station and the light should be activated by the entrance cover.

K.12.13 Access into the stations must be by an aluminum ladder. The location of the ladder must not interfere with the removal and installation of the pumps, etc. The ladder must be designed to extend and lock at least 600 mm above the station entrance. A platform is to be provided above the high-water level float to permit wet well access. The platform is to be a fibreglass grating.

All wiring in classified areas, including the wet well, area around the wet well, and the kiosk end compartment, must meet the Canadian Electrical Code requirements for that area classification. Sealing between classified and unclassified areas shall meet the requirements of the Canadian Electrical Code. The electrical design and installation is subject to the acceptance of Technical Safety BC.

K.12.14 All equipment must be CSA approved and have at least a one-year warranty for parts and labour. All pumps must be factory tested prior to installation.

K.12.15 A gate valve is required on the influent line and a plug valve on each pump discharge. The valves must be outside the station and be complete with square operating nut and nelson box.

K.12.16 A 38 mm diameter water connection for cleaning purposes must be provided. A backflow preventer is required for connections in the station.

K.12.17 The roof and cover of the lift station should be designed to withstand a loading of H-20 (Highways Standard).

K.12.18 The lift station electrical system shall include an automatic transfer switch and stationary standby generator set, in accordance with **District** standards.

K.12.19 Subject to the findings of the pre-design report regarding access and landscaping, the area around the station and all associated equipment or building must be asphalted. The size of the area is to be determined by the requirements for maintenance.

K.12.20 A receptacle compatible with the **District's** removable lifting arm must be incorporated into the design of the pump station to facilitate the removal and installation of the pump(s).

K.12.21 The interior surfaces of all fibreglass stations must receive at least two coats of two component white epoxy enamel.

K.12.22 The wet well bottom must be benched to direct all solids into the pump suction. The influent line must be located tangent to the wet well to encourage scouring of the wet well.

K.12.23 Minimum storage between the high-level alarm and the start of overflow under the more critical of:

- (a) Minimum 2 hour in wet well at average wet weather flow.
- (b) Minimum 1 hour in wet well and influent pipes at peak wet weather flow.

K.12.24 Station to allow removal of pumps using a hoist truck with a 1.8 m boom.

K.12.25 Security lighting and perimeter fencing is to be provided. The fence must be made of black chain link.

K.12.26 Landscaping acceptable to the **District** is to be provided including irrigation.

K.12.27 Minimum barrel size must be 2440 mm in diameter.

K.12.28 PLC, HMI, and SCADA programming shall be done by the **District's designated integrator**, in accordance with District standards, at the Owner's expense.

## K.13 **Operation and Maintenance Manual**

K.13.1 Before acceptance by the **District** of the completed station, the **Owner** must provide three copies of an Operation and Maintenance Manual to the **District**. The manual must contain:

- (a) as constructed shop drawings;



- (b) equipment layout drawings;
- (c) electrical, control, and alarm wiring diagrams;
- (d) operating instructions for all equipment;
- (e) maintenance instructions for all equipment, including frequency of maintenance tasks;
- (f) equipment data sheets;
- (g) spare circuit cards for critical components;
- (h) certified head/capacity curves for pumps;
- (i) equipment part lists;
- (j) emergency operating procedures.

K.13.2 The maintenance manuals must be bound documents with the name of the facility on the cover. Manuals must contain a table of contents with each section identified by a plasticized, labelled divider.

#### K.14 Sanitary Force Mains

K.14.1 In conjunction with sanitary pumping facilities, the following criteria must be noted in the design of force main systems:

- (a) At the lowest pump delivery rate anticipated to occur at least once per day, a cleansing velocity of 1.0 m/sec should be maintained. Maximum velocity should not exceed 3.5 m/s.
- (b) An automatic air relief valve must be placed at high points in the force main to prevent air locking.
- (c) The minimum size for force mains shall be 100 mm diameter.
- (d) The material for force mains must be HDPE (high density polyethylene) designed to suit the conditions of use.
- (e) All force mains must be designed to prevent damage from transient conditions.

#### K.15 Noise Control Criteria

K.15.1 Noise levels for facilities must not exceed 65 dB at property line or 20 m away whichever is closer.

#### K.16 Corrosion and Odour Criteria

K.16.1 Corrosion and Odour controls must be considered in all design.

K.16.2 Analysis for potential odour and sulfides is required.

K.16.3 Odour Criteria:

- (a) at 10 m from any gravity main, force main, manhole and lift station or other sewer facility (summer conditions, winds between 2-10 km/h), 1.0 odour units.
- (b) where sewer facilities are close to houses, parks or **walkways**, 0.0 odour units.
- (c) Dissolved sulfide maximum limit at any point in the system is to be 0.5 mg/l. However, for new tie-ins to District system, the maximum limit is 0.3 mg/l.
- (d) Wet well size, force main diameter and length, as well as other pertinent factors must be considered in optimizing system operations to avoid odours.

## SCHEDULE L DESIGN AND CONSTRUCTION ONSITE SEWERAGE SYSTEMS

### L.1 General

- L.1.1 Where the provisions of this Bylaw allow an **onsite sewerage system**, the **Owner** must design and construct such services in accordance with the provisions of this Bylaw.
- L.1.2 On-site disposal systems must be designed and constructed in accordance with the Sewerage System Regulation of the *BC Public Health Act*.
- L.1.3 If connection to a **community sewer system** can be achieved without a main extension, the **community sewer system** must be used as the method of sewage disposal, unless the **subdivision** or **development** is within the Agricultural Land Reserve and the land or **development** is to be used for agricultural purposes.
- L.1.4 If an **onsite sewerage system** is permitted under this Bylaw, for the **subdivision** or **development**, the subdivision must not be approved until the **Owner's Engineer** has demonstrated that each individual **parcel** has sufficient area for a septic disposal field suitable for effluent disposal including sufficient area for a backup septic disposal field.
- L.1.5 The septic disposal field area for an initial and replacement field must be surveyed and registered as a covenant preserving the land for use as a septic field on each individual lot.
- L.1.6 Onsite disposal is permitted on existing **parcels** less than 1.0 ha in size. However, **subdivision** into **parcels** less than one hectare in size, is not permitted in cases where a connection to a sanitary sewer is not available.

## SCHEDULE M DESIGN AND CONSTRUCTION OF STORM DRAINAGE SYSTEMS

### M.1 General

- M.1.1 If a **storm drainage system** is required pursuant to this Bylaw, the **Owner** of the **parcel** being subdivided or **developed** must provide the proposed **subdivision** or the **parcel** being **developed** with a **storm drainage system** constructed and installed in accordance with the provisions of this Bylaw.
- M.1.2 In addition to the requirements of Schedule C, a **storm drainage system** is required where the **subdivision** or **development** is located in an area where drainage studies prepared for the **District** and adopted by the **Council** indicate that drainage **work** should be constructed.
- M.1.3 In addition to the requirements of Schedule C, a **storm drainage system** is required where the **Owner** carries out construction of a paved area or roof area.
- M.1.4 In addition to the requirements of Schedule C, a **storm drainage system** is required where the **development** includes or is solely for the alteration of land in accordance with the **District's Stormwater** Management Bylaw, as amended from time to time
- M.1.5 The design of any facilities for **stormwater drainage systems** must specifically address and provide recommendations based on Professional Practice Guidelines provided by Engineers and Geoscientist British Columbia.
- M.1.6 The **District Engineer** may require a statutory right of way over the drainage course to allow for the future maintenance by the **District** and to prevent structures in a location where they could be damaged by **stormwater**.
- M.1.7 In preparation of a **stormwater** management plan, the **Owner's Engineer** must take into consideration the potential for changing weather patterns due to climate change. The determination of the primary method for the management and disposal of **stormwater** shall be at the discretion of the **District Engineer**. To aid in this determination, the **Owner** shall commission a study by a geotechnical **engineer** or hydrogeologist to determine the viability of ground disposal for storm water taking into consideration, as a minimum, the following:
- (a) The tributary drainage area including all contributing areas;
  - (b) Upslope and downslope conditions affecting both surface and groundwater;
  - (c) Bed rock or impermeable soil interface location and direction of groundwater flow;
  - (d) Potential for surface break out of groundwater and the location of potential breakout; and
  - (e) Potential for damage or inconvenience to public or private property and structures.
- M.1.8 It is the **Owner's Engineer's** responsibility to ensure that they obtain true and accurate elevations for the **development** of the site and to confirm the accuracy of any mapping or information that may be provided by the **District**.
- M.1.9 In consideration of the above, where ground disposal of **stormwater** is determined not to be a viable alternative by the **District Engineer**, a system of pipes, open channels, storage facilities, and treatment facilities; with ultimate conveyance to a natural water course shall be employed.

M.1.10 In addition to any measures taken to protect the environment within a system of pipes, open channels, storage facilities, and treatment facilities, and prior to disposal of water to a natural watercourse, **stormwater** must be treated as noted in clause M.2.4, below.

## M.2 Design Overview

M.2.1 The **Owner's Engineer** must design the **storm drainage system** so that all downstream drainage facilities are capable of handling the projected post **development** flows. **Stormwater** must be directed to an acceptable discharge point, such as lake, a major creek, a ditch or trunk main with adequate capacity.

M.2.2 **Stormwater** management systems must incorporate such techniques as lot grading, surface infiltration, and sub-surface disposal, storage, or other acceptable methods, to limit the peak run-off from the **development**.

M.2.3 **Development** within the **District** is required to provide water quality treatment for flows up to 50% of the 2twotwo-year event and to provide storage up to the 100 year (plus 10% volumetric safety factor) event with a maximum outlet rate based upon the five-year pre-**development** rate generated by the **subdivision** or **development**.

M.2.4 For water quality treatment, **stormwater** must be routed through some form of water quality treatment facility utilizing "best management practices" including but not limited to the urban runoff quality control guidelines for the province of British Columbia, Municipal Waste Branch Environmental Protection Division, BC Environment (June 1992) to remove suspended solids and floatables. The facility may be catch basins with sumps and trapping hoods with flow to drywells and subsequent overflow to the **District's stormwater** system or other treatment such as a wetland. The **District** will accept mechanical treatment where other options are considered to be impractical.

M.2.5 The release rate is to be based upon the post-**development** outlet hydrograph mirroring the pre-**development** runoff hydrograph up to the 5-year level. Release rates not based on this criteria may be allowed by the **District** based on downstream system capacity, ability to convey flows without causing erosion, or negatively impacting receiving stream flood protection or water quality.

M.2.6 An overflow shall be provided to route any excess water to the designated one-hundred-year flood route. Such an overflow can be in the form of a spillway or may be incorporated in the flow control structure through oversizing of downstream pipes, provision of overflow pipes or such other arrangement approved by the **District**.

M.2.7 A **stormwater** management plan must include all drainage facilities, lot grading (showing pre- and post-**development** contours), major flood path routing, and all other appropriate information pertinent to the design.

M.2.8 A **stormwater** management plan is required for rural residential or agricultural **developments**. A lot grading plan is required for all **development** to address:

- (a) The need to convey **stormwater** through or around the **development** directed towards the historical drainage pathway.
- (b) The need to address **stormwater** outlet flow rates and location of outfall.

- (c) The potential for disruption of groundwater infiltration patterns and the impact on subsurface flows.

M.2.9 It is the **Owner's Engineer's** responsibility to ensure that they obtain true and accurate elevations for the **development** of the site and to confirm the accuracy of any mapping or information that may be provided by the **District**.

M.2.10 Each **storm drainage system** must consist of the following:

- (a) A minor system consisting of pipes and ditches which convey flows of a 10-year return frequency.
- (b) A major system consisting of a piped system, surface flood paths, **roadways**, and water courses which convey flows of 100-year return frequency. Major flood path routing is required wherever surface overland flows in excess of 0.05 m<sup>3</sup>/s are anticipated. Creeks regulated by the Ministry of Environment may require design to a 1 in 200-year flood.
- (c) Driveway culverts that form part of the minor system must be designed to the 10-year return frequency with the design headwater not to exceed half the diameter of the culvert. Minimum culvert size shall be 450 mm with head walls at each end. Culvert material shall be galvanized corrugated steel pipe (GCSP).
- (d) 200-year return where required by the Ministry of Environment
- (e) For major structures such as bridges 1 in 200-year flood must be used

M.2.11 The hydrologic criteria needed to calculate basin runoff are rainfall, soil types, vegetation and ground cover, extent of **development** and land slope and shape. In areas where upstream flows originate in natural/undisturbed areas, consideration must be given to the impact of an intense rainfall event on frozen ground. It is expected that the **Owner's Engineer** will use criteria that are justifiable for the location of the **development**.

M.2.12 Roadway crossing culverts must be designed to accommodate the 100-year return frequency. The headwater profile may not exceed half the diameter of the cross culvert. Major overland flow routes protected by statutory right of way in favour of the **District** are required down-stream of any low-point in a **road** or **cul-de-sac**.

M.2.13 The system including driveway culverts must be designed to accommodate the design major flow, should any facility become blocked or restricted. Minimum major system culvert diameter 600 mm.

M.2.14 Where the slope of the storm sewer main exceeds 20%, anchorage shall be considered by the **Owner's Engineer**. Where slope is 30% or greater, anchorage must be incorporated in the design. Anchorage must be constructed in accordance with Standard Drawings.

M.2.15 A Parcel Drainage System must identify individual **parcel** drainage patterns. Where runoff from a **parcel** will cross neighbouring properties, the **Owner** must provide:

- (a) Drainage **works** designed and constructed to dispose of the runoff on the **parcel**, or
- (b) A surface or sub-surface conveyance system designed and constructed as part of the overall **storm drainage system** and where necessary, be protected by easements
- (c) A system of storage components where necessary for overall affective storm system operation and management.

M.2.16 The **Owner's Engineer** shall assess the potential for groundwater problems and a storm drainage service connection shall be required and permitted only in areas where groundwater or other geotechnical issues have been identified as a potential problem by the **Owner's Engineer** or in a drainage plan adopted by the **District**. Where groundwater is a potential problem, each **parcel** must be provided with a storm drainage service connection. Service connections shall be designed in conformance with Section M.11

### M.3 Design Methodology

M.3.1 Conventional systems must be designed using Hydrograph Methods. For **developments** where the tributary areas are less than 10 hectares, and detention facilities are not involved, the rational formula may be used. The **Owner's Engineer** must provide to the **District** all calculations pertinent to the design of the proposed drainage systems. All designs must take into consideration post-**development** upstream flows.

M.3.2 The Rational Formula is expressed as:

$$Q = CIA/360$$

where; Q = peak runoff, m<sup>3</sup>/s

C = runoff coefficient

A = area, hectares

I = rainfall intensity, mm/hr

Runoff Coefficient, (C) values should be established based on the proposed land uses, proposed **developments** and hydrogeological information. Calculations and justification for the determination of C values are to accompany **development** submissions. Developers and consultants are encouraged to look for ways to reduce the amount of Effective Impervious Area within their **developments** to reduce the amount of runoff generated and the costs associated with **stormwater** infrastructure. "Default" C values, as shown on **TABLE M-1** can also be used.

<b>TABLE M-1-RATIONAL METHOD "C" COEFFICIENTS FOR DESIGN</b>		
<b>Description of Area</b>	<b>Minor Storm</b>	<b>Major Storm</b>
Commercial	0.85	0.90
Residential - Single-Family areas	0.40	0.50
Residential - Multi-units, detached	0.50	0.60
Residential - Multi-units, attached	0.60	0.70
Apartments	0.75	0.80
Industrial	0.75	0.80
Parks	0.20	0.25
Natural Areas	1	1
Streets – Asphaltic	0.85	0.95
Streets – Concrete	0.85	0.95
Drives and walks	0.80	0.90
Roofs	0.80	0.90

<sup>1</sup> to be determined by site specific conditions

In a case of applying the Rational Method to a mixed land use in a drainage area, a weighted average C value should be used and can be calculated from the following formula:

$$C_{avg} = \frac{\sum A_i C_i}{A}$$

Where

$A_i$  is the area with the same type of land use correlated to run-off coefficient  $C_i$ , and  
 $A$  is the sum total of all areas,  $A_i$ .

The value of the design rainfall intensity ( $I$ ) for the Rational Formula is selected from the appropriate Intensity Duration Frequency (IDF) curve, with a duration chosen to coincide with the Time of Concentration. The Time of Concentration is the time required for run-off flow to become established and reach the design location from the furthest point within the contributing basin.

Time of concentration is the sum of two components, the "inlet time" and the "travel time" as shown in **TABLE M-2**.

<b>TABLE M-2-INLET TIMES</b>	
Event	Inlet Time (min.)
5	10
10	9
25	8
50	7
100	5

The inlet time is the overland flow time for run-off to enter the conveyance system. It varies with size of the catchment area and surface imperviousness. In **developed** urban areas where paved surfaces drain directly to catch basins, an inlet time of 10 minutes shall be utilized for assessment of 5 year and smaller design storms. Inlet times for higher intensity design storm events are as follows:

For inlet times in rural areas, the overland flow time must be calculated using appropriate formulas.

The travel time is the length of time required for flow to travel within the conveyance system from the point of inflow to the location being analyzed.

The most recent version of rainfall intensity-duration-frequency (IDF) data provided by Environment Canada for the recording station at the Kelowna International Airport shall be referenced for the purposes of this Bylaw.

- M.3.3 All minor storm drainage components draining areas larger than 10 ha. and all major **storm drainage systems** and storage facilities must be designed using computer modelling techniques. The selection and the proper application of computer models is the responsibility of the **Owner's Engineer**. It is necessary to utilize computer models which have the capability to generate hydrographs and which can route these hydrographs through a **network** of open channels, conduits and storage facilities showing volumes, hydraulic grade lines, the ability to simulate the minor and major system and their interrelation and the ability to simulate submerged and/or surcharged conditions.

## M.4 Minor System Design

### M.4.1 Site and Parcel

- (a) A **subdivision or development** must incorporate the following site and **parcel** grading techniques according to this section.
  - (i) Each **parcel** must be graded to drain to a **storm drainage system**
  - (ii) Areas around buildings must be graded away from the foundations.
  - (iii) An individual **parcel** will not be permitted to direct **stormwater** discharge or foundation drainage into any natural water course, park or green belt area(s). Sheet flow must be used.
  - (iv) Driveways must be constructed such that the runoff from the driveway does not enter any building on the **parcel**.

### M.4.2 The **Owner's Engineer** must establish a **minimum building elevation** to underside of main-floor joists or any mechanical installation below underside of floor joists which may be required, at the **District's Engineer's** discretion, to be registered as a restrictive covenant against the **parcel**. The **Owner's Engineer**, when establishing the **minimum building elevation**, must:

- (a) Ensure that the **minimum building elevation** is at least 150 mm above the maximum hydraulic grade line of a piped system at the point of connection.
- (b) Consider the physical elevation for a storm drain connection to the actual building site.
- (c) Consider the potential elevation for a sanitary sewer connection to the actual building site.
- (d) Consider the potential for surcharging of the **stormwater** system on the nearby **roads** to ensure flooding does not backup in either the storm or the sanitary sewer or flow overland to the building in question.
- (e) Consider the potential for artesian groundwater pressure.
- (f) Consider the **District's Zoning Bylaw** of the day.

## M.5 Streets, Gutters, and Ditches

### M.5.1 For urban cross-sections, the flooding depths for a 1:10 year storm, which will be permitted on streets, while the streets are acting as part of the minor **storm drainage system**, are as follows:

- (a) There shall be no curb overtopping.
- (b) Maximum depth of ponding at sag locations or inlets will be 150 mm.
- (c) On local **roads**, the flow may spread to the crown except where curb over-topping will occur.
- (d) On collector **roads**, the flow spread must leave one **lane** or a **road** surface equivalent free of water to ensure access for emergency vehicles (fire, ambulance).
- (e) On arterial **roads**, the flow spread must leave one **lane** in each direction free of water.

### M.5.2 Flow across urban **road** intersections shall not be permitted for storms with a return frequency of 5 years or less.

### M.5.3 For rural cross-sections, gravel or paved **roads** shall be constructed with swales or ditches that ensure adequate **road** subgrade drainage (in compliance with standard **road** design). Where ditching for minor drainage is provided, ditch design shall consider the following:

- (a) Sediment and erosion control measures to prevent incising and the movement of sediment.
- (b) Freeboard of 0.3 m.
- (c) Free surface elevations permitting agricultural tile drainage where required.
- (d) Stable side slopes.
- (e) **Road** subgrade.



## M.6 Catch Basins

M.6.1 To ensure that the capture or inlet capacity matches the storm main capacity, the spacing of catch basins on streets may be varied; however, they shall generally meet the following criteria:

- (a) **Road** grades less or equal to 3%, space 150 m maximum or 675 m<sup>2</sup> of paved area.
- (b) **Road** grades greater than 3%, space 100 m maximum or 450 m<sup>2</sup> of total area.
- (c) Space catch basins to ensure no overflows to driveways, **boulevards**, **sidewalks**, or private property.
- (d) Space at intersection so as not to interfere with **crosswalks**.
- (e) Side inlet catch basins are required for all curbed **roads**.

M.6.2 All catch basin leads are to be a minimum diameter of 200 mm and sized to convey the design inlet capacity.

M.6.3 All catch basin leads are to discharge into a manhole.

## M.7 Storm Mains

M.7.1 Hydraulic capacity shall be calculated using Manning's formula. A roughness coefficient of 0.013 shall be used for concrete and 0.011 shall be used for smooth plastic pipe.

M.7.2 The minimum velocity for pipes flowing full, or half full, must be 0.75 m/s.

M.7.3 Where velocity exceeds 4.5 m/s, scour protection may be required and anchor blocks will be required.

M.7.4 Where drainage discharge enters a natural watercourse, maximum velocities shall be <1.0 m/s.

M.7.5 Storm mains must be located within the **road** right-of-way as noted in the applicable Standard Drawings typical cross-section for that **road**. Minimum pipe diameter shall be per TABLE M-3

TABLE M-3 MINIMUM PIPE DIAMETER	
Mains; residential, single family	250 mm diameter
Mains; industrial, commercial, multiple family	300 mm diameter
Catch basins leads	200 mm diameter

M.7.6 When the storm main is required to cross private land(s), the right-of-way must be a minimum of 4.5 m wide, however, the width must be suitable to accommodate excavations based on WorkSafeBC regulations for trench side slopes.

M.7.7 When a storm main is located within a statutory right-of-way and appurtenances which require maintenance are located within the right-of-way, the property **owner** must ensure that maintenance access is available. For large structures or structures requiring an enhanced maintenance level such as oil/sediment chambers, control structures and pond inlet/outlet chambers, an access route adequate to support the maintenance vehicles is to be provided. The surface of the route may be gravel, pavers or asphalt depending on the location and the context of the site at the discretion of the **District Engineer**.

M.7.8 Provide 1.2 m minimum depth in travelled areas and 1.0 m otherwise. However, these minimums are to be used only when conflicts with other utilities will not occur and all upstream catchment areas are serviceable by gravity.

M.7.9 For catch basin leads 0.9 m minimum cover shall be used. If 0.9 m is not available, design to protect from freezing and traffic loads. Design calculations must be provided.

## **M.8 Alignment of Sewer Mains**

M.8.1 Sewer mains must be designed to follow a straight alignment between manholes unless approved by the **District Engineer**. Where approved by the **District Engineer**, horizontal curves will require a constant offset and must be uniform throughout the curve. In no case shall the radius of curvature be less than 300 times the outside diameter of the pipe barrel. Deflection of pipe joints is not permitted. The design velocity must exceed 0.90 m/sec. the minimum grade must be 1.0%, and the curve midpoint and two  $\frac{1}{4}$  points are to be located by survey and shown on the as-constructed drawings with an elevation of the invert and offset of each point.

## **M.9 Manholes**

M.9.1 Storm manhole spacing is to be related to pipe main size as follows:

- (a) 250 and 300 mm diameter - 135 m maximum spacing;
- (b) over 300 mm to 600 mm diameter - 120 m maximum spacing, and
- (c) over 600 mm diameter - 100 m maximum spacing.

M.9.2 Manholes are required at:

- (a) all grade or alignment changes (except curved sections)
- (b) pipe size changes
- (c) all intersecting mains
- (d) all upstream ends of mains
- (e) upstream and downstream end of all curvilinear mains unless a constant offset is maintained from the curb
- (f) all catch basin connections
- (g) outfalls to the major system (i.e. creeks, channels, lake) in order to isolate the upstream main to facilitate cleaning. The manhole is to be located as close as possible to the point of discharge.

M.9.3 Manhole sizing shall be in accordance with **District** standard detail drawings.

M.9.4 For hydraulic losses in manholes, the following criteria must be used:

- (a) The crown of the downstream pipe must not be higher than the crown of the upstream pipe,
- (b) Minimum drop in invert levels across manholes:
  - (i) Straight runs – no drop required other than slope of pipe
  - (ii) Deflection up to 45° – 15 mm drop
  - (iii) Deflection up to 45° to 90° – 50 mm drop
- (c) Drop manholes or outside ramps must be installed in accordance with Standard Drawings. Where provisions are required for a future drop manhole connection, the manhole must be constructed and installed in accordance with Standard Drawings.
- (d) Inside ramps will only be permitted where the proposed alignment conflicts with existing utilities or where an inside ramp is required to match upstream and downstream pipe slopes. Inside ramps must not exceed 450 mm.

M.9.5 All manhole lids are to be clearly labelled Lake Country Storm Sewer.

**M.10 Ground Water Recharge Systems**

M.10.1 Mains may be sized according to the required capacity taking 50% or the groundwater recharge capability into consideration. The groundwater recharge component must be calculated and justified by a qualified hydrogeologist/engineer experienced in this field. Minimum sizes of mains must still be utilized.

**M.11 Service Connections**

M.11.1 Service connections must:

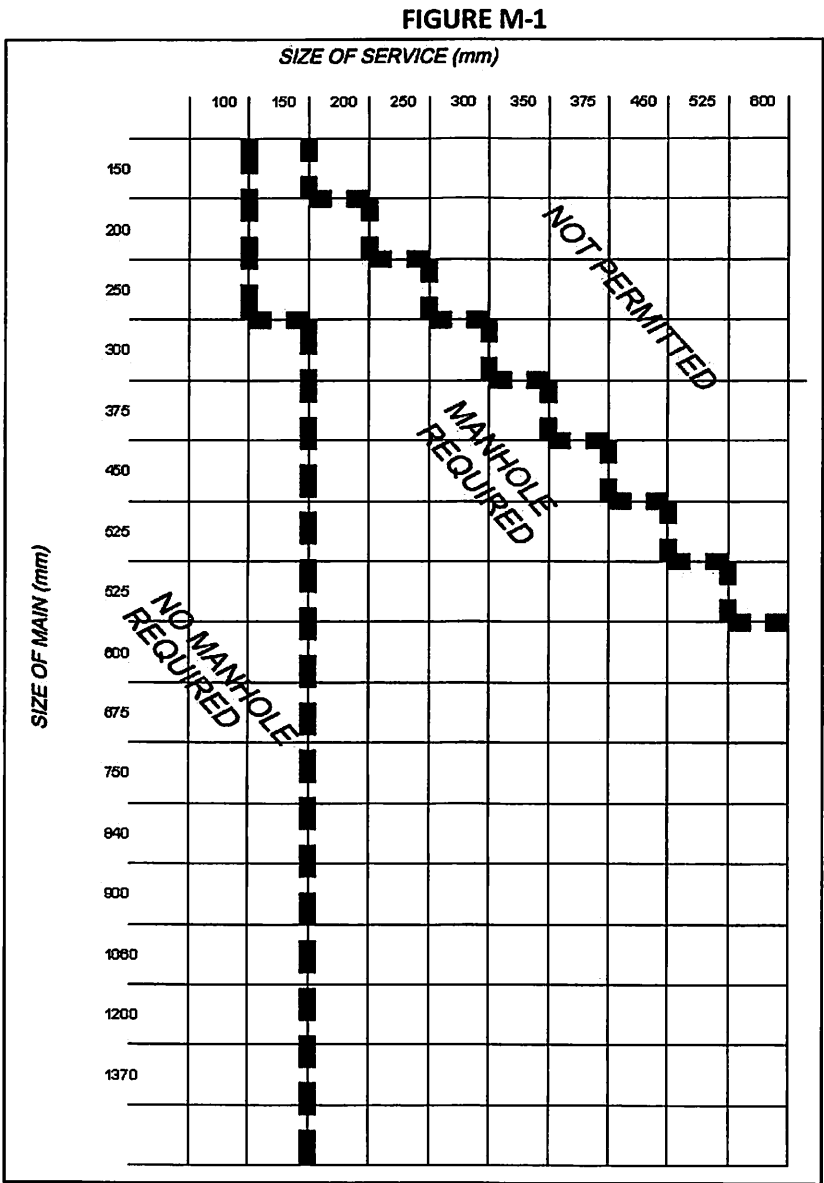
- (a) Be installed in accordance with Standard Drawings,
- (b) Have minimum diameter of 100 mm for residential and 150 mm for industrial or commercial, except that 100 mm is permitted to control discharge flow rate,
- (c) Have a slope greater than 2% for 100 mm diameter and 1% for 150 mm diameter,
- (d) Be installed at the downstream portion of the **parcel** and
- (e) Be installed at an offset of 4.0 m from the property pin.

M.11.2 Storm services to properties shall not be permitted from storm drains located in rights-of-way unless a clean-out is provided and the nature of the **development** will permit access to the right-of-way for inspection, maintenance, and **repair**.

M.11.3 Temporary clean-outs may be provided at terminal sections of a main provided that:

- (a) Future extension of the main is proposed or anticipated,
- (b) The length of storm drain to the downstream manhole does not exceed 45.0 m, and
- (c) The depth of the pipe does not exceed 2.0 m at the terminal point.

M.11.4 Manholes are required for services relative to the size of the main as shown in FIGURE M-1



**M.12 Roof Leaders**

M.12.1 Roof drainage leaders are to be connected to the storm service connection only where geotechnical requirements dictate the need. The evaluation of this requirement is to be included in the scope of the Hydrogeotechnical Study. Otherwise, roof leaders are to be directed to a splash pad for dispersal to the ground. Roof leaders shall not be directed onto driveways which drain directly onto District right-of-way or areas draining directly onto neighboring properties.

**M.13 Foundation Perimeter Drains**

M.13.1 Perimeter drains for buildings are required as per the British Columbia Building Code.

M.13.2 Foundation perimeter drains shall be connected by gravity via a storm service to the storm main provided that the elevation of the basement/crawlspace floor is at least 600 mm above the elevation of the storm main obvert, 600 mm above the anticipated or known high ground water table, or 600 mm above the 100 year hydraulic grade line within the main at that point, whichever is higher.

M.13.3 In general, design that allows for the potential for ongoing ground water problems should be avoided. In special cases, the **District Engineer** may allow a backflow prevention device and sump pump system inside the building discharging to the storm main via a storm service. A backwater or check valve and a siphon break must be installed in the sump pump discharge line to prevent backflow into the basement. Discharge may be to the surface or a soak away pit, if geotechnical conditions permit.

M.13.4 Where hydrogeotechnical studies justify their use, dry wells or ground infiltration systems may be used as the storm water disposal method for connection of perimeter drains. These systems are to be designed and supervised by a Geotechnical Engineer.

#### **M.14 Inlet and Outlet Structures**

M.14.1 Outfalls of the storm sewer minor system into watercourses shall be designed recognizing aesthetics and erosion control.

M.14.2 When culverts or storm pipes are greater than 600 mm, the outfall pipe or structure shall be protected against entry by a free swinging, lockable, weighted grating which will allow passage of materials on discharge. Inlet and outlet structures must be constructed in accordance with Standard Drawings.

#### **M.15 French Drains**

M.15.1 The use of French Drains shall only be permitted where the topography and soil conditions are proven adequate. A soils report will be required to support the design.

#### **M.16 Natural Watercourses**

M.16.1 All proposals for **works** affecting natural watercourses must be forwarded by the **Owner** to the Ministry of the Environment.

M.16.2 Should siltation or erosion controls be required by the above agencies, details of the proposed **works** must be included in the engineering drawings and must be installed as part of the **works**.

#### **M.17 Lot Grading/Swales and Driveways**

M.17.1 Swales shall have a minimum slope of 1 percent. Swales shall be lined with turf on a minimum 100mm topsoil or lined with a non-erodible hard surface. All such swales serving two or more **parcels** of property shall be designed to accommodate the anticipated flows and the right of way, sized accordingly (3.0 m minimum), shall be provided.

M.17.2 To ensure flooding is avoided, carports or garages attached to residential buildings shall not be constructed with their floor level below the curb or crown of pavement of the adjacent street, unless:

- (a) the drainage of the driveway serving the carport or garage is connected by gravity to a **District** storm sewer meeting the connection criteria, or
- (b) is above the 100-year flood line, or
- (c) the runoff water from the driveway may flow past the carport/garage without accumulating and entering. Properties utilizing this method must have an **Engineer** seal the design. All other relevant criteria of this Bylaw must also be met.

## **M.18 MAJOR STORM DRAINAGE SYSTEM DESIGN**

### **M.18.1 General**

- (a) Storm runoff generated by less frequent, higher intensity rainstorms may exceed the capacity of the minor system. Runoff from these events will pond in depressions and follow whatever overflow route is available. This network of ponding and overland flows is called the “major system”. If the major system is properly planned, it can alleviate the potential inconvenience and property damage caused by large rainfall events.
- (b) The major system includes all drainage infrastructures which conveys, detains, diverts and intercepts the 100-year design storm runoff. In general, all components of the major system must be designed to accommodate the flows generated by the upstream contributing area. The following section describes the major system provisions and technical requirements for use in planning and design of the major **storm drainage system**.
- (c) The depth of flooding permitted for the major event is as follows:
  - (i) For all classes of **roads**, the depth shall not exceed 0.3 m.
  - (ii) One lane, or a 3.5 m width at the crown shall be free from flooding.
  - (iii) Flooding is not permitted on private property
- (d) To meet the criteria for major storm runoff, sags or low points in **roads** or **subdivisions** must be designed with a safe overland outlet flow route.

### **M.18.2 Outfalls**

- (a) Ministry of Environment approval is required on all storm water outfalls to natural watercourses or water bodies.
- (b) Lake outfalls require approval from the Canadian Coast Guard. Outfalls into lakes are to be constructed to have minimum bury according to the following:
  - (i) soft bottom, 0.6 metres to allow for seasonal sand erosion and deposition
  - (ii) rock bottom, criteria to be confirmed by Canadian Coast Guard
  - (iii) exposed pipes must be a minimum of 2.4 metres deep during lake “low water”

### **M.18.3 Control Structures**

- (a) Control structures, such as the one shown on Standard Drawings shall be used to provide consistent control for design storm flows of different return periods. These can be modified to include multi-stage inlets. For example, three orifices located vertically on a control structure are normally designed such that the lower, smaller orifice restricts frequent storms and the larger upper orifices control less frequent larger storms. Safe overflow must still be available above the highest orifice.
- (b) Consideration shall be given for the design of smaller sediment trap basins at the points of discharge to the detention/retention facilities. Normally, basin inlets shall be designed to provide sediment containment. Buildup of sediment shall not restrict inflows and suitable designs shall be provided to allow ease of sediment removals.

**M.18.4 Culvert and Bridge Capacity**

- (a) Culverts over 30 m in length and/or 400 mm in diameter shall be constructed with headwalls and endwalls at the direction of the **District Engineer**. The headwall shall be constructed with a free swinging, weighted grating. To protect against entry, the **District** may require a locking mechanism which limits the range of movement of the grating.

**M.18.5 Ground Recharge Systems**

- (a) Ground recharge systems are not normally considered for major flood routing. However, given the soil conditions in the **District** area, geotechnical investigations may support the retention and ground infiltration of major events in some areas.

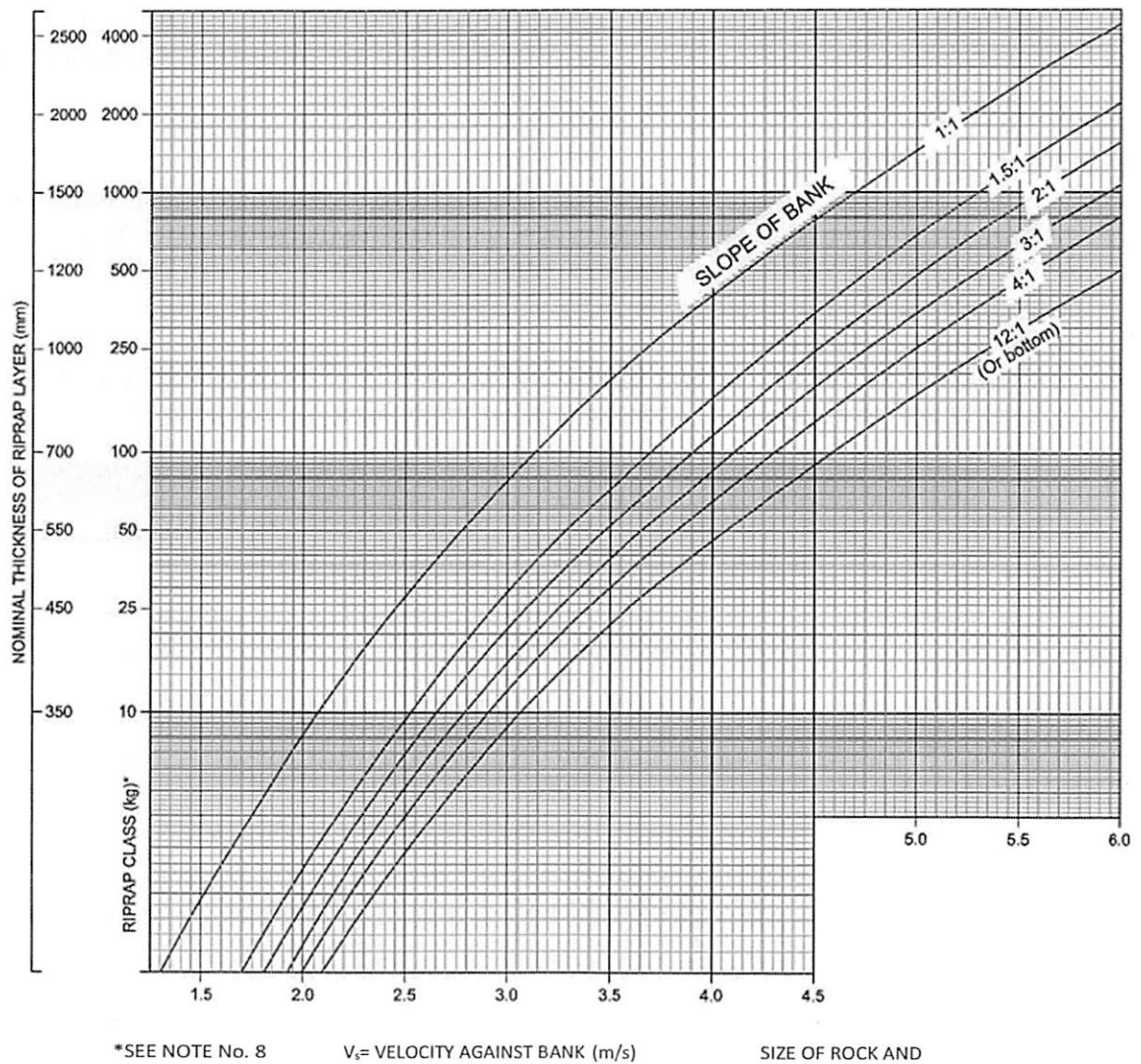
**M.18.6 Ditch and Swale Construction**

- (a) Velocity of flow in ditches and/or swales is not to exceed the limits given below for the various types of materials used as the conveyance surface. Shown in TABLE M-4 below.

TABLE M-4 VELOCITY FLOW LIMITS	
Lining Materials	Maximum Permissible Velocity m/s
Fine sand	0.45
Fine gravel	0.75
Stiff clay	1.00

- (b) For velocities higher than 1.00 m/s, the Rip Rap Design Chart shown below is to be used shown in **Error! Reference source not found.** below.

FIGURE M-2 RIPRAP DESIGN CHART



SIZE OF ROCK AND THICKNESS OF PROTECTION BLANKET THAT WILL RESIST DISPLACEMENT FOR VARIOUS VELOCITIES AND BANKSIDE SLOPES.

- Adapted from report of Sub-committee on slope protection, Am. Soc. Civil Engineers Proc. June 1948.
- Density of stone assumed at  $2,640 \text{ kg/m}^3$
- Enter graph at known velocity to intersection with desired slope curve. Move horizontally to required riprap class and thickness.
- $V_M$  = mean stream velocity.
- For parallel flow along tangent bank;  $V_s = 2/3 V_M$
- For impinging flow against curved bank;  $V_s = 4/3 V_M$
- For direct impingement on the bank;  $V_B = 2 V_M$
- \*The riprap class No. is the mass (kg) of the 50% rock size (i.e., at least half of the riprap must be heavier than its class mass). For details regarding the rock gradation see 2006 Design Build Standard Specifications for Highway Construction, adopted February 20, 2006 Construction and Maintenance Branch, British Columbia Ministry of Transportation
- Do not interpolate between riprap classes. Use the next highest class.



## M.19 Stormwater Storage

### M.19.1 General

- (a) This section identifies the general design parameters and requirements that must be considered by **Owner's Engineer** in the planning and design of **stormwater** storage facilities.

### M.19.2 Peak Flow Control

- (a) Control on peak flow rates and volumes in the **District** are necessary to:
  - (i) minimize impacts on watercourses and downstream **developments** from flow increases which will result from land **development**, and
  - (ii) maintain or lessen flows in watercourses so that creek channels and existing structures, such as bridges and culverts, will continue to operate without being flooded or damaged.
- (b) In consideration of the above noted peak flow, the **District** has the following objectives, considerations, and requirements:
  - (i) Impacts and expenditures to existing downstream users shall not be increased.
  - (ii) Increases in peak storm flows and volumes to the watercourses and receiving waters shall be limited.
  - (iii) The number of storage facilities shall be minimized. Detention will not be permitted under private **Ownership**, unless incorporated on-site within a private **development** and it only handles **onsite stormwater**.
  - (iv) Where storage facilities serve more than one property, facilities are to be owned and maintained by the **District**.
  - (v) Where land **developments** occur in advance of permanent detention facilities, the **District** may consider temporary storage facilities on an individual basis. Maintenance charges and responsibility for temporary storage facilities will be borne by the developer.
  - (vi) Storage facilities may be surface or underground. Rooftop or parking lot storage may be considered, where appropriate.

### M.19.3 Level of Service

- (a) Flows generated from rainfall events greater than 50% of the 2 year event for **developments** near lakes, Middle Vernon Creek, Winfield Creek, Okanagan Lake, Kalamalka Lake and Wood Lake can be discharged directly to a receiving body of water provided the required minor and major systems exist and approval from the **District** and the Ministry of Environment is obtained.
- (b) **Developments** within other areas of the **District** are required to provide storage up to the 100-year (plus 10% volumetric safety factor) event with a maximum outlet rate based upon the 5-year pre-**development** rate generated by the catchment area. The release rate is to be based upon the post-**development** outlet hydrograph mirroring the pre-**development** runoff hydrograph up to the 5-year level. Release rates not based on these criteria may be allowed by the **District** based on downstream conveyance system protection, stream protection, flood protection or water quality.

#### M.19.4 Geotechnical Considerations

- (a) Geotechnical investigations to address issues related to the design of all **stormwater** management lakes and dry ponds are to be undertaken as part of the planning and design studies, and are a prerequisite to the final design of such facilities.
- (b) Wherever possible, the **stormwater** storage facility shall be excavated in natural, stable ground. Should topography dictate that a berm be constructed along one or more sides of the basin, the berm shall be designed by a qualified professional **engineer** with relevant training and experience registered to practice in the Province of British Columbia.

#### M.19.5 Staged Construction - Standards for Interim Facilities

- (a) When **stormwater** management storage facilities are to be implemented in stages, the standards applicable to the design and construction of the interim facilities are to be generally in accordance with the standards set out herein for permanent facilities of that type. Where an interim dry pond facility is proposed as a preliminary stage in the implementation of a **stormwater** lake, it shall be designed and constructed in accordance with the criteria and standards applicable to a permanent dry pond.

#### M.19.6 Land Dedication

- (a) Generally, for storage not under private **Ownership**, the area of land covered by water when the basin is at the 5-year water level will be dedicated to the **District**. This dedication will also apply to all accesses to inlets/outlets, any structures and maintenance access routes to the facility.
- (b) Land that is adjacent to a basin which is subject to flooding as per the design standard established, but which is part of a privately-owned **developed parcel**, will be required to dedicate rights-of-way, to allow for encroachment of water onto the affected land. The right-of-way documents shall be prepared by the **development** proponent, naming the **District** as grantee.
- (c) A restrictive covenant will be placed on lots abutting the facility to control lot **development** so as not to compromise design requirements at the high-water level for major runoff events. This is to ensure an adequate freeboard is maintained.

#### M.19.7 Maintenance Access Requirements

- (a) An all-weather access for maintenance vehicles must be provided to all facility **works**. A vehicle access route shall also be provided to the edge of all storm water management lakes suitable to carry maintenance vehicles and for use as a boat launch point. The access surface shall be a minimum of 4.5 m wide, shall extend into the lake beyond the lake edge at normal water depth to a point where the normal water depth is 1.0 m, and shall be accessible from and extend to a public **road**. Sharp bends are to be avoided, and it shall have a straight run of 12 m or more leading to the lake edge (to permit a straight run in for launching of boats).

#### M.19.8 Emergency Overflow Provisions

- (a) The feasibility of an emergency overflow spillway is to be evaluated for each storage facility design and, where feasible, such provisions are to be incorporated in the facility design. In cases where a spillway is not feasible, then an overflow piped discharge to a receiving piped system or watercourse of sufficient capacity must be provided.

#### M.19.9 Landscaping Requirements

- (a) Landscaping plans for areas bounding the facility shall be submitted as part of the engineering design. Landscaping of all proposed public lands included for purposes of the facility and of all proposed rights-of-way on proposed private property up to the design high water level, is to be

part of the lake construction requirement and be dependent on the location and the context of the facility. The requirement for landscaping may be irrigated turf, constructed to the satisfaction of the **District**.

**M.19.10 Sediment Removal Provisions**

- (a) The facility design shall incorporate sediment capture and efficient removal for the control of solids which may be washed to the facility.

**M.19.11 Maintenance and Service Manual**

- (a) As part of the responsibility for design of a **stormwater** management storage facility the **Owner's Engineer** shall prepare and provide a maintenance and service manual for the facility.
- (b) Three complete copies of the manual are to be provided to the **District** prior to the time when the operation responsibility of the facility is transferred to the **District**, which will generally be at the time of substantial completion. The manual shall include complete equipment manufacturer's operation, maintenance, service and repair instructions, and complete parts lists for any mechanized or electrical equipment incorporated in the design.
- (c) The manual is to include, at a minimum, the following information:
  - (i) A copy of the **reviewed for construction** Engineering Drawings relating to the **Stormwater Storage Facility** and appurtenances, updated to "As-Constructed".
  - (ii) Schematic diagrams of the inlet and outlet arrangements, connections to and
  - (iii) Arrangement of upstream and downstream systems, including all controls, shutoff valves, bypasses, overflows, and any other operation or control features.
  - (iv) Location plans for all operating devices and controls, access points and routes, planned overflow routes, or likely point of overlapping in the case of exceedance of the design containment volume.
  - (v) Construction stage discharge curves with clear relationships of the construction stages relative to surrounding features.

**M.19.12 Signage for Safety**

- (a) The design for **stormwater** management facilities shall include the installation of signage to warn of anticipated water level fluctuations, with demarcation of maximum water levels to be expected for design conditions. Warning signs will be provided and installed by the **Owner**.

**M.19.13 Drawing Information**

- (a) The engineering drawings for any **stormwater** management facility are to include the following information, in addition to the physical dimensions:
  - (i) construction stage-volume and stage-area curves;
  - (ii) elevations at Normal Water Level, 5 Year Level and High-Water Level;
  - (iii) volumes at Normal Water Level, 5-year Level and High-Water Level
  - (iv) freeboard elevation;
  - (v) notation indicating the lowest allowable building elevation for lots abutting the lake;
  - (vi) contributing basin area;
  - (vii) measurements to locate submerged inlet(s), outlet(s) and sediment traps referenced to identifiable, permanent features which are not submerged at Normal Water Level.

**M.19.14 Side Slopes**

- (a) Areas normally or infrequently covered by water, from the design high water level down to a point 1.0 m below the normal water level shall have a maximum slope of 5 (horizontal) to 1 (vertical).

- (b) A slope of 3 (horizontal) to 1 (vertical) may be required from the 1.0 m depth point (below normal water level) to the pond bottom. The requirement for maximized slopes below water is an attempt to discourage the growth of unwanted vegetation.
- (c) In the case of constructed wetlands, benched areas above and below the Normal Water Level to encourage growth of aquatic and riparian plants is desirable.

#### M.19.15 Lake Bottom Material

- (a) For areas where the groundwater table is below the normal water level, the lake bottom and side slopes are to be composed of impervious material with a suitably low permeability (e.g. with a permeability coefficient in the order of  $1 \times 10^{-6}$  cm/s).
- (b) For areas where the groundwater table is expected to be near or above the normal water level, the lake bottom may be of a pervious material as dictated by geotechnical considerations.

#### M.19.16 Circulation Requirements

- (a) Narrow or dead bay areas where floating debris may accumulate are to be avoided. Inlets and outlets should be located with consideration of the need to maximize detention time and circulation within the lake water body.
- (b) The length of the wet pond relative to the width should not be less than 3:1 or greater than 6:1 so as to promote natural water circulation and avoid water quality deterioration associated with stagnant reaches within the facility.

#### M.19.17 Outflow Control

- (a) The outlet from a **stormwater** management storage system must incorporate appropriate means for control of outflow. In addition, the outlet **works** must include provisions for operational flexibility, and to address unintentional blockage of the outlet and the possible need to either stop outflow or increase the rate of outflow.

#### M.19.18 Drawdown Provisions

- (a) The means should be provided to permit discharge from storage facilities at the maximum rate of flow which the downstream system can accommodate after storm runoff peak flows have passed and the flows from other contributing areas have decreased or ended. The rate of discharge to be provided for drawdown purposes is to be sufficient to restore availability of storage capacity of facilities sufficiently to accommodate subsequent runoff events within a reasonable time frame. To achieve this purpose, drawdown of facilities is to be possible at rates to satisfy the following relationship of available volume to the time from commencing drawdown with the facility at the design high level as shown in TABLE M-5.

TABLE M-5 DRAWDOWN PROVISIONS	
Time After Commencing Drawdown From Full Level	Available Volume Required Below Design Full Level
24 hours	Volume equivalent of 1 in 10-year runoff
72 hours	100% of total storage volume

#### M.19.19 Submergence of Inlets and Outlets

- (a) Inlets and outlets are to be fully submerged, with the crown of the pipe at least 0.5 m below normal water level. Inlet and outlet pipe inverts are to be a minimum 0.1 m above the lake bottom.

**M.19.20 Provision for Free Outfall from Inlets to Lakes**

- (a) The invert elevation at the first manhole upstream from the lake in a minor system shall be at or above the normal water level of the lake to avoid deposition of sediments in the inlet pipe. To avoid backwater effects on the upstream sewers leading to the lake, the obvert of the inlet sewer at the first manhole upstream from the lake shall be at or above the lake level for the 1 in 5-year storm. A drop structure upstream from the lake will generally be required to achieve this. "Inlet" and "outlet" control calculations are required to verify the mode of operation of the lake inlets.

**M.19.21 Lake Edge Treatment**

- (a) Edge treatment or shore protection is required and shall be compatible with the adjacent land use. The treatment used shall meet criteria for low maintenance, safety, and ease of access to the water's edge.
- (b) The edge treatment is to cover ground surfaces exposed or covered by water during a lake level fluctuation to 0.3 m below or above the normal water elevation, and shall be adequate to prevent erosion of the lake edge due to wave action. The typical acceptable edge treatment shall be, but is not limited to, a 250 mm deep layer of well graded washed rock with a 75 mm minimum size or vegetated strip consisting of hardy materials suitable for this application.
- (c) The proposal of variations to the edge treatment minimum is encouraged with the final selection of edge treatment being subject to the approval of the District.

**M.19.22 Frequency of Operation**

- (a) All dry ponds shall be designed to temporarily detain excess runoff and thereby reduce the peak outflow rates to the connected downstream system. They shall not detain runoff for storms with post-development return periods of less than 2 years except where special provisions are made to facilitate clean up (i.e. paved bottom areas, etc.).

**M.19.23 Depth of Ponding**

- (a) The maximum live storage limit in a dry pond is 3.0 m, as measured from the invert elevation of the outlet pipe.

**M.19.24 Dry Pond Bottom Grading and Drainage**

- (a) The dry pond shall be graded to properly drain all areas after its operation. The dry pond bottom shall have a slope of 1.0% or greater. Sub-surface drains or similar means may be required where it is anticipated that these slopes will not properly drain the dry pond bottom, or where dictated by multiple use or other special considerations.

**M.19.25 Safety Provisions at Inlets and Outlets**

- (a) All inlet and outlet structures associated with dry ponds shall have grates provided over their openings to restrict access and prevent entry into sewers by children or other persons. A maximum clear bar spacing of 0.15 m shall be used for gratings.
- (b) Grated outlet structures are to be designed with a hydraulic capacity of at least twice the required capacity to allow for possible plugging. Further, the arrangement of the structures and the location of the grating shall be such that the velocity of the flow passing through the grating will not exceed 1.0 m/s. Appropriate fencing and guard-rails are to be provided to restrict access and reduce the hazard presented by the structure headwalls and wingwalls.
- (c) All inlet structures associated with infiltration basins shall have grates provided over their openings to restrict access and prevent entry into sewers by children or other persons. A maximum clear bar spacing of 0.15 m shall be used for gratings.

- (d) Appropriate fencing and guard-rails are to be provided to restrict access and reduce the hazard presented by the structure headwalls and wingwalls.

**M.19.26 Other Considerations**

- (a) An on-stream dry pond may be constructed upstream of a **road** crossing as long as geotechnical evaluations conclude that construction is appropriate. Facilities must be constructed to allow overtopping without causing undue erosion or damage. All facilities on fish bearing streams shall be designed to pass fish.
- (b) A detailed hydrogeological investigation must be conducted to support the proposed infiltration basin. The investigation must assess impacts to upstream and downstream properties and identify measures to alleviate impacts, if necessary.
- (c) To address the issue of sediment plugging during **development** in the catchment area, the basin is to be constructed to 90% of its ultimate depth and volume. When **development** in the catchment reaches 90%, the infiltration basin is to be completed.

**M.19.27 Outlet Design**

- (a) Infiltration basins do not have a formal outlet structure. As such, the storage volume must be based upon the complete runoff generated by the 1:100-year storm with no provision for outlet during the event, plus a 50% safety factor. In cases where a spillway is not feasible, then an overflow piped discharge to a receiving piped system or watercourse of sufficient capacity must be provided.

## **SCHEDULE N DESIGN AND CONSTRUCTION OF SEDIMENT AND EROSION CONTROL SYSTEMS**

### **N.1 General**

N.1.1 Where the provisions of this Bylaw require a sedimentation and erosion control system, the design and construction of such services must be in accordance with the provisions of this Bylaw.

### **N.2 Design Criteria**

N.2.1 The **Owner** must ensure that no silt, gravel or debris resulting from construction activity in the **subdivision or development** is allowed to discharge into existing drainage systems, natural drainage courses, water courses, or onto **highways** or adjoining properties.

N.2.2 All proposed **subdivision or development** projects must provide erosion and sedimentation controls to prevent the displacement of soil and the transport of sediment from the project site resulting from land disturbing activities. In order to prevent the displacement of soil and the sediment transport during land disturbing activities, erosion and sedimentation control measures are required and shall be performed as described below. Both temporary and permanent erosion and sedimentation controls both during construction and post-construction shall be implemented.

N.2.3 The objective of erosion and sedimentation control is to prevent the displacement of soil and the transport of sediment to streams, wetlands, lakes, drainage systems, **highways** and adjacent properties. Erosion on construction sites can result in excessive sediment transport to adjacent properties and to surface waters. Sediment transport can result in adverse impacts such as flooding due to obstructed drainage systems, smothering of aquatic habitat and the creation of algae blooms in lakes, among others.

### **N.3 Clearing Limits**

N.3.1 Prior to any site clearing or grading, areas to remain undisturbed during project construction shall be delineated and marked on-site by flagging or other method. At a minimum, clearing limit delineation shall be installed at the edges of all sensitive area buffers. Retain existing vegetation, where possible.

### **N.4 Cover Measures**

N.4.1 Temporary and permanent cover measures shall be provided when necessary to protect disturbed areas as detailed in the erosion and sedimentation control documents.

### **N.5 Perimeter Protection**

N.5.1 Perimeter protection to contain sediment from sheet flow shall be provided downslope of all disturbed areas where necessary as detailed in the erosion and sedimentation control documents. Such protection shall be installed prior to upslope grading. Perimeter protection includes the use of vegetated strips, as well as more conventional constructed measures such as silt fences.

**N.6 Traffic Area Stabilization**

N.6.1 Unsurfaced entrances, roads, and parking areas used by construction traffic shall be stabilized to minimize erosion and tracking of sediment off site as detailed in the erosion and sedimentation control documents.

**N.7 Sediment Retention**

N.7.1 Surface water collected from disturbed areas of the site shall be routed through a sediment pond or trap prior to release from the site as detailed in the erosion and sedimentation control documents, except areas at the perimeter of the site small enough to be treated solely with perimeter protection. Sediment retention facilities shall be installed prior to grading of any contributing area.

**N.8 Surface Water Controls**

N.8.1 Surface water controls shall be installed to intercept and convey all surface water from disturbed areas to a sediment pond or trap and discharge it downslope of any disturbed areas as detailed in the erosion control documents, except areas at the perimeter of the site small enough to be treated solely with perimeter protection. Significant sources of upslope surface water that drain onto disturbed areas shall be intercepted and conveyed to a stabilized discharge point downslope of the disturbed areas.

**N.9 Erosion Control Plan**

N.9.1 The **Owner's Engineer** must submit Erosion Control Plan detailing erosion and sedimentation control measures. All erosion and sedimentation control measures shall conform to the details and specifications in **District** Bylaws and policies unless an alternative is approved by the **District**.

**N.10 Construction within sensitive areas and buffers**

N.10.1 Unless a higher standard is required by a senior level of government, any construction that will result in disturbed areas on or within a stream or associated buffer, within a wetland or associated buffer, or within 15 metres of a lake or other water way shall be subject to "best management practices" including but not limited to "Urban Runoff Quality Control Guidelines for the Province of British Columbia from the Municipal Waste Branch Environmental Protection Division BC Environment" (June 1992) for erosion and sediment control. These provisions include phasing the project whenever possible so that construction in these areas is limited to the dry season.

**N.11 Maintenance**

N.11.1 All erosion and sedimentation control measures shall be maintained as per the erosion and sedimentation control plans submitted by the **Owner's Engineer**. The **Owner's Engineer** shall be responsible for ensuring maintenance and review of erosion and sedimentation control and for compliance with all conditions relating to erosion and sedimentation control.



**N.12 Final Stabilization**

**N.12.1** Prior to obtaining **total performance**, the site shall be stabilized and the structural erosion and sedimentation control measures (such as silt fences and sediment traps) shall be removed and drainage facilities cleaned as specified.

## SCHEDULE O DESIGN AND CONSTRUCTION OF STREET LIGHTING

### O.1 General

O.1.1 The **Owner** must provide **street lighting** designed and constructed in accordance with this Bylaw.

O.1.2 The **District Engineer** may require additional **street lighting** be installed in locations where **street lighting** will improve public safety.

### O.2 Design Criteria

O.2.1 Lighting is generally required in all urban and suburban areas. In other areas, lighting requirements shall be in accordance with warrants as indicated in the Transportation Association of Canada Guide for the Design of Roadway Lighting.

### O.3 Decorative Street lighting

O.3.1 Additional requirements for decorative **street lighting** shall apply to areas identified in the Town Centre Road and Bottom Wood Lake/Woodsdale Roads areas.

FIGURE O-1 Bottom Wood Lake/Woodsdale Roads

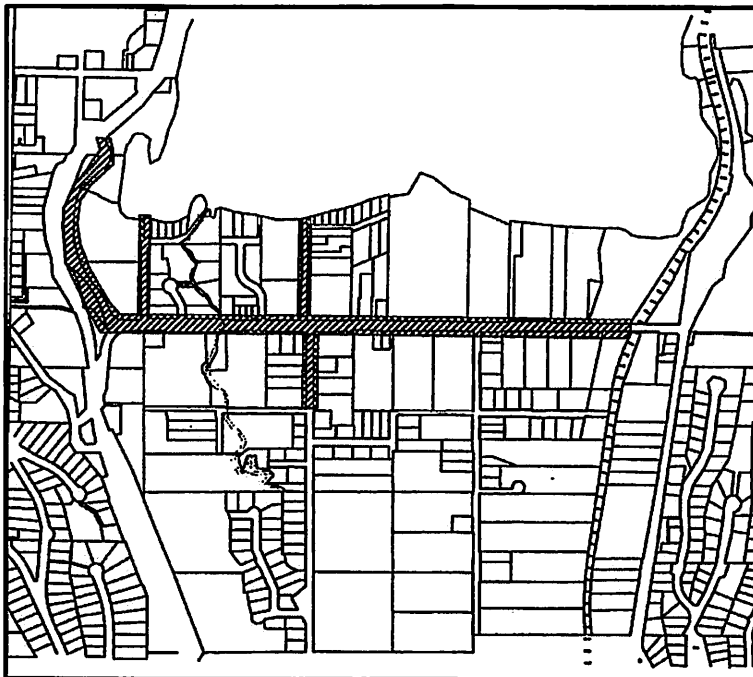
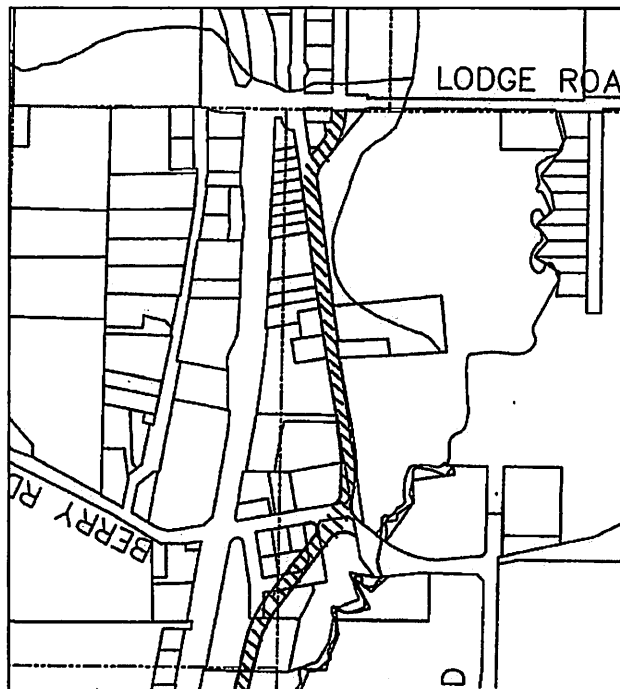


FIGURE O-2 Town Centre Road



O.3.2 Where decorative lighting is required, the following shall apply:

Decorative Luminaire

- King Luminaire K124 Paragon Series

Decorative Pole

- West Coast Engineering #23300-15FT-Rayleigh Series7

Pole Shall include:

- 15 Foot tapered steel shaft;
- Baseplate on pole shall be supplied with a 297 mm. bolt circle diameter (197 mm. bolt square) that will accept 1" diameter galvanized bolts;
- Handhole cover shall be 102 mm. x 178 mm. mounted 222 mm. up from the pole baseplate; and
- Decorative cast aluminum base shall be the two-piece wraparound Raleigh Series.

O.3.3 Fixtures shall be approved by the **District Engineer**.

O.4 **Codes and Standards**

O.4.1 Streetlight designs shall be performed to the latest edition of:

- IRDMA/AMSO RP-8 Design Guidelines for Roadway Lighting
- IESNA DG-19-08 Design Guidelines for Roadway Lighting
- IESNA DG-5 Recommendations for Walkways and Class 1 Bikeways
- CSA C653 Energy Efficiency
- MMCD**, Specifications, and Standard Drawings
- BC Electrical Code
- Transportation Association of Canada Guide for the Design of Roadway Lighting
- WorkSafe BC
- BC Hydro and FortisBC Design Guidelines

## O.5 Permits

O.5.1 It is the **Owners** sole responsibility to obtain all required electrical permits and inspections. A copy of the permits shall be submitted to the **District** upon application for **final approval**.

## O.6 Levels of Illumination

O.6.1 The average levels of illumination in lux must be as shown in TABLE O-1

TABLE O-1 LEVELS OF ILLUMINATION		
ROAD CLASSIFICATION	RESIDENTIAL AREAS	COMMERCIAL AND INDUSTRIAL AREAS
Arterial Highway	9.0 lx	17.0 lx
Collector Highway	6.0 lx	12.0 lx
Local Highway	4.0 lx	9.0 lx
Walkways	5.0 lx	5.0 lx

Note: The maximum uniformity ratio for local residential **roads** and **walkways** shall be 5:1 and for all other **roads**, be 3:1. The uniformity ratio is expressed as the average horizontal lux divided by the minimum horizontal lux.

## O.7 Light Loss Factor

O.7.1 Designs shall be performed using a light loss factor (LLF) per **MMCD** and IESNA design guidelines. The light loss factor shall take into account both lamp lumen depreciation (LLD), lamp dirt depreciation (LDD), and ballast factor (BF).

## O.8 Pole Specifications

O.8.1 In general, poles must be installed as follows:

- (a) **Arterial highways** - staggered spacing.
- (b) **Collector highways** - staggered spacing.
- (c) **Local highways** - spaced one side of street behind **sidewalk** if **sidewalk** required, otherwise staggered spacing.
- (d) **Walkways** - one at every entrance to a **walkway** and additional lighting where required to meeting illumination requirements. Design of the light distribution pattern must minimize light spill into adjoining properties.

O.8.2 Poles must be located within 0.6 metres of the property corners and must not conflict with driveways, underground services and fire hydrants. Street lighting poles shall be installed in accordance with Standard Drawings.

O.8.3 Pole heights shall be 6.7 metres for **local highways** and 9.0 metres for **collector highways**.

O.8.4 Luminaire poles shall be per MMCD standard drawings E4.1 and E.4.2. Concrete bases shall be Type C trapezoidal concrete per MMCD standard drawing CE1.3.

O.8.5 Poles shall black powder coat finish.

**O.9 Products**

O.9.1 Unless otherwise approved by the **District Engineer**, LED fixtures shall be used for the streetlights. Fixtures shall be full cut-off fixtures with the exception of some decorative lighting fixtures for the purpose of matching decorative styles in existing areas. For every 10 fixtures, 1 spare luminaire and pole shall be provided.

O.9.2 All luminaires shall be Phillips Roadstar series or equivalent as approved by the **District Engineer**.

**O.10 Scheduling**

O.10.1 Scheduling of **work** with the governing electrical authority is the **Owner's** responsibility. Where costs are incurred with B.C. Hydro or FortisBC in installing the light system, these costs shall be considered as part of the cost of the system and shall be at the expense of the **Owner**.

**O.11 Approval**

O.11.1 Prior to issuance of a **Certificate of Total Performance**:

- (a) the **Owner** must submit a copy of the Certificate of Inspection by the governing electrical authority showing that the installation is unconditionally approved.
- (b) If the **subdivision or development** is not located in an existing streetlight local service area, the **Owner** must submit a letter formally requesting that the local service area boundary be expanded to include the **subdivision or development**.

**O.12 Connection to Utility**

O.12.1 An allowance for a minimum of eight streetlights per electrical connection must be made and future extension of the **street lighting** system should be accommodated in this requirement.

O.12.2 Connection shall be made in accordance with Standard Drawings.

O.12.3 All **street lighting** in public right of ways must be provided with electrical metering equipment in accordance with standards of the appropriate electrical utility.

O.12.4 All **street lighting** kiosks must have a test switch.

O.12.5 Single service bases shall be per MMCD standard drawing E4.21. Where required, an aluminum single sided, single door, CSA type R3 rated kiosk may be used for meter installation.

**SCHEDULE P DESIGN AND CONSTRUCTION OF ELECTRICAL AND COMMUNICATIONS WIRING AND GAS DISTRIBUTION SYSTEMS**

**P.1 General**

P.1.1 Power supply, communication wiring, and gas service for each **parcel** must be designed and constructed in accordance with this Bylaw.

P.1.2 The **Owner** must obtain a letter of confirmation from the applicable utility that electrical, communication, and gas distribution infrastructure have been installed to their satisfaction.

P.1.3 Kiosks/Laminate Wrapping Requirements – All kiosks must be wrapped with anti-graffiti vinyl wrapping. Wrap material must be a cast vinyl with a high gloss laminated surface. The wrap is to be visually pleasing and compliment the area surrounding the installation location considering landscape, geography, and general theme of the area. Artwork must have a high degree of contrast so as to maximize resistance to graffiti vandalism. Artwork must not be for commercial advertising. All artwork must be approved by the **District Engineer** prior to installation.

**P.2 Utility Locations**

P.2.1 Systems of **works** for electrical and communications wiring and gas distribution systems must be installed in accordance with the standards required by the particular utility and any applicable federal and provincial codes.

P.2.2 All utility **work** must be installed in alignments as generally indicated on Standard Drawings. It is the responsibility of the **Owners Engineer** to coordinate with each utility the actual offsets required prior to a drawing submission to the **District**.

P.2.3 All systems must be designed and constructed so as to fully service all **parcels** in a **subdivision** or **development**.

## SCHEDULE Q DESIGN AND CONSTRUCTION OF HILLSIDE DEVELOPMENT AREAS

### Q.1 General

Q.1.1 In steep slope areas where it is impractical to conform to technical requirements of this Bylaw and a Hillside **Development** permit has been issued by the **District**, the **District Engineer** may approve **works** which comply with the criteria set out in this schedule.

Q.1.2 Use of this schedule is required in steep slope development areas. **Steep slopes** means lands in their natural state that have a slope angle of 20% or greater for a minimum horizontal distance of 10 meters, or adjacent areas where existing or potential sloughing or stability warrants concerns. The definition applies to all properties which are 0.5 hectares or greater in size, and where 10% or greater of the parent property contains slope of more than 20%.

Before agreeing to the use of this Schedule, the **District Engineer** must be satisfied that use is warranted due to the topographical constraint involved and that the varied criteria are presented and accepted as good engineering practice and that the varied criteria are environmentally sound and do not adversely affect transportation or public safety.

### Q.2 Pre-design Report

Q.2.1 When an approved hillside **development** permit is in place for the proposed **subdivision or development** and prior to carrying out a design and submitting design drawings, the **Owner's Engineer** must prepare a pre-design report that considers the following:

- (a) Use of innovative design techniques that minimize impacts to:
  - (i) Future land **development**,
  - (ii) Ongoing maintenance and operation
  - (iii) Sensitive **steep slopes**, and
  - (iv) Natural drainage areas.
- (b) Consideration of detailed geotechnical, slope stability, hazard assessments, and hydrogeological reports.

Q.2.2 Specifically address and provide recommendations for:

- (a) Slope Stability concerns. The **District Engineer** may require a more intensive investigation as outlined in the Guidelines for Legislated Landslide Assessments for Proposed Residential **Developments** in BC – APEGBC May 2010.
- (b) A lot grading and drainage management plan that mitigates the potential impacts on site and downstream. The drainage management plan shall include at a minimum the following:
  - (i) Existing and proposed topography.
  - (ii) Key cross sections showing cuts and fills related to building sites, **roads**, and retaining walls.
  - (iii) Erosion and sedimentation control and protection.
  - (iv) Pre-and post-**development** hydrogeological conditions above, through and below the subject properties.
  - (v) **Stormwater** quality and treatment.
  - (vi) Protection of natural drainage patterns or water courses.
  - (vii) Drainage control around future buildings and between upper and lower lots.
  - (viii) Control and discharge of roof and footing drainage.
  - (ix) Consideration of overland flow routes for major storm events.
- (c) Restrictions on irrigation and removal of vegetation.

- (d) Assessment of up gradient and down gradient conditions.
- (e) Land clearing and tree retention and removal plans.

Q.2.3 Roads

- (a) Hillside collector **roads** shall accommodate traffic volumes servicing a maximum of 500 units. If on-street parking is desired, additional right of way width may be required.
- (b) Hillside local **roads** shall provide access to residential dwellings and accommodate traffic volumes servicing a maximum of 200 units. Hillside local **roads** may provide access on both sides of the **road**, one side or no access. Local **roads** must either connect to another **road** on each end or provide a turnaround at the terminus.
- (c) Hillside emergency vehicle access routes shall provide vehicle and pedestrian access to and from the **development** and should restrict non-emergency vehicles through the use of gates or similar moveable obstructions. Primary access to individual properties cannot be via the hillside emergency vehicle access.

Q.2.4 Rock Cuts

- (a) Rock cut catchment areas are required for **roads**. The minimum catchment width will be as recommended by the geotechnical **engineer**. The catchment area is to be located within the **road** right of way. The structural separation of the catchment area from the remainder of the **roadway** shall be as recommended by the geotechnical **engineer**. Fencing at the bottom and top of rock cuts shall be as recommend by the geotechnical **engineer**.

Q.2.5 Vertical Alignment

- (a) Engineering design grades shall be as per **TABLE Q-1** Located at the end of this schedule.

Q.2.6 Horizontal Alignment

- (a) Engineering design for horizontal curves shall be per **TABLE Q-1**

Q.2.7 Roadway Cross Sections

- (a) Roadway cross sections may be as illustrated in Standard Drawings and as shown in **TABLE Q-1**
- (b) The **District Engineer** may consider alternative utility offsets within **road** section.

Q.2.8 Road Lane Grade Separation (Split-Road Section)

- (a) Cross-sectional separated grade (one way) **lanes** are a design option to minimize excessive cut/fill slopes, protection of large trees, improve property access or allowance for gravity sewer connections for down slope lots to the street. Normal traffic flow patterns, maintenance vehicle access, and emergency vehicle access must be carefully considered.

Q.2.9 Intersection Grades

- (a) Through street maximum grade is 8%.

Q.2.10 Storm Drainage

- (a) Ditching, swales, or natural drainage courses exceeding 6% slope require a cross section that will mitigate risks of erosion from minor and major events taking into account soil type, water flow rates, and velocity.
- (b) Roof leaders and foundations drains shall be discharged to a closed **storm drainage system**, where one has been provided for this purpose.



Q.2.11 Utility Corridors

- (a) The width of the underground utility corridor shall consider depth of bury, access, separation from private structures, and long-term operation and maintenance as well as the utility provider's standards for servicing.

Q.2.12 Retaining Walls/Stairways

- (a) Any retaining or landscape structures used to mitigate steep slope impact must be identified with profiles and typical cross sections.

Q.2.13 Driveway Access

- (a) Reciprocal driveway access may be used for a maximum of 3 lots. The maximum grade for a private or shared driveway shall be 2% for the first six (6) meters and 12% thereafter where hardsurfaced and 15% where not hardsurfaced.
- (b) In areas with severe vertical curves, driveway locations may require modification to maintain proper sight lines and stopping sight distance.

Q.2.14 Solid Waste Collection

- (a) Special attention shall be given to the provision and location of areas designated for positioning of solid waste collection carts.

Q.2.15 Site Restoration

- (a) Restoration practices shall be specifically identified to address the type and degree of disturbance and the specific conditions of the site.

Q.3 Detailed Design

Q.3.1 Detailed design must also consider the following:

- (a) Underground infrastructure pipe bedding, trench backfill, and mechanical restraints.
- (b) Roadwork structure, barrier curb, and the requirements for safety barriers.
- (c) Driveway access concerns.
- (d) Building code structural or foundation requirements.
- (e) Environmental impact assessment.
- (f) A list of requirements on a lot by lot basis pertaining to covenants that may be required.
- (g) Each **parcel** created by **subdivision** must have a buildable site with building envelope setbacks and driveways shown on the design drawing.
- (h) **Boulevard** grades in excess of 2% may be designed with the following conditions:
  - (i) to a point 1.0 m from the back of **sidewalk** or curb (where no **sidewalk** present) where on street parking is provided and to a point 2.4 m back where parking is adjacent to the street, behind the curb, as long as it can be demonstrated that the depth of bury on underground utilities will not be negatively impacted and there is sufficient space for snow storage.
  - (ii) In areas where the **boulevard** grade exceeds 2%, the **Approving Officer** may require the developer to undertake **boulevard** slope stabilization and planting.
- (i) In no case shall the grade from the property line to back of **sidewalk**, back of curb, or back of ditch be less than 1%.
- (j) Level access and clearance of 1.3m around fire hydrants, transformers, and vaults must be established.

- (k) Centre median cross-section slope protection from erosion. Centre medians must be designed to be maintenance free.
- (l) Alternate utility offsets.
- (m) Down slope **road** section with storm mains and sanitary mains in common trench.
- (n) Cut/fill slopes, vegetation planting, retaining wall structures, and parking and associated sight distances shall be designed to protect all site distances.
- (o) Side yard and rear yard utility corridors shall only be approved if they are included in a right-of-way that restricts the construction of permanent structures (excluding fences).
- (p) Utility service and transformer boxes, which need to be at **road** grade, require suitable grading and retaining structures.
- (q) Disturbed areas within the **road** right-of-way or on disturbed areas of the site that are not within formal landscaped areas or building envelopes shall be restored to a natural condition or to a condition that will prevent erosion prior to **substantial performance** being issued or final occupancy in the case of a Building Permit application.
- (r) Individual driveways should:
  - (i) Have a grade of not more than 20%. If this is not achievable, 2 readily accessible off-**road** parking stalls shall be provided on the property.
  - (ii) On the downslope driveways, the driveway grade for the first 3.5 m length from property line shall not be greater than 7%.

TABLE Q-1 -HILLSIDE DEVELOPMENT STANDARDS

STREET TYPE	CONDITION <sup>1</sup>	DESIGN SPEED	MAX. GRADE	ROW WIDTH <sup>5</sup>	PAVEMENT WIDTH (M) <sup>2</sup>	PARKING <sup>5, 6</sup>	CURB & GUTTER	SIDEWALK <sup>3, 4</sup>	STREET TREES
<b>HILLSIDE LOCAL ROAD</b>									
Development fronts both sides	A	40	12	14	6.4	Both sides	Barrier	1	Optional
Development fronts one side	B	40	12	12	6.0	Both sides	Barrier	1	Optional
No Development fronting	C	40	12	10	6.0	Where Required <sup>8</sup>	Barrier	1	Optional
<b>HILLSIDE COLLECTOR ROAD</b>									
Development fronts both sides	A	50	10 <sup>7,9</sup>	18	9.4	Above curb Both sides	Rollover <sup>10</sup>	2	2 Sides
Development fronts one side	B	50	10 <sup>7,9</sup>	15	9.4	Above curb Both sides	Rollover <sup>10</sup>	1	2 Sides
No Development fronting	C	50	10 <sup>7,9</sup>	14	9.4	Where Required <sup>8</sup>	Barrier	1	2 Sides
<b>HILLSIDE EMERGENCY VEHICLE ACCESS</b>									
		20	15	4.5	4.6				

<sup>1</sup> Condition refers to Standard Drawings SD-HS1, SD-HS2 and SD-HS3.

<sup>2</sup> Pavement width measured from back of curb.

<sup>3</sup> **Sidewalks** shall terminate at a destination or connect with another **sidewalk** or pathway. The numbers indicate whether **sidewalk** is required on either one or both sides of the street.

<sup>4</sup> **Sidewalks** are not required on local streets in steep slope areas unless they are required to provide connectivity to schools, parks, commercial areas or lands beyond.

<sup>5</sup> Roadway cross sections may be further reduced in width if parking is to be established at strategic locations.

<sup>6</sup> Split **road** section **lane** widths require 3.0 m traveled **lane** plus 2.5 m parking or cycling width.

<sup>7</sup> Collector Streets maximum grades may be increased to 12% where necessary due to topographic constraints. Where approved, grades exceeding 10% shall be topographically surveyed at the developers' expense, to verify final **road** grades, prior to final **subdivision** approval.

<sup>8</sup> Required adjacent to parks, green space and /or trail access points.

<sup>9</sup> Except for the 100-metre portion of Chase Road intersecting with Glenmore Road as shown on Standard Drawing SD-HS4 attached to the Administrative Subdivision and Development Standard Forms Policy 155, 2017, as amended from time to time, and generally fronting portions of the following properties:

- 5000 Chase Road, Lot 2 Plan KAP81535, PID 026-759-900, Roll 02121.002
- 5474 Chase Road, Lot C Plan KAP87779, PID 027-694-968, Roll 02118.003; and
- 5235 Chase Road, Lot A Plan KAP35082, PID 002-897-687, Roll 02173.372,

<sup>10</sup> to act as gutter pan

TABLE Q-2-HILLSIDE ALIGNMENT DESIGN CRITERIA

Criteria	Design Speed			
	60 km/h	50 km/h	40 km/h	30 km/h
<b>1. Horizontal Curve Radii</b>				
Roadway				
normal crown (-2%)	260m	165m	90m	45m
2% superelevation	205m	120m	65m	30m
4% superelevation	150m	80m	45m	22m
6% superelevation	120m	-	-	-
Through Intersections	200m	120m	70m	40m
<b>2. Superelevation</b>				
Maximum Superelevation	6%	4%	4%	4%
Maximum Superelevation at Intersection	4%	4%	4%	4%
<b>3. Superelevation Transition Lengths</b>				
Transition Lengths (2/4 lane roadways) <sup>1</sup>				
normal crown to +2%	24m/36m	22m/34m	20m	20m
normal crown to +4%	38m/54m	33m/50m	30m	30m
normal crown to + 6%	48m/72m	-	-	-
Min. Tangent Length between reversing				
2% superelevation (2/4 lane roadways) <sup>2</sup>	15m/22m	13m/20m	12m	12m
4% superelevation	28m/42m	26m/40m	24m	22m
6% superelevation	42m/64m			
<b>4. Gradients</b>				
Minimum Grade	0.50%	0.50%	0.50%	0.50%
Maximum Grades				
on horizontal tangents	8% <sup>3</sup>	10% <sup>4</sup>	12%	12%
on minimum radius horizontal curves <sup>5</sup>	8%	9%	10%	10%
Grades Through Intersections				
with design speed on major road	8%	8%	8%	-
approach distance for major road <sup>6</sup>	15/5m <sup>7</sup>	5m	0m	-
with design speed on minor road	5% <sup>8</sup>	5%	6%	6%
approach distance for minor road <sup>9</sup>	20m	15m	5m	5m
<b>5. Vertical Curve K Values</b>				
Criteria				
Minimum Crest	15	8	4	2
Minimum Sag	10	7	4	2
Crest/Sag on approach to stop condition	4	3	2	2
K values listed assume that new roadways will be illuminated				
<b>6. Stopping Sight Distances</b>				
Down grades: 12%	109m	78m	52m	34m
9%	101m	73m	50m	32m
6%	94m	69m	48m	31m
3%	89m	66m	46m	30m
0%	85m	63m	45m	30m
Up grades: 3%	81m	61m	44m	29m
6%	78m	59m	42m	29m
9%	76m	57m	41m	28m
12%	73m	56m	40m	28m
<b>7. Decision Sight Distance</b>				
Minimum decision sight distance for 60km/h: 175m-235m.				

- <sup>1</sup> Values for transition lengths include tangent runoff applied at the same rate as superelevation runoff.
- <sup>2</sup> 60% of superelevation runoff occurs on the tangent approach and 40% on the curve, resulting in a minimum length of tangent between reversing curves of 120% of the superelevation length.
- <sup>3</sup> Under special circumstances, grades up to 10% may be permitted.
- <sup>4</sup> Under special circumstances, grades up to 12% may be permitted.
- <sup>5</sup> Applies where radius is less than 1.5 times minimum allowable radius.
- <sup>6</sup> Minimum distance back from the gutter line of the minor **road** that the specified grade may not be exceeded.
- <sup>7</sup> Distances for design **road** approach to intersection with collector **road**/local **road**.
- <sup>8</sup> 4% desirable.
- <sup>9</sup> Minimum distance back from the gutter line of the major **road** that the specified grade may not be exceeded.
- <sup>10</sup> Note that decision sight distance applies only to multi-lane **roads** at intersections.
- <sup>11</sup> The range of values recognizes the variation in complexity that occurs at various sites. For less complex situation, values towards the lower end of the range are appropriate and for more complexity, values at the upper end are used.

## **SCHEDULE R DRAWINGS**

### **R.1 General**

R.1.1 Where **works** are required to be constructed to service a **subdivision** or **development**, the **Owner's Engineer** must prepare engineering design drawings in accordance with the provisions of this Bylaw.

R.1.2 Drawings submitted to the District for review subsequent to the initial drawing submission, must clearly identify any revisions using a "revision cloud".

R.1.3 When required, the **District Engineer** may request that the **Owner's Engineer** provide 3-dimensional renderings of the proposed **subdivision** or **development**.

### **R.2 MMCD**

R.2.1 **MMCD** Standard Detail Drawings must be referenced to and interpreted simultaneously with the pertinent sections of this Bylaw.

R.2.2 AutoCad Standard border and blocks shall be as per **MMCD**.

### **R.3 As-Constructed Drawings**

R.3.1 Prior to the issuance of a **Certificate of Total Performance** the **Owner** must deposit with the **District**:

- (a) one complete set of original as-constructed drawings; and
- (b) electronic copies of the drawings in a format acceptable to the **District Engineer**.
- (c) one set of Service Cards in the prescribed format for:
  - (i) Water
  - (ii) sanitary sewer
  - (iii) storm sewer
  - (iv) fire hydrants

R.3.2 As-constructed drawings must be prepared in accordance with the provisions set out in this Bylaw.

### **R.4 Design Drawings**

R.4.1 In simple servicing cases where a standard drawing contained in this Bylaw is deemed by the **District Engineer** to be sufficient for construction purposes, the **District Engineer** may, in his sole discretion, waive the requirement for design drawings where a **District** approved **contractor** is being used

### **R.5 Standard Drawings**

R.5.1 Existing **works** refers to previously constructed **works**.

R.5.2 Proposed **works** refers to **works** to be constructed and installed during the current **subdivision** or **development** phase.

R.5.3 Future **works** refers to any **works** that will be constructed or installed in future phases or as a part of a **District** construction project.

R.5.4 Where no standard is defined in this Bylaw for the preparation of a drawing to portray a particular service, structure, or other item, instructions and requirements shall be obtained from the **District Engineer**.

R.5.5 The drawings must include a title page, key plan, building envelope plan, composite utility plan, plan profile, details, cross sections, and any other related drawings.

## R.6 Preparation

R.6.1 Drawings must be prepared:

- (a) Using the **District** standard border, title block, drawing symbols and material symbols in accordance with **District** Standard Drawings. The drawings are available from the **District Engineer** in electronic format.
- (b) using a cadastral base that matches the legal plan upon which a building permit application is based or on the legal plan which will be sent to the Land Titles Office for registration of the proposed **subdivision**.
- (c) in accordance with the sample engineering drawings.

## R.7 Sheet Layout

R.7.1 Sheet layout shall conform to the following standards:

- (a) Sheet size to be A1.
- (b) All information shall be completely contained within the drawing borders and shall not encroach on the title block.
- (c) Place north arrow close to the top right-hand side of the sheet. For fragmented plan views, place north arrow at the top right-hand side of each fragment.
- (d) North arrow must point towards the top of the page or towards the left-hand edge of the page.
- (e) In all cases the title page, key plan, location plan and composite utility plan must be oriented in the same direction.
- (f) Matchlines must be drawn and reference the appropriate sheet showing the continuation if the size of the **subdivision** or **development** makes it necessary to place the key plan or composite utility plan onto two or more sheets.

## R.8 Dimensions and Units

R.8.1 The following conventions must be used:

- (a) Dimensions and units must be shown in metric. No imperial units are permitted.
- (b) Distances must be in meters and grade in percent to an accuracy of 2 decimal places.
- (c) Elevations to an accuracy of 3 decimal places.
- (d) Areas must be in square meters rounded to the nearest square meter.
- (e) Pipe sizes must be in millimeters as per ASTM specifications using 1" = 25 mm.
- (f) Existing imperial dimensions, except for pipe sizes, are to be soft converted using the factors of 1 inch = 25.4 millimeters or 1 foot = 0.3048 meters.

**R.9 Lettering**

R.9.1 Lettering must conform to the following:

- (a) All lettering to be upper case AutoCAD - Romans.
- (b) All lettering to maintain a 1:10 ratio between plotted text height and plotted pen thickness.
- (c) The minimum plotted text height shall be 1.5 mm.
- (d) The maximum plotted text height shall be 5.0 mm.
- (e) Use black ink on all as-constructed drawings except that green ink may be used on the plan profile grid lines.

**R.10 Scales**

R.10.1 The following scales must be used:

- (a) Plan View Drawings 1:500
- (b) Plan and Profile Drawings Horizontal 1:500 Vertical 1:50
- (c) Scales for location plans, key plans, cross-sections, and details shall be chosen as deemed suitable for the application.

**R.11 Title Page**

R.11.1 Title Pages shall contain the following information:

- (a) Name of **development**
- (b) Name and address of **development**
- (c) Name and address of **Engineer**
- (d) Site plan of **subdivision or development**
- (e) Overall plan with lot numbers, plan numbers and street names for the subject **development** and adjoining properties.
- (f) For phased **development** all phases must be shown with the current phase outlined darker than future or existing phases.
- (g) File numbers of approving authorities, (i.e. **District** and the Ministry of Transportation and **Highways**).
- (h) Complete list of drawings belonging to the set.
- (i) Legal description of subject properties.
- (j) North Arrow
- (k) The lettering used on this page is not required to conform to R.9.1 in respect to text styles and text height.

**R.12 Key Plans**

R.12.1 Key Plans shall contain the following information:

- (a) Lot numbers, plan numbers, and **road** names of the subject **development** and adjoining properties.
- (b) Cross reference of the detailed drawings by outlining the area contained in each drawing and referencing that drawing by drawing number.
- (c) North Arrow.



### R.13 Building Envelope Plan

R.13.1 Building Envelope Plan shall contain the following information:

- (a) Overall plan of current phase
- (b) Lot numbers
- (c) **Roads**, curbs, gutters and **sidewalks**
- (d) Rights of way and easements
- (e) Offset lines from all property boundaries indicating required building setbacks
- (f) 10 meter by 10 meter square on each **parcel** indicating the required minimum building envelope
- (g) Notes that indicate the required setbacks from all property boundaries pursuant to the Zoning Bylaw
- (h) North arrow
- (i) Minimum building elevation

### R.14 Composite Utility Plan

R.14.1 Composite Utility Plans shall contain the following information:

- (a) All existing and proposed utilities, **roads**, **walkways**, and **sidewalks**.
- (b) All rights of way and easements including widths.
- (c) Control station monuments with identification number.
- (d) All legal information, including bearings, dimensions, lot numbers, block numbers, legal plan numbers, and street names. All lots must be numbered.
- (e) Show all BC and EC locations on curved lot lines.
- (f) Dimensions for curved lot lines shall include radius and arc length.
- (g) All **roadway** dimensions including width of right of way, BOC to BOC and BOC to edge of right of way.
- (h) Area of each **parcel**.
- (i) Lots with curved **frontage** that do not meet the minimum **frontage** requirement, show arc length and radius at property line and at 6.0 meter offset.
- (j) North Arrow.

### R.15 Plan and Profile Drawings

R.15.1 The plan and profile drawings shall be prepared in accordance with this section and shall be divided into two parts: plan view on the top half of the page and profile view on the bottom half of the page.

R.15.2 For complex servicing with multiple utilities located within the same corridor or alignment, each utility shall be shown on a separate plan and profile drawing in addition to composite plan and profile drawings.

R.15.3 Plan Views must be divided into two views as follows:

- (a) Above Ground View, must include the following:
  - (i) All features and utility installations visible above ground
  - (ii) Lot numbers
  - (iii) Dimensions establishing location of all surface **works** constructed within statutory rights of way and easements.
  - (iv) Horizontal curve data for **road** centerlines including radius, arc length, tangent length, and delta angle.

- (v) Curb, gutter, and **sidewalk** information including type of curb, width of **sidewalk**, location of letdowns for driveways, wheelchair ramps, etc.
- (b) Below Ground View, must include the following:
  - (i) Lot numbers
  - (ii) All underground utilities such as sanitary and storm sewers, water, electrical and communication wiring, gas and all applicable appurtenances.
  - (iii) Utility alignment referenced to the nearest property line or right of way boundary.
  - (iv) Size of all pipes and direction of flow for sewers.
  - (v) Specifications for all fittings, valves, and hydrants.
  - (vi) Geodetic invert elevations at property line for all sewer services connected directly into manhole.
  - (vii) Lot services (sanitary, storm, water) referenced to the nearest legal pin.

**R.15.4 Profile View**

- (a) Profiles shall be drawn on a grid that has horizontal lines with 2 mm spacing and vertical lines with 20 mm spacing. Horizontal lines must be accented every 20 mm. All vertical lines must be accented. All elevations shall be relative to a geodetic datum.

**R.15.5 Plan and profile drawings must include the following:**

- (a) Continuous stationing on the accented vertical grid line.
- (b) Pre-construction ground profile along the centerlines of proposed **roads**. In statutory rights of way or easements, show pre-construction ground profile for each utility. Include any related data or date surveyed.
- (c) Profile shown at true centerline length and projected above to the plan view in as close a relationship as possible.
- (d) **Road** centerline profile including the following information:
  - (i) percent grade
  - (ii) chainage and elevations of BVC, EVC, and PVI
  - (iii) external "e" value
  - (iv) "K" value
  - (v) "A.D." value
  - (vi) length of vertical curve
  - (vii) station and elevation of low point or high point vertical curves
  - (viii) on super elevated curves and crossfall sections, show percent crossfall and transition length and crown
- (e) Profiles of invert and crown of pipes for sanitary sewer, storm sewer, and water mains as well as length, size, type, grade, and class of pipe (i.e. 75 m 200 mm SAN SDR 35 PVC at 2.38 %).
- (f) Manhole rim elevations and invert elevations at all inlets and outlets.
- (g) Top and bottom inverts on manhole drop structures.
- (h) Location type, and elevation of all crossing utilities.
- (i) Gutterline and grate elevations for catch basins.
- (j) Elevations at the right- and left-hand side of the profile and repeated at breaks in the profile.
- (k) Elevations at every even metre graduation on the horizontal accented line.

**R.16 Electronic Drawings**

**R.16.1 General Requirements**

- (a) The **Owner** must submit to the **District Engineer** a complete set of electronic drawings of the **subdivision or development** in DWG format compatible with the current version of AutoCAD being used by the **District**.

The electronic drawing must be prepared in accordance with this Bylaw.

**R.16.2 Conventions**

- (a) Drawing symbols must be in accordance with Standard Drawings.
- (b) Material symbols must be in accordance with Standard Drawings.
- (c) No drawing shall be submitted that contains any external references (xrefs).
- (d) All as-constructed drawings must be purged of all unnecessary information prior to submission to the **District**.

**R.16.3 Prototype Drawings**

- (a) An electronic copy of the **District** prototype drawing is available from the **District**. The prototype drawing contains the **District** standard border, titleblock, layers, blocks and linetypes to be used in all submissions of design or as-constructed drawings.

Standard Detail Drawings are provided in Subdivision Standard Forms Policy 155, 2017. Where not superseded by a **District** drawing, the relevant **MMCD** Standard Detail Drawings must be referenced and interpreted simultaneously with this bylaw.

## **SCHEDULE S FORMS, AGREEMENTS, AND CERTIFICATES**

### **S.1 Subdivision and Development Servicing Agreement**

S.1.1 Prior to **works** being carried out:

- (a) on a **District highway** or
- (b) in a statutory right of way in favour of the **District**

for the servicing of a **subdivision** or **development**, the **Owner** must:

- (i) enter into a **subdivision** and **development** servicing agreement; and
- (ii) provide a security deposit in accordance with this Bylaw.

S.1.2 Prior to entering into, and as a condition of a Servicing Agreement, the District Engineer may require the Owner's Engineer to provide a plan demonstrating constructability of the works.

S.1.3 All **works** required to be constructed and installed at the expense of the **Owner** of the land being subdivided or **developed** shall be constructed and installed in accordance with the provisions of the Bylaw before the **Approving Officer** approves the **subdivision** or the **Building Inspector** issues the building permit unless the **Owner** of the land:

- (a) Enters into a **Subdivision and Development Servicing Agreement** with the **District** accepting the terms and conditions in that agreement, and undertaking to construct and install the required **works** within one year from the date of executing the agreement; and
- (b) The **Owner** deposits with the **District** security in the form of cash, a bank draft or an irrevocable letter of credit in a form acceptable to the Chief Financial Officer in the amount of:
  - (i) One hundred and twenty five percent (125%) of the awarded tender value for the construction and installation of the **works**; plus
  - (ii) One hundred and twenty five percent (125%) of the **Owner's Engineer's** fee for the design and inspection of the **works** as estimated by the **Owner's Engineer**; plus
  - (iii) enter into a Maintenance Security Agreement to warrant for the maintenance of the **works** for a period of eighteen (18) months after the date of **substantial performance**; and
  - (iv) provide a Maintenance Security deposit in accordance with this Bylaw;
- (c) The **Owner's Engineer** certifies that the tender has been awarded and that a contract has been executed between the **Owner** and the **contractor**; and
- (d) The **Applicant** complies with the provisions of Schedule S, Section 4, Certificate to Commence Construction; and
- (e) The **Applicant** provides written proof that all the requirements of the Ministry of Transportation and Infrastructure and other agencies having jurisdiction have been met, if applicable.

S.1.4 The **Owner** will not be required to enter into a Maintenance Security Agreement, nor be required to provide a security deposit when:

- (a) There are no **works** required under the provisions of this Bylaw or
- (b) Those **works** are not required as a result of a **development** variance permit granted by **Council**.

### **S.2 Commitment by Owner and Engineer**

S.2.1 A Commitment by **Owner** and Engineer must be submitted to the **District Engineer** prior to review of design drawings.

S.2.2 A Commitment by **Owner** and Engineer shall be signed by the **Owner** and **Owner's Engineer** certifying that:

the **Owner's Engineer** has been contracted by the **Owner** for the design of all **works**, reviews and designs associated with the **subdivision or development**;

- (a) the **Owner's Engineer** shall adhere to all Provincial Statute for his or her profession;
- (b) the **Owner's Engineer** shall ensure that the **works** comply with the provisions of all **District** Bylaws, permits, policies, and applicable legislation and regulations;
- (c) the **Owner's Engineer** shall ensure that only qualified personnel are retained to carry out tests, inspect or carry out design **work**, detailing, or **field reviews**;
- (d) the **Owner's Engineer** has been given contractual mandate by the **Owner** for the purposes of **subdivision or development**;
- (e) the **Owner's Engineer** shall submit summary reports to the **District Engineer** on request;
- (f) the **Owner's Engineer** shall submit letters of Certification of Bylaw Compliance as required;
- (g) the **Owner's Engineer** is licensed to practice as an **engineer** in the Province of British Columbia;
- (h) the **Owner's Engineer** covenants that his or her firm presently carries, and will continue to carry for the duration of the project, liability insurance in the amount of five million dollars (\$5,000,000).

S.2.3 Notification of termination of the **Owner's Engineer** shall be provided to the **District Engineer** in writing thirty (30) days prior to any intended termination;

S.2.4 Where the **Owner's Engineer** ceases to be retained at any time during construction of the **works**, **work** on shall cease until:

a new **Engineer** has been retained; and

- (a) an updated Commitment by **Owner** and **Engineer** and Commitment to Design and **Field review** have been submitted to the **District Engineer**.

### S.3 **Commitment to Design and Field review**

S.3.1 A Commitment to Design and Field Review from the Engineer representing each engineering specialty shall be submitted to the **District Engineer** prior to issuance of a Certificate to Commence Construction.

S.3.2 A Commitment to Design and Field Review shall be signed by the **Owner's Engineer** and each Engineering Specialist certifying that:

- (a) the **works** identified by the **Engineer's** initial, will be designed, constructed and installed in accordance with all applicable **District** Bylaws, permits and policies and legislation and regulations;
- (b) **Field reviews** shall be completed and provided to the **District Engineer** during construction.
- (c) The **District** shall be notified immediately in writing if the contract for **field reviews** is terminated at any time during construction.
- (d) the **Engineer** is licensed to practice as an **engineer** in the Province of British Columbia;
- (e) the **Owner's Engineer** covenants that his or her firm presently carries, and will continue to carry for the duration of the project, liability insurance in the amount of five million dollars (\$5,000,000).

#### S.4 Certificate to Commence Construction

S.4.1 No person shall excavate or fill land for the purpose of constructing **works**, nor shall any person construct or install any of the **works** until a Certificate to Commence Construction has been issued.

S.4.2 The **District Engineer** shall not issue a Certificate to Commence Construction until the **Owner** submits the following information:

- (a) three complete paper copy sets and one electronic copy in pdf format of design drawings showing all pertinent information as required by this Bylaw and prepared in accordance with this Bylaw;
- (b) detailed design calculations in support of the **street lighting** layout.
- (c) detailed design calculations in support of the fire flows and storage required in the design of a **community water system**.
- (d) detailed design calculations in support of a **storm drainage system**.
- (e) detailed design calculations in support of a **community sewer system**.
- (f) plans and documentation in support of a Drainage, Sediment and Erosion Control Plan.
- (g) Letter of Commitment by **Owner and Engineer**;
- (h) Quality assurance/quality control documentation
- (i) Letter of Commitment to Design and **field review**;
- (j) If required, letters approving design from the Ministry of Transportation and Infrastructure, and other agencies having jurisdiction.

#### S.5 Certification of Bylaw Compliance

S.5.1 A Certificate of Bylaw Compliance from each Engineer shall be submitted to the **District Engineer** prior to the issuance of a **Certificate of Total Performance**.

S.5.2 A Certificate of Bylaw Compliance may not be submitted until after Substantial Performance of the **works**.

S.5.3 After submission of Certification of Bylaw Compliance, each Engineer must arrange and conduct a final inspection with the **District Engineer** to determine the acceptability of the Certification of Bylaw Compliance.

S.5.4 A Certification of Bylaw Compliance shall be signed by the **Owner's Engineer** and the **engineer** representing each engineering specialty certifying that:

- (a) all obligations for **field reviews** pursuant to this Bylaw have been met;
- (b) all obligations pursuant to the previously submitted Commitment to Design and Field Review have been met;
- (c) **works** identified in the signed Commitment to Design and Field Review comply in all materials respects with the provisions of this Bylaw and the design drawings and supporting documentation submitted in support of the **subdivision** or **development** application;
- (d) the final as-constructed drawings and supporting documents prepared have been submitted;
- (e) the **Owner's Engineer** is licensed to practice as an **engineer** in the Province of British Columbia;
- (f) the **Owner's Engineer** covenants that his or her firm presently carries, and will continue to carry for the duration of the project, comprehensive general liability insurance in the amount of two million dollars (\$2,000,000);
- (g) the **Owner's Engineer** covenants that his or her firm presently carries, and will continue to carry for the duration of the project, automobile liability insurance in the amount of two million dollars (\$2,000,000);

- (h) the **Owner's Engineer** covenants that his or her firm presently carries, and will continue to carry for the duration of the project, errors and omissions insurance in the amount of five hundred thousand dollars (\$500,000)

## S.6 Certification of Slope Stability

S.6.1 A Certification of Slope Stability from the geotechnical Engineer shall be submitted to the **District Engineer** prior to the issuance of **Certificate of Total Performance**.

S.6.2 A Certificate of Slope Stability may not be submitted until after Substantial performance of the **works**.

S.6.3 A Certification of Slope Stability shall be submitted by a geotechnical Engineer certifying that:

- (a) all obligations for slope stability review pursuant to this Bylaw have been met;
- (b) all issues related to safety and slope stability have been addressed;
- (c) In consideration of slope stability matters due consideration has been given to, "Guidelines for Legislated Landslide Assessments for Proposed Residential **Developments** in BC", Association of Professional Engineers of British Columbia, Revised May, 2010;
- (d) **works** identified in the signed Commitment to Design and Field Review comply in all materials respects with the provisions of this Bylaw and the design drawings and supporting documentation submitted in support of the **subdivision** or **development** application;
- (e) the final as-constructed drawings and supporting documents prepared have been submitted;
- (f) the **Engineer** is licensed to practice as an **engineer** in the Province of British Columbia;
- (g) A report confirming slope stability on the lots created as required in Schedule D of this Bylaw.

## S.7 Certification of Total Performance

S.7.1 A **Certificate of Total Performance** will be issued by the **District Engineer** indicating that **total performance** of the **works** has been achieved, once the **Owner** has complied with the provisions of this Bylaw.

S.7.2 The **District Engineer** must not issue a **Certificate of substantial performance** until the following has been submitted:

- (a) as-constructed drawings;
- (b) Utility Service Cards;
- (c) Maintenance Security Agreement;
- (d) Certification of Bylaw Compliance;
- (e) three copies of the plan of **subdivision** which have been executed by all required parties and are ready for registration;
- (f) executed copies of all Statutory Right of Way plans and agreements, if applicable and which are ready for registration;
- (g) all applicable fees, charges and security deposits;
- (h) video reports and air testing results;
- (i) confirmation that a final inspection has been conducted by the **District Engineer** and **Owner's Engineer**;
- (j) a letter from the governing electrical authority approving the **street lighting** installation;
- (k) a letter from communication, gas, and electrical utilities as applicable and Ministry of Transportation and Infrastructure as applicable, confirming that their requirements have been met;
- (l) a letter from the applicable **private water utility** approving the **water distribution system**; and

- (m) confirmation that **substantial performance** of the **work** has been achieved.

## S.8 Maintenance Security Agreement

S.8.1 Upon Substantial performance of the **subdivision** or **development** and prior to issuance of a **Certificate of Total Performance** the **Owner** must:

- (a) Enter into a Maintenance Security Agreement to warrant for the maintenance of the **works** for a period of eighteen (18) months after the date of **Substantial performance**; and
- (b) Provide a maintenance security deposit in accordance with this Bylaw.

S.8.2 The **Owner** will not be required to enter into a Maintenance Security Agreement, nor be required to provide a security deposit when:

- (a) There are no **works** required under the provisions of this Bylaw or
- (b) **Council** grants a **Development Variance Permit** exempting the **Owner** from some or all of the **works** required under this Bylaw.



**SCHEDULE T FEES AND SECURITY****T.1 Fees and Deposits**

- (a) The **Owner** shall provide all security deposits and pay all fees required under any applicable **District** bylaws, including but not limited to, this bylaw and the **District's** Fees Bylaw, as amended from time to time.

**T.1.2 Security Deposits**

- (a) Security deposits must be provided to the **District** in the form of cash, bank draft, irrevocable letter of credit, or another form acceptable to the **District**, as follows:
- (i) 125% of the awarded tender value (or the **Owner's Engineer's** estimate if the project has not been tendered) for the engineering, design, quality assurance, contingency, construction and installation of the **works**; plus
  - (ii) 150% of the **Owner's Engineer's** fee for the design and inspection of the **works** as estimated by the **Owner's Engineer**; plus
  - (iii) the value calculated and in a form acceptable to the **District** to warrant for the maintenance in accordance with **TABLE T-1 Maintenance Security Table**; plus
  - (iv) \$2000 per sheet for drafting deficiencies.

**T.1.3 Maintenance Security Deposit**

- (a) A maintenance security deposit must be provided to the **District** in the form of cash, bank draft, Irrevocable Letter of Credit or another form acceptable to the **District**, in accordance with the following table:

<b>TABLE T-1-MAINTENANCE SECURITY TABLE <sup>1</sup></b>	
<b>Description</b>	<b>Maintenance Security</b>
Fee Simple Subdivisions (on site <b>works</b> )	\$580 per <b>parcel</b> or 5% of value of <b>works</b> whichever is greater
Bare Land Strata <b>developments</b>	5% of the value of <b>offsite works</b> <sup>2</sup>
Offsite <b>works</b> for <b>subdivision</b> or <b>development</b>	5% of value of capital costs <sup>2</sup>
Deficiencies and/or defects	200% of the estimated cost to <b>repair</b> <sup>3</sup>
Building Permits	5% of value of capital costs

<sup>1</sup> more than one of the items contained in the Maintenance Security Table may apply to any **subdivision** or **development**.

<sup>2</sup> five percent (5%) or one thousand dollars (\$1,000.00), whichever is greater, of the cost of designing, constructing and installing the **works** required under this Bylaw, as submitted by the **Owner's Engineer** and as approved by the **District Engineer**.

<sup>3</sup> two hundred percent (200%) of the cost to **repair** deficiencies and defects as estimated by the **Owner's Engineer** and as approved by the **District Engineer**.

**T.1.4 Cash in Lieu**

- (a) The **District Engineer** may require the **Owner** to provide to the **District** non-refundable cash in lieu of **work** where works are;
- (i) Required to be constructed or installed under Section B.4 (Building Permit) or B.5 (**Subdivision**); or
  - (ii) Where **works** are scheduled to be constructed at a future date pursuant to the **Transportation for Tomorrow Plan Development** Cost Charge Bylaw or other **District** infrastructure master plans; the form of cash in lieu required is as follows:

- A. 150% of the **Owner's Engineer's** fee for the design; and
- B. 125 % of the value of the design, construction and installation of the **work** as estimated and submitted by the **Owner's Engineer** and approved by the **District Engineer**. The value of design will be 10% of estimated construction cost.

**T.1.5 Excess or Extended Capacity (Latecomer)**

- (a) Pursuant to the *Local Government Act*, the **District Engineer** may require the **Owner** to provide excess or extended services to provide access to or to service land other than the **parcel** being **subdivided** or **developed**. Where excess or extended services are required, the **Owner** shall provide additional documentation as requested by the **District Engineer** to assist in making a determination. Such information may include, but is not limited to, drawings that define catchment areas, design drawings, a traffic impact analysis and **onsite** utilities impact analysis.
- (b) Where the **Owner** is required to provide excess or extended services, the **Owner** shall be entitled to receive latecomer payments in accordance with the **District's** Latecomer Policy.

**T.2 Fees**

**T.2.1** The following fees shall apply as set out in applicable **District** fee's Bylaws:

- (a) Re-inspection fee due to incomplete **work**, failure of test or **District Engineer** to attend
- (b) **Preliminary Layout Review** Application Fee
- (c) **Subdivision** Plan Approval Fee
- (d) **Subdivision and Development** Engineering and Inspection Fee to be paid at the earlier of:
  - (i) Issuance of building permit;
  - (ii) Upon execution of Servicing Agreement;
  - (iii) Upon issuance of Certificate to Commence Construction; or
  - (iv) Upon issuance of **Certificate of Total Performance**.