SCHEDULE A

SERVICE LEVELS

This is Schedule A of the Corporation of the Village of Valemount Subdivision and Development Servicing Bylaw No. 450, 1998.

_____

Clerk

SCHEDULE A

SERVICE LEVELS

Two servicing levels will be required for new subdivisions and developments in different areas of the Village delineated on Map 1 which forms part of this schedule.

SERVICE LEVEL 1

1.1 The following services shall be provided in all new subdivisions and developments in areas delineated in Map 1 as "Service Level 1".

1.2 Standard 1 Highways as indicated on Table A.1, including:

.1 asphaltic concrete paving on roadways, walkways and lanes as required in Schedule "B";
.2 curb and gutter as required in Schedule "C";
.3 sidewalks as required in Schedule "C";
.4 street lighting as required in Schedule "G";
.5 underground hydro and telephone as required in Schedule "H".

1.3 Water distribution system and connection to community water system as required in Schedule "D".

1.4 Sanitary sewer collection system and connection to community sanitary sewer system as required in Schedule "E".

1.5 Storm sewer drainage in accordance with a drainage plan as required in Schedule "F".

SERVICE LEVEL 2

2.1 The following services shall be provided in all new subdivisions and developments in areas delineated on Map 1 as "Service Level 2".

2.2 Standard 2 highways as indicated on Table A.1, including:

.1 asphaltic concrete paving on roadways, walkways and lanes as required in Schedule "B";
.2 street lighting as required in Schedule "G";
.3 underground wiring for hydro and telephone as required in Schedule "H".

2.3 Water distribution system and connection to community water system for domestic purposes as required in Schedule “D”; for industrial water usage, the owner may be required to provide an alternate source of supply.

2.4 Sanitary sewer collection system and connection to community sanitary sewer system for domestic purposes as required in Schedule “E”; for sewage generated by industrial use, the owner may be required to provide alternate treatment and disposal facilities.

Through subdivision and development areas where connection to the community sewer system is not feasible, as determined by the Village Engineer, a sewage collection system shall be installed through the subdivision or development, and capped for future use. Individual septic tanks and disposal fields may be installed on each lot in accordance with Health Act requirements and used until connection to the community system is feasible.

2.5 Surface storm water drainage in accordance with a drainage plan as required in Schedule “F”.

INFILLING

3.1 Throughout the Village, where an applicant wishes to subdivide a maximum of 2 existing land parcels, and there is no potential or opportunity for future subdivision of adjacent parcels the owner may apply to Village Council for a Development Variance Permit to provide a level of service equivalent to that in adjacent parcels.

TABLE A.1
HIGHWAY STANDARDS FOR SERVICE LEVELS 1 AND 2

Road Classification	Right-of-Way Width	Pavement Width	Lane Widths	Curb & Gutter	Sidewalks	Shoulder Width
Service Level 1 - Highway Standards As Delineated on Map 1						
Downtown Commercial	25.0 m	20 m	3.75 m	Both Sides	2.5 m Both Sides	Not Required
Service Level 2 - Highway Standards As Delineated on Map 1						
Frontage/Commercial	20.0 m	18 m	3.75 m	Not Required	Not Required	1.0 m
Collector	20.0 m	8.5 m	3.75 m	Not Required	Not Required	1.5 m
Local	20.0 m	7.5 m	3.75 m	Not Required	Not Required	1.0 m
Cul-de-sac a) Entrance b) Terminus	 15.0 m 15 m radius	 7.5 m 11.5 m radius	3.75 m	Not Required	Not Required	1.0m
Industrial	20.0 m	7.5 m	3.75 m	Not Required	Not Required	1.5 m
Lane	6.0 m	6.0 m	3.0 m	Not Required	Not Required	

**** Pavement width is defined as the width between the curb gutter lines on each side of the road.***

SCHEDULE B

REGULATIONS, STANDARDS, AND SPECIFICATIONS FOR THE DESIGN AND CONSTRUCTION OF HIGHWAYS

This is Schedule B of the Corporation of the Village of Valemount Subdivision and Development Servicing Bylaw No. 450, 1998.

_____

Clerk

SCHEDULE B

REGULATIONS, STANDARDS, AND SPECIFICATIONS FOR THE DESIGN AND CONSTRUCTION OF HIGHWAYS

1.0 GENERAL

Where the provisions of Schedule A of this Bylaw require the construction of roads, the Owner shall construct such roads in accordance with the regulations, standards and specifications set out in this Schedule.

1.01 Approval of Engineering Drawings Required Prior to Construction

Engineering drawings showing detailed design of roads shall be submitted to the Village Engineer for approval prior to commencement of construction. These drawings shall show existing groundline and proposed alignment and grade of the highways, horizontal and vertical curve information and all other details as may be required. Grades shall be given at all changes in vertical and horizontal alignments for centreline and gutter lines. Elevations shall be shown on the drawings at all changes in vertical alignments.

1.02 Classification of Highways

Prior to design of the road system, the Village Engineer shall classify each road proposed within the subdivision and stipulate the required standards in accordance with the provisions of this Bylaw.

1.03 Geotechnical Evaluation

In addition to the Geotechnical overview undertaken during the preliminary phase of the project the Owner shall engage the services of a qualified Geotechnical Engineer to investigate surface and sub-surface conditions within the proposed subdivision. 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 over and above those stipulated in this Bylaw, cut slope geometry, pavement structures for roads, and any other geotechnical issues affecting road construction within the proposed subdivision. A copy of the Geotechnical evaluation shall be submitted to the Approving Officer at the time the engineering drawings are submitted to the Approving Officer for approval.

2.0 DESIGN CRITERIA

2.01 General Design Requirements

In the preparation of engineering plans for highways, the Owner shall take into account the following general design considerations:

.1 Continuation of Existing Streets

The design and arrangement of highways within a subdivision shall provide for the continuation or projection of existing streets in the surrounding area. In no case shall the arrangement of highways within a proposed subdivision make impractical the subdivision of adjoining parcels; and

.2 Topography to be Taken into Account

The design and arrangement of highways shall be suited to the topography of the land proposed to be subdivided.

2.02 Consistency with Official Community Plan

The location, classification and standard of all highways proposed within a subdivision shall take into account the proposed use of the land and shall conform to the provisions of the Village of Valemount Official Community Plan.

2.03 Local Highways

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

2.04 Cul-de-Sacs

Cul-de-sac streets shall not exceed 150 metres in length measured from the intersection to the center of the bulb and shall be provided with an area designed to permit safe and adequate space for the turning of motor vehicles.

2.05 Lanes

Lanes, meeting the standards set out in this Bylaw, shall be provided where the Village Engineer deems them to be necessary.

2.06 Walkways and Fences

.1 Walkways shall be provided where the Village 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.

.2 Walkways shall be chain link fenced for their full length on both sides. The minimum height shall be 1.5 meters but may vary at the discretion of the Approving Officer according to individual situations and the height requirements of the Municipal Zoning Bylaw.

2.07 Driveways

.1 Single Family Residential Driveway:

.1 minimum driveway width shall be 3.0 metres;
.2 driveway widths (surfaced) in excess of 8.0 metres must be approved in writing by the Village Engineer;
.3 maximum driveway grade shall not exceed 12%;
.4 minimum driveway surface shall be compacted all weather gravel surface;
.5 surface water from driveway on private property must be contained on-site, unless otherwise approved in writing by the Village Engineer;
.6 driveway access roads must have a minimum of 9.0m centre line radius on all curves and corners along the road;
.7 turn around facilities are to be provided for any dead-end access driveway fronting an arterial roadway;
.8 the finished elevation of the driveway at the road property line shall not vary more than 150 mm from the elevation of the centreline of the existing road, unless otherwise approved in writing by the Village Engineer; and
.9 unless otherwise approved in writing by the Village Engineer only one driveway will be permitted into each lot.

.2 Reciprocal Access Driveway for a Maximum of Three (3) Single Family Residences:

.1 minimum driveway width shall be 6.0 metres;
.2 driveway widths (surfaced) in excess of 8.0 metres must be approved in writing by the Village Engineer;
.3 maximum driveway grade shall not exceed 12%;
.4 minimum driveway surface shall be hot mix asphaltic concrete with curb and gutter; and
.5 surface water from driveways on private property must be contained on-site, unless otherwise approved in writing by the Village Engineer.

.6 driveway access roads must have a minimum of 10.25m centreline radius on all curves and corners along the road;
.7 turn around facilities are to be provided for any dead-end access driveway;
.8 the finished elevation of the driveway at the road property line shall not vary more than 150 mm from the elevation of the centreline of the existing road, unless otherwise approved in writing by the Village Engineer; and
.9 unless otherwise approved in writing by the Village Engineer only one reciprocal access driveway will be permitted into clusters of single family residence.

.3 Multi-Family Driveways and All Other Driveways Not Noted in Clause 2.07.1 and 2.07.2 of Schedule B:

.1 driveways shall be in accordance with the requirements of clause 2.07.2 of Schedule B.

2.08 Highway Right-of-Way Requirements

.1 Highway rights-of-way widths shall be in accordance with Table A.1 of Schedule A.

.2 The tops of road cuts and the toes of road fills that are outside the highway right-of-way shall be identified and legally protected.

2.09 Intersections

Intersections shall be designed as follows:

.1 intersecting highways shall meet substantially at right angles (between 70 degrees and 110 degrees);
.2 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 the intersections along a street shall be 40 m;
.3 intersections having more than four intersecting legs shall not be permitted;
.4 intersections shall provide adequate crossing sight distances and stopping sight distances, whichever is greater; and
.5 a property line cutoff of 3.0 metres for local roads and 4.0 metres for collector and arterial roads shall be at all intersections.

2.10 Reverse Curves

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

2.11 Mail Boxes

Where required by Canada Post, the Owner shall construct a base for super mail boxes in the location specified by Canada Post and approved by the Village Engineer. The owner is referenced to Canada Post for location and design guidelines.

2.12 Street Names and Traffic Signs

Street name signs and traffic signs required as a result of constructing or improving streets shall be provided by the Village of Valemount at the expense of the Owner. Street names shall be assigned by the Village of Valemount.

2.13 Appurtenances

The Design 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 keeping with good engineering practices.

The design should show the location of all traffic signs, street signs, and other traffic control devices required to be placed in the road allowance.

Drawings must show all utility poles. The Design Engineer shall indicate those poles which require relocating 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.

2.14 Vertical Alignment

The vertical alignment of a road shall be set so the grades of the driveway to adjacent properties shall be in accordance with clause 2.07 of Schedule B. The maximum grade of the driveway as it crosses the road boulevard will be 3 percent.

The minimum longitudinal gradient at the gutter line shall be 0.50% for all classifications of streets.

2.15 Design Speeds

The design speeds used for design of Highways shall be as in Table B.1.

TABLE B.1
DESIGN SPEED

Collector (C)	60 km/h
Local (L)	50 km/h

2.16 Road Crossfall

Minimum road crossfall shall be 2%.

2.17 Road Grades

Minimum and maximum road centreline grades shall conform to Table B.2 based on the classification of the road.

TABLE B.2
ROAD GRADES

Road Classification	Minimum Grade	Maximum Grade
Collector	0.5%	10%
Local	0.5%	10%
Cul-de-Sac (entry downhill)	0.5%	8%
Cul-de-Sac (entry uphill)	0.5%	10%
Cul-de-Sac (bulbs)	0.5%	6%
Lane	0.5%	8%
Walkway	0.5%	15%

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

2.18 Vertical Curves

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 all grade changes greater than 1.0%. Vertical curve length is calculated by the equation L = KA where:

.1 L is the length of the vertical curve in metres;
.2 K is a constant related to lines and geometry of a parabolic curve; and
.3 A is the algebraic difference in grades in percent.

L shall not be less than the design speed in kilometres per hour.

Minimum K values (in metres) for vertical curve design shall be as described in Table B.3.

TABLE B.3
MINIMUM K VALUES FOR VERTICAL CURVE DESIGN

Road Classification	Crest Curve	Sag Curve	
	Minimum	Lighting	No Lighting
Collector	15	10	20
Local	7	6	11

2.19 Horizontal Alignment

Centre Line Radii

The minimum required centreline radius for various superelevation rates for each classification of roadways are described in Table B.4.

TABLE B.4
MINIMUM CENTRELINE RADIUS

Road Classification	Horizontal Curve Radii (m)			
	Superelevation (m/m)			
	None	0.02	0.04	0.06
Collector (60 kph design speed)	160	140	130	N/A
Local* (50 kph design speed)	95	N/A	N/A	N/A

** Radius may be reduced at the discretion of the Village Engineer*

2.20 Curb Return Radii

Curb return radii shall conform to the following and be based on the lesser classified Highway:

.1 Collector 11 m;

.2	Local	8.0 m;
.3	Cul-de-Sac	11.5 m; and
.4	Industrial	11 m.

2.21 Intersection Design

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

2.22 Intersection Grades

Approach grades for a crest curve 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 projected curb line of the major street using K values as described in Table B.5.

TABLE B.5
INTERSECTION CURVES

Intersecting Street	Minimum K Value (in metres)	
	Crest Curve	Sag Curve
Collector	7	(1)
Local	4	(1)

(1) *Approach grades for a sag curve of minor streets at intersections to major streets shall be designed to provide a maximum gradient of 3% at a point 15 metres from the projected curb line of the major street.*

2.23 Pavement Structure

The pavement structure shall be designed in accordance with Manual Series MS-1 of the Asphalt Institute (1981 or most recent edition). The pavement structure shall be designed for a fifteen (15) year design life. Staged construction may be considered in the structural design by the Village Engineer when a road is to be constructed and to be widened at a later date.

Roads shall be classified as follows for purposes of structural design of the total pavement structure; design traffic values and minimum depths of hot mix asphalt shall be as described in Table B.6.

TABLE B.6
PAVEMENT STRUCTURE

Road Classification	Design Traffic (EAL'S)	Min. Depth of Hot Mix Asphalt (mm)
URBAN		
Collector	2.8×10^5	75
Industrial	5.6×10^5	75
Residential	2.8×10^4	50
RURAL		
Lanes	Not Applicable	50
Walkways	Not Applicable	50

(1) *To be specifically designed, based on projected equivalent axle loads (EAL's), in accordance with MS-1 of the Asphaltic Institute.*

Soils used to construct the roadway subgrade shall be evaluated in accordance with MS-1 (see Chapter V) to determine the load bearing capacity of the subgrade. For this purpose, the California Bearing Ratio (CBR) test value shall be obtained using soil moulded to the minimum specified compaction level. The design CBR values shall be determined in the soaked condition in accordance with ASTM Des D1883. This value shall be used for structural design purposes. The minimum compacted depth of crushed granular base course, in the total pavement structure, shall be 100 mm.

If the soaked CBR value of the subgrade soil is less than 3, subgrade enhancement shall be provided to create a soaked CBR of 3, and the pavement structure shall be designed using a soaked CBR of 3. Subgrade enhancement shall be provided by placement of an initial layer of granular sub-base of a thickness which has been calculated to provide the necessary structural improvement to the subgrade.

A minimum pavement structure for roads shall be provided, not withstanding the structural character of the subgrade. Minimum pavement structures shall be as described in Table B.7, and will be considered structurally adequate when the subgrade soil exhibits a minimum soaked CBR of 6.

TABLE B.7
MINIMUM PAVEMENT STRUCTURES

Road Classification	Sub-base (Pitrun) mm	Crushed Granular Base (mm)	Hot Mix Asphalt (mm)
URBAN			
Downtown/Frontage/ Commercial	450	80	80
Collector	400	100	75
Industrial	400	150	75
Local & Cul-de-Sac	300	75	50
Lanes	300	75	50
Walkways	200	75	50

The design of structural overlays of existing pavements shall be based on the analysis of the results of Benkelman beam tests and test hole information acquired from the existing road which is to be upgraded.

The Transportation Association of Canada procedure for designing structural design of overlays of existing pavements, as published in "The Pavement Management Guide", shall be used. The maximum permissible Benkelman beam deflections to be used for overlay design shall be as described in Table B.8.

TABLE B.8
MAXIMUM ROAD DEFLECTIONS

Road Classification	Maximum Permissible Deflection After Overlay
Downtown/Frontage/ Commercial	1.00 mm
Collector	1.25 mm
Industrial	(1)
Residential	1.50 mm

(1) *As specified by the Village Engineer.*

The structural design of pavements for roads shall be performed by a qualified pavement engineer. Structural designs of pavements shall be submitted to the Village Engineer in an acceptable report format.

Other payment evaluation systems may be considered upon consultation with the Village Engineer.

2.24 Highway Cross-Sections

The standard street cross-section for various classifications of roadways shall be as described in Table B.9 and the Standard Drawings.

TABLE B.9
HIGHWAY CROSS-SECTIONS

Road Classification	Typical Cross-Section (Dwg. Number)
URBAN	
Downtown Commercial	B-1
Frontage	B-2
Local Rural Road	B-3
Cul-De-Sac	B-4

3.0 MATERIALS

3.01 Roadway Embankment

Roadway embankment material shall be free of rock detrimental to proper compaction and free of organic or other deleterious matter.
Imported roadway embankment material shall conform to the gradation limits as described in Table B.10.

TABLE B.10
IMPORTED EMBANKMENT GRADATION LIMITS

USBC Sieve Size	Percent by Weight Passing
150 mm	100%
75 mm	74 - 100%
38 mm	56 - 100%
25 mm	46 - 94%
4.75 mm	20 - 70%
1.18 mm	10 - 52%
0.300 mm	2 - 26%
0.075mm	0 - 8%

3.02 Rock Fill

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.

Rock fill shall be any material containing more than 15% by volume of rock larger than 150 mm diameter, to a maximum of 300 mm diameter.

It shall only be used in approved areas and by approved methods to provide maximum stability of the fill.

3.03 Granular Sub-base Course

Granular sub-base shall be well graded material within the following gradation limits when tested in accordance with ASTM C136 as described in Table B.11.

TABLE B.11
GRANULAR SUB-BASE GRADATION LIMITS

USBC Sieve Size	Percent by Weight Passing
75 mm	100%
25 mm	50 - 85%
0.150 mm	0 - 16%
0.075 mm	0 - 8%

3.04 Crushed Granular Base Course

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. The gradation shall be within the following limits 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.

TABLE B.12
CRUSHED BASE GRADATION LIMITS

USBC Sieve Size	Percent by Weight Passing
25.00 mm	100%
19.00 mm	80 - 95%
9.50 mm	50 - 80%
4.75 mm	35 - 65%
2.36 mm	25 - 50%
1.18 mm	15 - 35%
0.300 mm	5 - 20%
0.075 mm	3 - 8%

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

3.05 Crushed Granular Aggregate for Asphaltic Concrete

Crushed granular aggregate for asphaltic concrete shall be composed of hard, durable, crushed gravel free from shale, clay, silt balls, loose coatings and other deleterious materials.

The gradation of aggregates, when blended to meet the job mix formula shall be within the following limits 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 as described in Table B.13 and Table B.14.

TABLE B.13
ASPHALTIC CONCRETE AGGREGATE GRADATION LIMITS

USBC Sieve Size	Arterial, Industrial and Collector Streets Percent Passing by Weight		Residential, Lanes, Walkways, Percent Passing By Weight
	Lower Course	Surface Course	
25 mm	100		
19 mm	85 - 95	100	
12.5 mm	65 - 85	85 - 95	100
9.5 mm		70 - 85	50 - 90
4.75 mm	40 - 65	50 - 65	45 - 80
2.36 mm		38 - 52	32 - 64
1.18 mm	20 - 38	28 - 42	24 - 51
0.600 mm		20 - 30	17 - 40
0.300 mm	10 - 20	12 - 20	13 - 29
0.150 mm	8 - 15	10 - 16	7 - 18
0.075 mm	3 - 8	3 - 7	3 - 8

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

TABLE B.14
ASPHALTIC CONCRETE AGGREGATE
GRADATION TOLERANCE LIMITS

Tolerance Limits (% Passing By Weight)[1]		
Max. Size To	4.75	5.0
	2.36	4.0
	1.18	4.0
	0.600	3.0
	0.300	3.0
	0.150	2.0
	0.075	1.5

(1) *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.

3.06 Tack Coat

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.

3.07 Asphalt Cement

TABLE B.15
TYPE OF ASPHALT

Requirements	Minimum	Maximum
Viscosity @ 60°Pa/s	5	5
Penetration @ 25°C	150-200	
% 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	35	
Ductility at 25°C, 5 cm/min. - cm	100	
Water %		0.5

The asphalt cement shall be homogenous, free from water, and shall not foam when heated to 175°C.

3.08 Asphaltic Concrete

Asphaltic Concrete shall be as described in Table B.16.

TABLE B.16
ASPHALTIC CONCRETE DESIGN

Property	Arterial & Collector Streets		Residential
	Lower Course	Surface Course	Surface Course
Marshall blows per face	75	75	50
Marshall Stability @ 60°C, kN	10 min.	10 min.	8 min.
Marshall Flow, 0.25 mm units	8 - 14	8 - 14	8 - 15
Voids in Mineral Aggregate %	12.5 - 14.0	13.5 - 15.0	14.0 - 15.5
Air Voids in Mixture, % - at design A.C. - Allowable production range	 4.0 ± 0.2 3 - 5	 4.0 ± 0.2 3 - 5	 3.5 ± 0.3 3 - 5
Index of Retained Stability after water immersion for 24 hours @ 60°C	75% min.	75 % min.	75% min.

The Owner shall supply the Village Engineer with a current 5 point Marshall mix design, performed in accordance with ASTM D-1559, under the signature of a Professional Engineer. The design asphalt content shall be specified to comply with the requirements of this article.

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.

3.09 Chain Link Fence

All frames to be welded and covered with two coats of zinc rich paint. Each knuckle to be independently tied and set flush with the top rail. Dome tops to be riveted or welded to end posts. All galvanizing shall be minimum of 488 gm/M. All poles to be set in concrete. Material used for chain link fence construction shall conform to the following:

.1 fabric - 9 gauge (3.55 mm) galvanized 50 mm mesh;
.2 top rail - 42 mm O.D., 3.55 mm wall thickness, galvanized steel pipe;
.3 end & corner posts - 73 mm O.D., 5.15 mm wall thickness, galvanized steel pipe
.4 line posts - 48 mm O.D., 3.68 mm wall thickness galvanized steel pipe;
.5 gates - sizes as required. Frames 42 mm O.D., 3.55 mm wall thickness galvanized steel pipe;
.6 barbed arms - Galvanized malleable steel;
.7 tension wire - 6 gauge (4.50 mm) galvanized steel;
.8 tie wire - 9 gauge (3.55 mm) aluminium;
.9 tension bar - 4.76 mm x 19 mm galvanized steel; and
.10 dome tops - size as required. Galvanized malleable steel.

4.0 WORKMANSHIP

4.01 Notification of Village Engineer Prior to Undertaking Roadworks

Adequate notice shall be given to the Village Engineer by the Owner prior to the commencement of roadworks as described in Table B.17 The Owner shall not proceed from one stage as described in Table B.17 to another stage without the approval of the Village Engineer.

TABLE B.17
ROADWORKS

Stage	Minimum Notice Required
Prior to construction of fills and subgrade preparation	24 hours
Prior to placement of sub-base gravel	24 hours
Prior to placement of concrete for curbs and sidewalks	48 hours
Prior to placement of base course	24 hours
Prior to paving	96 hours
Prior to top soiling boulevards	24 hours

4.02 Clearing

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 Village Engineer.

4.03 Roadway Excavation and Embankment

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.

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.

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.

Each layer shall be compacted with approved equipment to 95% Standard Proctor Density.

Sufficient amounts of watering and compaction equipment required to efficiently and properly compact the material for the rate at which the material is being hauled into the embankment area shall be provided.

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 of this Bylaw shall be undertaken

Unsuitable materials encountered in the excavation areas, or at the subgrade elevation, shall be excavated, and wasted.

Over excavations shall be rebuilt to grade with an approved compacted material and compacted to the satisfaction of the Engineer.

At transition sections where the profile grade changes from embankment to cut, the natural slope (excepting solid rock) 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.

4.04 Subgrade Preparation

Prior to placement of the granular sub-base, 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 or sidewalk on either side of the road.

4.05 Proof Rolling

Upon completion of the subgrade preparation, the subgrade shall be proof rolled in the presence of the Village Engineer with a loaded single axle truck with a rear axle load of 8165 kg.

Any areas found to be soft or wet shall be excavated and backfilled with select granular sub-base, or imported granular roadway embankment, and compacted to 100% Standard Proctor density.

4.06 Spreading and Compaction of Granular Sub-Base and Base Gravels

Granular sub-base and base gravels 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.

4.07 General Paving Requirements

Paving shall not be undertaken 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. Asphaltic concrete shall be constructed in lifts of compacted thickness as described in Table B.18.

TABLE B.18
MAXIMUM ASPHALTIC CONCRETE LIFT THICKNESS

Mix type	Permissible Compacted Lift Thickness (mm)	
	Minimum	Maximum
Lower course	50	100
Surface Course	40	75

4.08 Placing and Compacting Asphaltic Concrete

Surfaces onto which bituminous concrete pavement is placed shall be dry, above 4 degrees C and cleaned of all loose and foreign materials. Mixtures shall not normally be laid when the atmospheric temperature is less than 4 degrees C and falling. An approved self-propelled mechanical paver shall be used to spread the mixture to the specified thickness. Compaction shall commence immediately after the bearing capacity of the course is adequate to support the compaction equipment without undesirable displacement or cracking. Compaction methods shall be carried out as specified in the Asphalt Paving Manual published by the Asphalt Institute.

4.09 Density of Completed Asphaltic Concrete Pavement

The minimum allowable density of the completed pavement shall be not less than 97% of the laboratory compacted Marshall density.

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 Village Engineer by reason of faulty materials or methods of placement shall be repaired, removed, replaced or otherwise corrected.

4.10 Tie-Ins to Existing Pavement

Tie-ins to existing pavement shall be made by cutting back the existing pavement to sound material as necessary to produce a neat, vertical face with a straight edge. Prior to placing asphaltic concrete, exposed faces and other abutting structures shall be painted with liquid asphalt and heated to 66 degrees C.

4.11 Restoration of Improvements

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 Village Engineer.

4.12 Materials Testing

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 professional engineer within the office from which the testing services are provided and he shall review all test data. The owner shall provide a copy of all test data in summary form to the Village Engineer prior to applying for final approval. Testing will be performed at the following minimum frequencies:

1. <u>For Roadwork embankment and subgrade construction:</u>

   .1 Moisture - density relationship (Standard Proctor) - ASTM D698; - one test for each soil type incorporated; and

   .2 Moisture and density tests:

      .1 roadwork embankment - one test per lift per 500 square metres of road; and
      .2 road subgrade preparations - one test per 500 square metres of road.

.2 For Trench Backfill:

.1 One test per lift per 120 lineal metres of trench.

.3 For Sub-Base and Base Course Construction:

.1 Gradation analysis - one test per 1000 m^3 or 2200 tonnes of material delivered to the site with a minimum of 1 test per day of placement;

.2 Moisture - density relationship (Standard Proctor) - ASTM D698; - one test per class of material for each 1000 m^3, or 2200 tonnes delivered to site; and

.3 Compaction testing - one test per 500 square metres of road per lift, to include dry density and moisture content;

.4 For Hot Mix Asphalt Pavement Production and Placement:

.1 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;

.2 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;

.3 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;

.4 Density, air voids and pavement thickness tests - 1 core (100 mm dia.) per 500 m^2 of paved area per lift. Air void tests shall be performed in accordance with ASTM D3203; and

.5 Tests on tack coat products - one test per product per project.

The Village shall be provided with copies of all sieve and compaction test results pertaining to subgrade, granular base, granular sub-base and pavement structure.

4.13 As Constructed Drawings

Prior to final acceptance, the Owner shall deposit with the Village one computer diskette (3½" floppy) in AutoCAD (latest release) format and one set of original as constructed mylar drawings showing all the information requested by this schedule and conforming to the criteria set out in Schedule I.

SCHEDULE C

REGULATIONS, STANDARDS, AND SPECIFICATIONS FOR THE DESIGN AND CONSTRUCTION OF CURBS AND GUTTERS, SIDEWALKS AND BOULEVARDS

This is Schedule C of the Corporation of the Village of Valemount Subdivision and Development Servicing Bylaw No. 450, 1998.

_____

Clerk

SCHEDULE C

REGULATIONS, STANDARDS, AND SPECIFICATIONS FOR THE DESIGN AND CONSTRUCTION OF CURBS AND GUTTERS, SIDEWALKS AND BOULEVARDS

1.0 GENERAL

1.01 Standards and Specifications of this Schedule to Apply to All Works

Where the provisions of Schedule A of this Bylaw require the provision of curbs and gutters, sidewalks and boulevards, the Owner shall construct such services in a manner consistent with the regulations, standards and specifications set out in this Schedule.

1.02 Approval of Engineering Drawings Required prior to Construction

Engineering drawings showing detailed design of the necessary works shall be submitted to the Village Engineer for approval. No construction of the works shall commence until the design drawings have been approved by the Village Engineer.

1.03 Curb, Gutter and Sidewalk Requirements

Curb, gutter and sidewalk shall be provided only on Downtown Commercial Zones; only non-mantable concrete curbing shall be constructed.

2.0 DESIGN CRITERIA

2.01 Design Gradient

The design gradient shall be as specified for roads in Schedule B of this Bylaw, except that the minimum gradient around curb returns and around cul-de-sacs shall be 0.5%.

2.02 Curb Return

The minimum curb return radius shall be as set out in Section 2.20 of Schedule B of this Bylaw. Elevations shall be shown on the engineering drawings for the beginning and end of the curb return, as well as at any changes in grades in between. Engineering drawings shall provide all geometric details, both vertically and horizontally, of curb returns.

2.03 Grading of Boulevards

Upon completion of road, curb and gutter and sidewalk constructions, boulevards shall be shaped and graded as shown on the Standard Drawings. Native material and 100 mm of top soil shall be placed flush with the top of curb or back of walk and shaped to conform

with general lot grading. Unless otherwise approved, boulevards shall be graded to drain to the curb at a minimum slope of 2% and a maximum slope of 10%.

2.04 Granular Sub-base and Base Gravel Depths

Granular sub-base and base gravel depths for curb and gutters, sidewalks, driveways and commercial crossovers shall conform to the depths of sub-base and base gravels specified for the road as noted in Table B.7 of Schedule B.

2.05 Sidewalks Cross Section

Concrete sidewalks shall have a thickness not less than 100 mm and shall be constructed consistent with the Standard Drawings. The sidewalk shall be graded to drain to the curb at a slope of 2%.

2.06 Driveway Access Across Boulevards

Maximum driveway access for all boulevards shall be 3%. Where non-mountable curb is required under this Bylaw, only one access per parcel shall be permitted. In residential subdivisions, only one access per parcel shall be permitted unless the parcel frontage is greater than 75 m. The number of additional accesses shall be at the discretion of the Village Engineer.

2.07 Curb and Gutter Cross Section

Curbs and gutters shall be constructed consistent with the Standard Drawings.

2.08 Commercial Crossovers

Commercial crossovers shall be provided at all access locations for usages other than residential. Commercial crossovers shall be constructed consistent with the Standard Drawings.

2.09 Wheelchair Ramps

Wheelchair ramps shall be provided at all intersections on streets provided with sidewalks. Wheelchair ramps shall be constructed consistent with the Standard Drawings.

3.0 MATERIALS

3.01 Base Materials - Granular Sub-Base and Base Courses

Granular sub-base material shall be 75 mm minus gravel sub-base conforming to gradation limits as referred in Schedule B, Article 3.03.

Granular Base material shall be granular 25 mm crushed gravel base conforming to gradation limits as referenced in Schedule B, Article 3.04.

3.02 Concrete

Concrete shall conform to CSA CAN3-A23.1, Latest Edition; the mix design shall include the following:

.1 Minimum compressive strength 32 MPa at 28 days;
.2 Maximum aggregate size 19 mm for hand-formed; 10 mm for extruded;
.3 Slump - 80 mm for hand-formed; 25 mm for extruded;
.4 Air entrainment 6% - 8%.

3.03 Testing

The Owner shall retain an independent materials testing firm to carry out comprehensive testing of concrete which shall be taken to include determination of unit weight of the plastic concrete, performing slump and air content tests and casting of test cylinders. One test consisting of three standard cylinders may be made for each 175 m of curb and gutter or sidewalk installed. In no case, however, will there be less than one test for concrete placed in one day. One cylinder shall be tested at seven days, and two at twenty-eight days. All test results shall be submitted to the Village Engineer for review and approval.

3.04 Curing Compound

Curing compound shall be a spray-applied liquid type conforming to ASTM C309 containing a fugitive dye applied at a rate recommended by the manufacture.

3.05 Boulevards Top Soil

Top soil used for boulevard improvement shall be loam, free from any rock, clay lumps, roots or any other deleterious material.

3.06 Driveway Approaches

Base for driveway approaches shall consist of a minimum of 300 mm depth of granular sub-base and 100 mm depth of granular base placed on compacted subgrade. Approaches shall be paved using 50 mm hot mix asphalt.

4.0 WORKMANSHIP

4.01 Base Preparation

All topsoil, organic soils, peat, frozen materials, roots, branches or other deleterious material shall be removed and the base shall be excavated or filled to subgrade elevation

prior to placement of granular base and sub-base material. All embankment material shall be compacted to 95% Standard Proctor Density. The top 300 mm of sub-grade shall be compacted to 100% Standard Proctor Density. Granular sub-base and base shall be compacted to 100% Standard Proctor Density.

The granular base aggregate shall be moistened immediately prior to placing concrete.

4.02 Commercial and Industrial Crossovers

Commercial and industrial crossovers shall be built on a base with the same construction as the roadway they border. Commercial and industrial crossovers shall have a minimum concrete thickness of 150 mm and be reinforced with 15M metric bars on 300 mm centres both ways. Commercial and industrial crossovers shall have the concrete curb and gutter reinforced by two 15M bars running the full length between the extremities of the flare of the crossovers. Expansion joints shall be made at the sides of the crossover.

4.03 Placing and Finishing Concrete

The Village Engineer shall be notified forty-eight hours in advance of any concrete pours for curb and gutter or sidewalks. Concrete shall be prepared, delivered, and placed in conformance with CSA CAN3-A23.1-94 (Latest Edition) "Concrete Materials and Methods of Concrete Construction". The surface of the curb, gutter and sidewalk shall be finished prior to final set by brushing to provide a uniform non-skid finish. Both edges of the sidewalk shall be trowelled smooth to a width of 50 mm and rounded to a radius of 12 mm.

During hot, cold, or drying weather conditions, special attention shall be given to preparation, delivery, placement, and airing of concrete to ensure that the requirements of CSA CAN 3-23.1-94 are met.

Curb and gutter contraction joints shall be made at a maximum of 3 m intervals.

Fifteen (15) mm thick contraction joints shall be installed through the full depth and the entire width at the beginning and end of every curb return, on both sides of crossovers and against walls and structures. A 6 mm rounded edge shall run along each side of the joint.

Contraction joints shall be made by cutting a groove through the surface of the concrete to a minimum depth of 25 mm. Horizontal and vertical alignments shall not vary from established line and grade by more than 5 mm over a 3 m section. Where these tolerances are not met, the faulty section shall be removed and replaced.

Expansion joints shall be 13 mm width and located at all tangent points and at the end of each day's pour.

4.04 Curing Concrete

Between April 1 and October 1, concrete shall be sprayed with two coats of an approved membrane curing compound as soon as the concrete has obtained its initial set. Prior to April 1, or after October 1, alternate methods of curing concrete must be used and the method approved by the Village Engineer.

4.05 Boulevards Driveway Approaches

Construction of driveway approaches shall be according to specifications set out in Schedule B, Clause 2.07, of the Bylaw. Care shall be taken to avoid damage to existing utilities such as curb and gutter and water curb stops.

4.06 As Constructed Drawings

Prior to final acceptance, the Owner shall deposit with the Village a computer diskette (3½") in AutoCAD (latest release) format and one set of original as-constructed mylar drawings showing all the information requested by this schedule and conforming to the criteria set out in Schedule I.

SCHEDULE D

REGULATIONS, STANDARDS, AND SPECIFICATIONS FOR THE DESIGN AND INSTALLATION OF WATER SYSTEMS

This is Schedule D of the Corporation of the Village of Valemount Subdivision and Development Servicing Bylaw No. 450, 1998.

_____

Clerk

SCHEDULE D

REGULATIONS, STANDARDS, AND SPECIFICATIONS FOR THE DESIGN AND INSTALLATION OF WATER SYSTEMS

1.0 GENERAL

1.01 Water Distribution System to be Constructed by Owner

Where the provisions of Schedule A of this Bylaw require the construction of a water distribution system, the Owner shall provide a water distribution system and storage facilities including water mains, valves, hydrants, service connections, pump stations, reservoirs and pressure reducing stations consistent with the regulations, standards and specifications set out in this Schedule. All standards not specifically described in this schedule shall be in accordance with appropriate AWWA standards or as directed by the Village Engineer.

1.02 Approval of Engineering Drawings Required prior to Construction

Engineering drawings showing detailed design of the necessary works shall be submitted to the Village Engineer for approval. No construction shall commence until the engineering drawings have been approved by the Village Engineer. These drawings shall show alignment, size and depths of pipes, pipe bedding requirements, existing ground line and proposed final ground line over the pipe, location and detail of all fittings, valves and hydrants, location of all service connections, location, access to, size and details of any pump stations and reservoirs, all easements and all such other details as may be required. Where a water system is not yet available, rights-of-way may be required to be provided by the Owner to allow for the eventual installation of this facility. Such rights-of-way shall be registered in favour of the Corporation of the Village of Valemount at the Owner's expense.

2.0 DESIGN CRITERIA

2.01 Capacity of System and Sizing of Water Mains

Water distribution systems shall be designed to deliver water in adequate quantities at adequate pressures for both domestic use under peak consumption conditions and fire flows. Mains shall be sized to carry the peak hourly flow rate or the maximum daily flow rate plus the fire flow rate, whichever is the greater. Mains shall be sized using the Hazen-William formula with "C" equal to 120 and maximum flow velocity for peak hourly demand rate of 2.0 m per second. For fire flow, plus the maximum day rate, the flow velocity shall not exceed 3.0 m per second.

2.02 Domestic Demand Criteria

For residential areas, the daily domestic demand criteria for purposes of designing water distribution systems shall be assumed to be:

.1 Average day: 945 litres/day/capita;
.2 Maximum Day: 2360 litres/day/capita; and
.3 Peak Hour/Maximum day Consumption Ratio: 1.5.

For other than residential areas, the demand criteria shall be selected to suit the particular circumstances subject to the Approval of the Village Engineer.

2.03 Fire Flow Requirements

Water distribution systems shall also be designed to ensure that fire flows as required by the Insurers' Advisory Organization (IAO) are available for required durations. Fire flows shall not be less than 3640 litres per minute. The amount and duration of design fire flows shall be provided to the Village Engineer for his approval prior to final design of the water distribution system.

2.04 Design Pressures

Water systems shall be designed for pressures in the range of 245 kPa to 630 kPa, with 245 kPa measured under peak hourly conditions and 630 kPa measured under static conditions. The minimum pressure shall be measured or calculated at the main floor elevation of the highest proposed house and an allowance made for pressure loss in the service line to the house wall. Minimum residual pressure at any hydrant shall not be less than 140 kPa under maximum day domestic consumption plus fire conditions. Reservoir level shall be assumed at mid point for calculation of minimum pressures and full for calculation of maximum static pressures.

2.05 Minimum Pipe Size

The minimum pipe size for all water mains shall be 150 mm diameter, however the pipe size shall be capable of providing present and future domestic, and fire flows.

2.06 Location and Grade of Water Mains

Water mains shall be located in the road right-of-way as shown on the Standard Drawings unless otherwise approved by the Village Engineer. Where the location of the watermain is not practical there shall be a minimum lineal horizontal clearance of 1 metre between a water main and other existing or proposed underground services, except sanitary sewer mains. A minimum of 3.5 metre horizontal distance between a watermain and a sanitary sewer main shall be maintained. In special cases such as installations in rock or hardpan,

the horizontal clearance may be reduced, with the approval of the Village Engineer, provided the invert of the water main is a minimum of 450 mm above the crown of the sanitary sewer and subject to any Provincial regulations. On side-hill streets, the main shall, where possible, be located on the cut side of the centre line of the street.

Water mains shall be normally designed to follow a straight alignment between intersections, at grades parallel to the road centreline.

Curved alignments may be accepted provided that the pipe alignment is at a parallel offset with an established boundary and the radius of curvature is not less than 60 m or twice the minimum radius of curvature recommended by the pipe manufacturer, whichever is the greater. The design drawings shall indicate where short lengths or field belled pipe lengths are required on curves.

Water mains shall be designed with a rising grade wherever possible to minimize high points in the main. Where a high point is unavoidable, either a blow off, service or air release valve shall be installed at that point.

Where the water main network is weak, installation of supplementary mains of a minimum of 150 mm diameter to existing mains may be required at the discretion of the Village Engineer and may necessitate the provision of rights-of-way in favour of the Corporation of the Village of Valemount.

No gas main, electric or telephone duct or other utility line shall be installed in the same trench with water mains.

Where it is necessary for the water main to cross other underground services, the crossing shall be made at an angle greater than 20 degrees and the vertical clearance between services at the crossing point shall be not less than 200 mm except for sanitary sewers where the clearance shall be 450 mm between the exterior walls of the pipes.

The drawings shall indicate whether the water main passes over or under other underground services which it is crossing.

2.07 Spacing of Fire Hydrants

Fire hydrants shall be located, in general, at highway intersections and at maximum spacing of 150 metres in low density residential areas and 100 metres in high density residential, commercial and industrial areas. Additional hydrants may be required by the Village Engineer at schools, major multiple family developments, commercial buildings or other major developments consistent with the current fire flow requirements of the Canadian Underwriters' Association.

Where hydrants are located other than at intersections, they should be located on the projection of the property line dividing two lots. In selecting the location of a hydrant, the probable route of the fire engine shall be considered.

A hydrant shall not be located within 3 m of a utility pole, pad mounted transformer or light standard, within 1.5 m horizontally of underground service pipes or open ditches, or within 1 m of the curb line or back of sidewalk.

2.08 Line Valves

Line valves in residential areas shall be located at a maximum spacing of 250 m in a continuous line and shall generally be located so that not more than 2 hydrants or 50 dwelling units will be without adequate pressure in the event of any one water break. In commercial and industrial areas, line valves shall have a maximum spacing of 120 m and be located so that not more than one hydrant will be out of service during water system repairs.

Each tee shall have two line valves; each cross shall have three line valves. Each line valve shall be the same diameter as the pipe on each downstream branch of the tee or cross. At the discretion of the Village Engineer, line valves may be required on all branches of a wye or tee.

A line valve may be required on a new pipe line near each point of connection to existing mains.

2.09 Blow Offs

Permanent blow offs shall be installed at all permanent dead-ends and an adapter will be required for connecting a standard 63 mm fire hose for flushing the main, as shown on the Standard Drawings.

Temporary blow offs (usually a corporation stop) may be installed to facilitate chlorination and flushing of any part of the system. After flushing, the temporary blow off shall be removed as directed by the Village Engineer.

2.10 Air Relief Valves

Double acting air relief valves shall normally be installed at all summits in the mains.

2.11 Fittings and Appurtenances

Fittings and appurtenances with other than standard hub ends shall be so indicated on plan.

Where practical, all fittings shall be located in respect to each other so that flanges or standard pipe lengths can be used to connect them.

The centre-to-centre dimension between fittings near each other shall be shown on the final engineering drawing.

2.12 Service Connections

The diameter of water services shall be determined by the Design Engineer and is subject to approval of the Village Engineer, and in no case shall the diameter be less than 20 mm.

Water services shall be installed to the center of each lot in accordance with the Standard Drawings and shall be installed, whenever possible, in a common trench with the sanitary sewer service. Through areas of steep topography and roads the service location may be moved to 3.5 m from the lowest (elevation) lot line.

A water service shall be installed where required to provide a connection to each lot created by the subdivision and to any other existing or possible future lot which can be serviced from mains installed by or for the subdivision.

In general, 20 mm to 50 mm diameter service connections may be tapped into mains 150 mm diameter and greater with double strap service saddles. Multiple corporation stops shall be staggered and not less than 300 mm apart.

No tappings shall be made at an angle of greater than 30 degrees above the horizontal centreline plane of the pipe.

Where it is necessary to install service connections at less than 1 m centres in a 100 mm diameter main, the 100 mm diameter main, in all cases, shall be ductile iron.

The curb stop at the end of each service pipe shall be located 0.3 m in front of the street/property boundary line, and 3.0 metres from the lowest corner lot pin. Where such location will conflict with other services, the location may be revised with the approval of the Village Engineer.

2.13 Depth of Cover

The depth of the water main shall be sufficient to provide all services with a minimum cover of 2.5 m to the top of the service anywhere within the Right-of-Way. In no instance shall the minimum cover over the crown of the main be less than 2.5 m.

2.14 Tie-ins to Existing Water Mains

Connection of a new pipe to an existing water main shall be undertaken by the Village, who will supply and install all materials to construct the connection. The cost of the connection will be charged to the Owner by the Village.

2.15 Reservoirs

Reservoirs, where required, shall be designed to suit the particular circumstances. In general, reservoir capacity shall be not less than:

Total Storage Requirement = A + B + C, where:

A = Fire Storage, based on minimum 3640 litres per minute fire flow;
B = Equalization Storage (25% of maximum day demand);
C = Emergency Storage (25% of A + B).

Reservoir design, at minimum, shall incorporate the following features:

.1 sufficient geotechnical data to prove the site suitable for reservoir construction;
.2 structures to be below ground and covered, unless specifically approved otherwise;
.3 material - reinforced concrete;
.4 2 cells, each containing one-half of total required volume and capable of being drained and filled independently;
.5 lockable access opening in roof for cleaning and maintenance - minimum dimension 1 m x 1 m to be located between overflow pipe and wall;
.6 ventilation pipes or openings;
.7 slope floor to sump;
.8 sub-drain under floor to collect and drain any leakage (connect to overflow pipe in a manhole);
.9 interior wall ladder from roof access to floor (no exterior ladder required);
.10 inlet, outlet pipe to be perforated and designed to disperse water throughout the reservoir;
.11 overflow drain to be provided and sized to transmit the maximum pump discharge. The overflow drain shall be connected to an acceptable point of discharge; and
.12 access roads; and
.13 telemetry alarm system.

Reservoir valve chamber design shall incorporate:

.1 sump in valve chamber floor, connected to overflow pipe;
.2 50 mm valved outlet off supply line within valve chamber for water supply for cleaning reservoir; and
.3 valves shall be OS & Y.

2.16 Pump Stations

Pump stations, where required, shall be designed to suit the particular circumstances. In general, pump stations shall be designed to meet maximum daily demands with the largest pump out of service with balanced storage on line. If equalization storage is not on line, pump station capacity must meet peak hour demand with the largest pump out of service.

Pump station design, at minimum, shall incorporate the following features:

.1 reinforced concrete, blockwork or brick construction, aesthetically pleasing;
.2 lockable access doorways sized so that the largest single piece of equipment may be safely removed and replaced. Lifting hooks or rails with pulley blocks as required;
.3 pumps to start and stop individually. Start and stop to be based on water levels in control reservoir. Automatic alternation of pump sequence;
.4 power failure protection with manual reset;
.5 high water override start plus alarm;
.6 high pressure (discharge) override start;
.7 low pressure (discharge) override start plus alarm;
.8 low pressure/no flow (suction) override start;
.9 alarms to be audible and visible;
.10 control valves to minimize starting and stopping surges;
.11 duplicate control cables (without splices) between pump stations and reservoirs;
.12 power factor correction as required by Power Authority;
.13 hour meters and amp meters on each pump;
.14 recording flow meter at each pump station;
.15 recording suction and discharge pressure gauges at each pump station;
.16 automatic heating, ventilating and dehumidifying systems;
.17 in-station lighting;
.18 drainage to be provided for all pump station;
.19 interconnection with the Village's alarm telemetry system;
.20 electrical phase loss protection;
.21 electrical drawing schematics for control panels;
.22 access roads; and
.23 pump manuals.

For each design submission to the Village, an extra set of drawings pertaining to the design of the pump station, keyplan, and a location plan shall be submitted for the maintenance department to review.

Before commencement of construction, the Owner shall provide five sealed sets of mechanical shop drawings and five sealed sets of electrical line diagrams for review by the Village Engineer. Two sealed copies of design calculations shall be provided for documentation. Before acceptance of the completed station, by the Village, the Owner shall provide 3 copies of an Operation and Maintenance Manual to the Village. The manual shall contain:

.1 cover page and table of contents;
.2 as constructed shop drawings;
.3 equipment layout drawings;
.4 electrical, control, and alarm wiring diagrams;
.5 operating instructions for all equipment;

.6 maintenance instructions for all equipment, including frequency of maintenance tasks;
.7 equipment data sheets;
.8 certified head/capacity curves for pumps;
.9 equipment part lists; and
.10 emergency operating procedures.

The maintenance manuals shall be hardbacked bound documents with the name of the facility embossed on the cover. Each section of the manual shall be identified by plastic covered tabbed dividers, with the section name identified on the tab.

2.17 Pressure Reducing Stations

Pressure reducing stations, where required, shall be designed to suit the particular circumstances. In general, each pressure reducing station shall have a separate pressure reducing valve and appurtenances for maximum daily demand and a separate pressure reducing valve and appurtenances for fire flows.

Pressure reducing station design, at minimum, shall incorporate the following features:

.1 access road to chamber;
.2 precast or cast in place buried concrete chamber suitable for H20 Highway loading;
.3 lockable access hatch (914 mm x 914 mm minimum);
.4 aluminium ladder and safety port;
.5 sump with sump pump assembly;
.6 fluorescent lighting, heating, venting and one electrical outlet;
.7 pressure reducing valves with downstream surge control;
.8 wye strainers;
.9 OS&Y isolating gate valves;
.10 victaulic couplings;
.11 pressure gauges;
.12 one 20 mm hose bib connection;
.13 pipe stands; and
.14 ceiling and wall of chamber to be painted with two coats of latex white paint;

For each design submission to the Village, three sets of drawings pertaining to the design of the pressure reducing station, key plan and a location plan shall be submitted.

2.18 Access

An all weather vehicular access shall be provided to all reservoirs and pump stations. The access roads shall conform to the following standards:

.1 minimum surface width - 6m;
.2 ditching along both sides to at least 100 mm below subgrade;
.3 300 mm pitrun gravel subbase; and

.4 50 mm crushed gravel base.

3.0 MATERIALS

3.01 Pipe

Pipe for water mains shall either be ductile iron or polyvinyl chloride (PVC).

.1 Ductile iron pipe shall conform with American Standard AWWA C150/A21.50 and C151/A21.51, Latest Edition. All pipes shall conform to AWWA C151, minimum pressure class 150, unless specified otherwise by the Village Engineer. Pipes shall be cement mortar lined, conforming with AWWA C104/A21.4, Latest Edition. Joints shall be mechanical or a rubber gasket bell and spigot to AWWA C111, A21.11, Latest Edition.

.2 PVC pipe shall conform with AWWA C-900 and CSA CAN3-B137.3 for mains 100 - 300 mm diameter and with AWWA C-905 and CSA CAN3-B137.3 for mains 350 mm to 600 mm diameter. Joints shall be wall thickened and sleeve reinforced bell and spigot ends with formed groove for elastomeric gasket seal conforming to ASTM D2122.

3.02 Fittings

Fittings shall be ductile iron for use with ductile iron or PVC pipes conforming to AWWA C110/A21.10 and shall be designed for a minimum pressure of 1720 kPa unless specified otherwise by the Village Engineer. Fittings shall be Terminal City only.

3.03 Buried Gate Valves

Buried gate valves shall conform to:

.1 AWWA C-500 iron body, bronze mounted wedge valves with non-rising stem, O-ring stem seal, suitable for 1 MPa minimum; or

.2 AWWA C-509 iron body, resilient seated valves with non-rising stem, O-ring stem seal, suitable for 1 MPa minimum.

Valves shall be equipped where a 50 mm square operating nut and tie-lugs where restraining is required. Valves to open counterclockwise.

3.04 Valve Boxes

Valve boxes shall be Nelson or Robar type with anchored flanges approximately 100 mm from the top of the box.

3.05 Hydrants

All hydrants shall be Terminal City compression type, complete with 2 - 63 mm ports and 114 mm pumper port. Threads shall conform to the British Columbia Fire Hose Thread specifications. Hydrants shall be painted red above the ground line. Drain outlets shall be provided. Depth of bury shall be a minimum of 2.5 metres. Hydrant extensions shall be installed as required to suit the final boulevard grade. Hydrants shall be equipped with a standard BC pentagon operating nut and shall open counterclockwise. Cap chains not required. Hydrant colour shall be red.

Hydrant lead pipe shall be a minimum of 150 mm diameter. At the discretion of the Village Engineer, a concrete wing wall shall be installed at hydrants adjacent to road cut slopes. In areas where road ditches exist, a culvert and a 3 metre wide gravelled pad across the ditch shall be provided for access to the hydrant.

3.06 Service Connection Pipe, Saddles, and Joints

All pipe for underground services 50 mm diameter and smaller shall be Polybutylene Municipal grade series 160 service pipe complete with stainless steel inserts conforming to AWWA C902. Pipe for services 100 mm and 150 mm diameter shall be the same as specified for watermain pipe.

Service connections to PVC pipe shall be made using bronze double strap saddles with either bronze or stainless steel fasteners tapped for AWWA thread. Saddles shall provide full support around the circumference of the pipe and shall provide a minimum bearing width of 50 mm measured along the axis of the pipe.

Joint fittings shall be compression type suitable for 1035 kPa working pressure.

3.07 Corporation Stops

Corporation stops shall be Mueller H15008 for 20 mm diameter through 50 mm diameter, or approved equal.

3.08 Curb Stop and Boxes

Curb stops shall be Mueller Mark II Oriseal H 15209 stop, or approved equal, for 20 mm diameter through 50 mm diameter. Service boxes shall be Mueller A726, or approved equal, for 20 mm diameter to 40 mm diameter and Mueller A728, or approved equal, for 40 mm diameter through 50 mm diameter.

3.09 Air Valves

Air valves shall be 50 mm Terminal City, Apco, or approved equal, double acting air valves or as approved by the Village Engineer.

3.10 Stops and Drains For Blow Offs

Stops and drains shall be minimum 50 mm Mueller A-10284 Mark II Oriseal, or approved equal.

3.11 Meter Chambers

Metering may be required at the discretion of the Village Engineer, at the Owner's expense. The location of meter chambers shall be approved by the Village Engineer. All meters and remote readout devices shall be easily accessible to the Village. Meter chambers or enclosures shall include:

.1 structures shall be watertight;
.2 drainage, ventilation and lighting;
.3 protection from freezing;
.4 adequate access and interior space for maintenance and equipment removal;
.5 minimum headroom of 2.0 m;
.6 piping primed and painted with a rust-inhibiting paint;
.7 remote readout device;
.8 meter bypass; and
.9 meter for domestic and irrigation use - bypass for fire flows.

3.12 Concrete

All concrete shall conform to CSA:A23.1M with a minimum 28-day compressive strength of 20 MPa for unshrinkable fill and thrust blocks, and 25 MPa for all other purposes. Concrete slump shall be in the range of 50 mm to 100 mm.

Cement shall be Portland cement conforming to CSA:A.5, and shall be normal type unless specified by the Village Engineer or dictated otherwise by soil conditions.

Admixtures shall not be included in the concrete mix without the approval of the Village Engineer.

3.13 Bedding Material

Bedding shall for all pipe bedding shall be sand or crushed rock free of clay lumps, organic and other deleterious material. Gradation shall conform to the gradation limits set out in Table D.1.

TABLE D.1
PIPE BEDDING GRADATION LIMITS

USBC Sieve Size	Percent by Weight Passing
19	100
12.5	75 - 100
4.75	40 - 80
2.36	25 - 65
0.300	5 - 25
0.075	0 - 8

Through areas of high groundwater and/or unstable soil conditions, crushed gravel or drain rock shall be installed to bed the pipe.

3.14 Backfill Material in Pipe Zone (Pipe Surround)

Backfill material in the pipe zone (pipe surround) shall be sand and crushed rock free of clay lumps, organic and deleterious material. Gradation shall conform to the gradation limits set out in Article 3.13.

3.15 Backfill Material Above Pipe Zone

In Road Areas

.1 Backfill material below the pavement structure for trenches in road areas may be native soil provided the native soil is free of organic or foreign matter and can be readily compacted to a minimum of 95% standard Proctor density in compliance with ASTM D-698. Native material is not acceptable if it is not competent enough

to provide an adequate subgrade to support road sub-base, base and asphalt. Maximum particle size of backfill material not to exceed 200 mm.

If the native material is deemed unacceptable, it shall be disposed of and competent granular backfill material conforming to Clause 3.01 of Schedule B imported.

In Non-Road Surfaces:

.2 Backfill material for trenches and easements or other non-road areas may be native material excavated from the trench providing it is sufficiently free of frozen soil, roots or other objectionable material so as not to cause undue settlement. Maximum particle size of backfill material not to exceed 200 mm.

3.16 Encasement Pipe Filler Sand

To be well graded, clean sand, free from organic materials and conforming to the following gradation limits as set out in Table D.2.

TABLE D.2
ENCASEMENT PIPE FILLER SAND GRADATION LIMITS

USBC Sieve Size	Percent By Weight Passing
4.750 mm	100
2.360 mm	20 - 70
1.180 mm	13 - 50
0.850 mm	8 - 35
0.300 mm	5 - 25
0.150 mm	2 - 15
0.075 mm	0 - 8

3.17 Insulation

Fifty (50) mm Styrofoam SM insulation shall be installed over all watermains and service lines that are installed shallower than the specified 2.5 m depth of earth cover.

3.18 Bolts and Nuts

Bolts and nuts to be Type 314 stainless steel.

4.0 WORKMANSHIP

4.01 Trench Excavation

Trenches shall be excavated to suit the cross-section shown on the Standard Drawings. Open trenches through existing paved surfaces will be allowed only with the prior express consent of the Village Engineer. When trenches through existing pavement are allowed, the pavement shall first be saw-cut by mechanical means in straight continuous lines parallel to the trench centreline.

If trenches are excavated wider than the specified widths, a higher class of pipe or special bedding may be required.

Rock excavation in trenches shall provide a minimum clearance of 150 mm below the pipe for pipes 600 mm in diameter or less, and 250 mm for pipes larger than 600 mm in diameter.

The top of the trench at ground level shall be kept to the minimum width consistent with the depth, natural angle of repose of the material and the regulations of the Workers' Compensation Board.

Excavation for chambers, fittings and other appurtenances shall be to the lines which will permit the assembly of these sections, and to permit adequate backfilling and compaction operations.

Where an existing structure or underground installation may be affected by the works, it is the responsibility of the Owner to inform the Village of such facility sufficiently in advance that the Village may make an inspection and specify the protective measures to be undertaken.

Where an unforeseen or other obstruction is encountered which interferes with the designed alignment or grade, the construction shall cease until such time as revised proposals are approved by the Village Engineer.

The attention of the Owner is directed to the provisions of the Workers' Compensation Board safety regulations. All municipal employees have been instructed not to enter excavations which are not properly braced or which otherwise do not conform with the requirement of the Board. It follows, therefore, that approvals cannot be given to installations not inspected because of unsafe working conditions.

Any over-excavation of the trench subgrade beyond the specified depth shall be backfilled with select material and compacted to 100% Standard Proctor density.

In rock excavation the depth of compacted bedding material below the pipe shall be a minimum of 150 mm for pipe of 600 mm diameter or less and 250 mm for pipe in excess of 600 mm diameter. This depth shall exist for the full wall-to-wall width of the trench.

Where the bottom of any excavation as uncovered is soft and is in the Design Engineer's opinion unfit to support the pipes or structures, a further depth shall be excavated and refilled to the correct shape, grade and elevation as directed by the Design Engineer.

When the bottom of a trench is found to consist of unstable material which, in the opinion of the Design Engineer, cannot be removed and replaced with bedding material, a pile foundation or other structural support in accordance with plans prepared by the Design Engineer shall be constructed.

In areas of clay or other impermeable soils, where over excavation of the trench subgrade is required, the over excavation shall continue to a point where ponding of water in the trench bottom will be avoided.

Open cut trenches shall be sheeted and braced as required by the Workers' Compensation Act, as may be necessary to protect life, property, or the work, unless the trench excavation is sufficiently wide at the top to be naturally stable. When close sheeting is required, it shall be driven so as to prevent the soil from entering the trench either from below or through such sheeting. A minimum distance or 150 mm from the closest point of the pipe to the sheeting shall be maintained.

When possible, vertical trench timber or sheeting shall be placed so that it does not extend below the level of the bottom of the excavation. Sheeting driven below the pipe grade shall not be removed unless the sheeting can be removed without causing settlement or lateral displacement of the pipe.

Unless otherwise indicated in the drawings or specifications, or unless approval to leave it in place is received from the Village Engineer, trench sheeting and bracing shall be removed when backfilling has been completed or has reached a level which will permit its safe removal without causing injury to persons or damage to the works. When sheeting and bracing is left in place, it shall be cut such that no sheeting remains closer than one metre to the established sub-base road grade or the existing ground surface, whichever is the lower.

Particular caution will be taken to ensure that pipe bedding is not disturbed such that settlement of the pipe results.

Timber supports or sheeting shall be left in place when its removal would endanger adjacent structures or result in a shifting of pipe bedding material and a displacement of the pipe. The Village Engineer may require the pipe to be bedded in concrete (Class A Bedding)

when, in his opinion, the removal of sheeting would disturb the pipe bedding. Discharge from trench pumps, well points, or other dewatering aids, shall be located and controlled in such a manner as to not cause loss or damage to public or private property, nuisance on roads or walks, or injury to the public.

4.02 Pipe Class and Bedding Class

Notwithstanding other provisions of this Bylaw, the quality of the pipe and bedding shall be so selected such that the installation will adequately support the loads to be placed on it during construction and in operation. For ductile iron pipe, the calculations shall follow the method shown in AWWA C-150, latest edition. For PVC pipe, the calculations shall follow the methods outlined in AWWA C-900 and C-905, latest edition.

For all pipe, a minimum Class B bedding, as defined by the Standard Drawings, is required. Pipe class and bedding class must be identified on all engineering drawings.

4.03 Pipe Alignment and Depth of Cover

Pipe shall be installed true to the alignment shown on the approved construction drawings and to a depth sufficient to provide a minimum cover of 2.5 m measured from the top of the installed pipe to the finished grade elevation over the pipe.

4.04 Pipe Installation

Prior to installing pipe, all standing water shall be drained or pumped from the trench. Pipe shall be carefully offloaded and lowered into the trench in a manner that will prevent damage to the pipe. The pipe shall be jointed in strict accordance with the manufacturer's recommended practice.

Uni-flange thrust restraints shall be installed on pipes installed on grades in excess of 20%.

4.05 Service Connections

Service connections shall be connected to the Corporation stop and a gooseneck formed in a horizontal plane as shown on the applicable Standard Drawing. Pipe shall be installed in a straight line between the gooseneck and the terminus of the service.

Compression joints shall be required for connecting service piping. Service tapping shall be spaced along the length of pipe and staggered around the circumference to avoid cracking of pipe between tappings. Minimum distance between two tappings and between the end of a pipe and the tapping shall be 300 mm. A marker stake shall be set with bottom flush with the end of the service and the top projecting a minimum 1,000 mm above the ground. Marker stakes shall be cut to an even 200 mm length, and depth from top of marker to water service shall be clearly marked on the stake. Marker stake tops shall be painted blue with yellow painted stencilled numbers and letters.

Service boxes shall be set flush with ground or road surface. A length of copper flattened on one end shall be installed on the private property side of the curb stop to prevent entrance of foreign material and this pipe shall extend 1,500 mm into private property.

4.06 Thrust Blocking

Concrete thrust blocking shall be provided at fittings and on hydrants as shown on Standard Drawing D-1. Concrete shall be placed between undisturbed ground and the fitting to be anchored such that the pipe and the fitting joints are accessible for repair. Bolts on flanged fittings shall be left free.

4.07 Valves, Fittings and Hydrants

Valves, fittings and hydrants shall be set plumb and directly on the centreline of the pipe. A valve box shall be provided for every valve. The valve box shall not transmit shock or strain to the valve and shall be centered and plumb over the nut of the valve. The 150 mm riser pipe must be placed in such a manner as to permit the use of long-handled angle wrenches through the box to tighten packing gland nuts. On valves 200 mm and over, a cast bell bottom fitting shall be used over the valve. A 1.5 metre radius asphalt apron shall be placed around all valves installed on gravel roads and gravel shoulders.

Hydrants shall be plumb and shall have their nozzles at right angles to the curb. Hydrants shall be set with ground flange above the ground at the elevation directed by the Village Engineer generally at 50 mm above finished ground, curb or sidewalk grade. When set in a permanent sidewalk or other solid structure, a suitable expansion joint material shall be placed around the hydrant to allow for movement between hydrant and structure. All hydrants shall be supplied with drains. Sufficient drain rock shall be placed to allow for proper hydrant drainage, generally a minimum of 0.5 cubic metres.

4.08 Blow-Offs

Blow-offs shall be installed as shown on the applicable Standard Drawing.

4.09 Granular Bedding and Backfill in Pipe Zone

The pipe zone is considered as being the depth of trench between the trench bottom and a level 300 mm above the top of the pipe.

The pipe zone backfill shall be hand placed and thoroughly compacted to a density of 95% Standard Proctor Density in layers not exceeding 150 mm using hand tampers.

4.10 Backfill Above Pipe Zone

In Road Areas

.1 In road areas trench backfill material shall be placed in layers not exceeding 300 mm in thickness and compacted by mechanical means to a minimum of 95% Standard Proctor density.

The water content of the material shall be controlled to achieve the required density.

In Non-Road Areas

.2 In easements and other non-roads areas, native trench material may be used for trench backfill above the pipe zone. Backfill shall be placed and compacted to 90% Standard Proctor Density.

4.11 Pipe Casings

Pipe casings shall be installed as shown on the Standard Drawing. The water pipe shall be blocked at each joint to ensure line and grade is maintained and the casing is to be sealed at both ends with joint filler with proper care taken to ensure that the pipe remains on line and grade and does not float. The annular space between the water pipe and the casing pipe shall be filled with sand as specified in Section 3.16.

A length of 6 mm polypropylene rope shall be laid alongside the carrier pipe inside the casing to assist future retrieval.

4.12 Asphalt Restoration

If the edges of the cut asphalt become ragged as a result of the construction operation, the asphalt shall be re-cut to form a straight line prior to placing new pavement. The edges of the existing asphalt shall be thoroughly clean and coated with an approved bituminous bonding agent prior to placing the new hot asphalt mix. The finished grade of the asphalt surface shall conform with that of the existing surface such that no rises, depressions or ridges result from the repaving process.

4.13 Leakage Tests

Following final trench backfilling, leakage tests shall be performed on all installed piping according to AWWA C600, Latest Edition. Tests shall be conducted in the presence of the Village Engineer with 24 hour notice provided to the Village in advance of the test. A leakage test shall be conducted after all mains and service connections have been completely installed and backfilled. The Owner shall furnish all necessary apparatus, test water and labour to conduct test. Leakage tests shall be performed in the following manner:

The section to be tested shall be filled with water and all air expelled from the piping. It is recommended that the test section be filled with water for at least 24 hours prior to testing. By pumping water into the test section, the pressure within the piping shall be increased to the pressure rating of the main or at least 1 1/2 times the operating pressure at the point of testing, whichever is greater. This pressure shall be maintained constantly in the pipe within ± 35 kPa throughout the duration of the test, by the addition of make-up water. The duration of the test shall be a minimum of 2 hours. Hydrant leads shall be shut off at the hydrant such that the hydrant is placed under test. The quantity of water pumped into the test section to maintain the specified pressure over the period of the test shall be considered to be the leakage. Piping will not be accepted until the leakage is less than the maximum allowable leakage determined from the following formula,

$$L = \frac{NDP^{1/2}}{131{,}000}$$, where:

L	=	the allowable leakage in L/hr;
N	=	the number of joints in the test section;
D	=	the nominal diameter of the pipe in mm; and
P	=	the average test pressure during the leakage test, in kPa, not to vary more than ± 35 kPa.

Should any test disclose leakage greater than that specified above, the source of the leakage shall be located and the defect repaired or the necessary replacement made and the section retested until a satisfactory test is obtained. All repairs to the work shall be made with new material equivalent to that requiring repair or replacement. The use of repair and maintenance aids such as clamps will not be permitted.

Leakage tests shall be carried out between valved sections of the installation such that every valve in the system is tested for leakage in the shut-off position.

4.14 Flushing

The pipe shall be cleaned of dirt and other foreign materials. The pipe shall be flushed at water velocities of 1 m/s or as high a velocity as can be obtained from the available water source. Flushing time shall be at least five times the time required to travel the main at 1.5 m/s velocity. Flushing shall continue for the required time or until 10 minutes after the water has cleared, whichever is greater.

4.15 Chlorination

On completion of the flushing operation, main pipes and services shall be chlorinated. Chlorination procedures shall conform to AWWA C651, Latest Edition. No pills, powders or solids shall be placed in the main during installation or for chlorination purposes. Chlorination shall be applied by the continuous feed method.

After preliminary flushing, the chlorine solution shall be injected at a measured rate such as to fill the main with a 25 mg/L available chlorine solution.

All appurtenances shall be operated in this solution to disinfect them. All measures shall be taken to prevent the disinfectant solution from flowing into existing water supply system. The disinfecting solution shall remain in the main for 24 hours and shall have no less residual than 10 mg/l at the end of that period. Following disinfection of lines to the required standard, the line shall have a final flushing to completely purge all disinfecting solution. Any water with residual greater than 2.5 mg/L shall be diluted prior to discharging to an open ditch. Flushing shall continue for 15 minutes after a concentration of 1 mg/L is reached. Water with a chlorine concentration greater than 1 mg/L shall not be discharged to a recognized water course without the approval of the Ministry of Environment. A log of all test results and disinfection procedures shall be submitted to the Village Engineer. On completion of chlorination, the entire piping system shall be thoroughly flushed, filled with water and left in a condition ready for use.

4.16 Materials Testing

The Village shall be provided with copies of all sieve and compaction test results pertaining to bedding, backfill, and road restoration.

4.17 As Constructed Drawings

Prior to final acceptance, the Owner shall deposit with the Village one computer diskette (3½") in AutoCAD (latest version) format and one set of original as-constructed mylar drawings showing all the information requested by this schedule and conforming to the criteria set out in Schedule I.

SCHEDULE E

REGULATIONS, STANDARDS, AND SPECIFICATIONS FOR THE DESIGN AND CONSTRUCTION OF SANITARY SEWERS

This is Schedule E of the Corporation of the Village of Valemount Subdivision and Development Servicing Bylaw No. 450, 1998.

_____

Clerk

SCHEDULE E

REGULATIONS, STANDARDS AND SPECIFICATIONS FOR THE DESIGN AND CONSTRUCTION OF SANITARY SEWERS

1.0 GENERAL

1.01 General Requirements

Where a sanitary sewage collection and disposal system is required, sanitary sewer facilities including gravity sewer mains, pump stations and force mains, manholes, service connections and all related appurtenances shall be provided.

A sewer service lateral shall be installed where required to provide a connection to each parcel to be created by the subdivision and to any other existing or possible future parcels which can be serviced from mains installed by or for the subdivision. The routing of sewers shall be in accordance with the directions of the Village Engineer.

Through areas where connection to the community sanitary sewer system is not feasible as determined by the Village Engineer, a sewage collection system including service connections to each lot shall be installed and left in a dry state until connection to the Village system sometime in the future. Subject to applicable soil conditions, individual septic tanks and disposal fields may be installed on each lot in accordance with Health Act requirements; however, the individual treatment systems (e.g. septic tanks) shall be designed to facilitate easy connection to the dry collection system when it is connected to the community sewer system.

1.02 Approval of Engineering Drawings Required Prior to Construction

Engineering drawings showing detailed design of the necessary works shall be submitted to the Village Engineer for approval. No construction of sanitary sewers shall commence until the drawings have been approved by the Village Engineer. These drawings shall show alignment and size of pipes, proposed grades, distances between manholes, manhole invert elevations, existing ground line and proposed final ground line over pipe, location of all service connections to the property line, all easements, lift stations, force mains, pipe bedding requirements and all other details which may be required by the Village Engineer.

2.0 DESIGN CRITERIA

2.01 Pipe Capacity

Sanitary sewer facilities constructed in a subdivision shall be designed to provide sufficient capacity to carry the required quantity of sewage flow from the fully developed upstream contributing area, as defined by the Village Engineer.

Sewage design flows shall be based on the equivalent population of the contributing area as determined by the Village Engineer but no less than 66 persons per hectare with an average per capita flow of 510 litres per day. A peaking factor calculated using the Harmon Peak Factor curve shall be applied to the average flow as follows:

$$\text{Peak Factor} = 1 + \frac{14}{4 + P^{1/2}}$$

where P = equivalent contributing population in thousands.

An infiltration rate of 5,000 litres per hectare per day shall be used. In areas where the water table is higher than the sewer main inverts, 8000 litres per hectare per day shall be used.

The peaking factor shall be applied to the sanitary contribution only and not to the infiltration allowance.

Pipe sizes shall be selected so that sewers flow 2/3 to 3/4 full at peak hour design flow.

2.02 Minimum Velocity and Design Grade

Minimum velocity for pipe flowing full or half full shall be 0.6 metres per second. Minimum grades are as described in Table E.1, assuming a pipe roughness coefficient "n" of 0.013.

TABLE E.1
MINIMUM PIPE SIZES AND GRADES

Pipe Dia.	Min. Grade	Pipe Dia.	Min. Grade
100 mm	2.00%	375 mm	0.15%
150 mm	1.00%	400 mm	0.14%
200 mm	0.40%	450 mm	0.12%
250 mm	0.28%	525 mm	0.095%
300 mm	0.22%	600 mm	0.080%
350 mm	0.17%		

There shall be no change in the grades of pipe between manholes.

2.03 Sizing of Sewermains

The minimum pipe size for all sewer mains shall be 200 mm.

No reduction of pipe size shall be made downstream, irrespective of pipe grade.

2.04 Depth of Cover

The depth of the main shall be sufficient to provide all service connection piping with a minimum cover of 1.8 m to top of the service piping anywhere within the finished right-of-way. Sanitary mains shall be designed such that gravity drainage is possible from the full basement level of all parcels. In no instance shall the minimum cover over the crown of gravity mains be less than 1.8 m, and over forcemains less than 2.5 m.

2.05 Manhole Spacing

Manholes shall be installed at a maximum spacing of 100 metres and in the following locations:

.1 at the end of each line where cleanouts are not provided;
.2 at all changes in grade and/or alignment (for non curvilinear sewers);
.3 at all changes in pipe size;
.4 at all pipe junctions;
.5 at all intersections; and
.6 at the beginning and end of pipe curvature for curvilinear sewers.

Manholes shall normally be constructed in accordance with the details as shown on the Standard Drawings. In cases where these details will not suffice, a detailed design drawing must be approved by the Village Engineer.

Drop manholes on sanitary sewers may be allowed where particular circumstances preclude the use of normal manholes and where invert elevations differ by more than 600 mm.

The relative elevations of sanitary sewers entering and leaving a manhole are to be such as to ensure that the manhole does not substantially reduce the hydraulic capacity of the system. Minimum fall through the manhole shall be 30 mm.

2.06 Cleanouts

Cleanouts rather than manholes, may be permitted at the end of non-extendable sewer mains in non-travelled areas with the consent of the Village Engineer. Cleanouts shall be constructed in conformance with the Standard Drawing.

2.07 Service Connections

The diameter of sewer services shall be determined by the Design Engineer, subject to the approval of the Village Engineer, but in no case shall the diameter be less than 100 mm.

Sewer services shall be installed to the center of each lot in accordance with the Standard Drawings and shall be installed, wherever possible, in a common trench with the water service. Through areas of steep topography and road grades, sewer services may be installed 3.0 m from the lowest (elevation) lot corner.

Service connections shall be made with an approved branch wye and be installed in a straight line and at a uniform grade from the terminus at the property line to the 45 degree long radius bend at the main. An approved wye saddle may be used to connect a 100 mm diameter service to an existing main. The minimum pipe grade for sewer service pipes shall be:

.1 2% for 100 mm service pipe; and
.2 1% for 150 mm service pipe.

In areas where the depth of the service pipe at the main is less than that of the pipe main, service risers shall be constructed consistent with the applicable Standard Drawing.

For services 200 mm and larger, a manhole shall be installed at the intersection of the main and the service. A wye or saddle will not be accepted for services 200 mm or larger.

A cleanout shall be installed 300 mm from the property line on all services, as shown on the applicable Standard Drawing.

2.08 Location of Sewer Mains

Sanitary sewer mains shall, wherever possible be located in the road right-of-way as shown on the Standard Drawings. Where the location of the sewer main within the road right-of-way is not practical due to topography or other factors, the sewer main shall be located in a utility right-of-way registered in favour of the Corporation of the Village of Valemount and having a width of not less than 6.0 metres. The Village Engineer may require a utility right-of-way wider than 6.0 metres in the case where services in addition to sanitary sewer will be placed in the same right-of-way or where the depth of the sewer main requires a wider easement. There shall be a minimum clear lateral distance between the outside walls of sanitary sewers and storm sewers of 0.75 m.

2.09 Alignment of Sewer Mains

Sewer mains shall generally be designed to follow a straight alignment between manholes. Curved alignments within rights-of-way shall be subject to the approval of the Village Engineer and provided that the pipe is set at a grade greater than the specified minimum and pipe alignment is at a parallel offset with an established boundary. In these cases, the radius of curvature shall be not less than 30 metres, or twice the minimum radius recommended by the pipe manufacturer, whichever is the greater.

2.10 Sanitary Force Mains and Lift Stations

Pre-design Requirements

The objective of the Corporation of the Village of Valemount is to minimize the number of sewage lift stations required and thoroughly consider other options to avoid lift stations wherever practical. The Design Engineer shall obtain approval from the Village Engineer as to the siting of the lift station.

Prior to commencing detailed design of a lift station, the Design Engineer shall submit a pre-design report that addresses the design considerations of the station to the Village Engineer. Approval of the pre-design concepts must be obtained prior to the Design Engineer commencing detailed design.

This requirement covers 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.

The location and layout of a lift station shall include, at minimum, an assessment of the following basic design considerations:

.1 Lift station shall be designed to handle the flows of the designated catchment area;
.2 Type of station and impact on neighbours;
.3 Construction dewatering requirements;
.4 Access for construction and maintenance complete with asphalt driveway or approved equivalent of sufficient strength to handle heavy trucks and with enough space to turn around;
.5 Aesthetics, noise, odour, and landscaping requirements;
.6 Security against vandalism and theft;
.7 Flood elevations. Station uplift design shall be based on maximum flood level;
.8 Proximity of receiving sewers, watermains, and adequate power supply;
.9 Minimizing energy requirements;
.10 Standby power and its requirements and compatibility;
.11 Soils investigation shall be undertaken prior to site approval being given;
.12 Convenience of operation and maintenance;
.13 Safety of operators and the public; and

.14 Capital costs and operation and maintenance costs.

2.11 Design Requirements

All sewage lift stations shall meet the following design requirements:

.1 pumps shall meet maximum flow condition with one pump in failure mode. The pump shall handle the maximum flow with the smallest impeller for that pump size to allow for any future expansion. Pump specifications should be approved by the Village Engineer;

.2 pumps shall operate alternately. However, a further safety feature shall allow for both pumps to operate at the same time during extreme flows;

.3 pumps shall have non-clog impellers that will pass a 60 mm minimum spherical solid;

.4 control panel shall be mounted in the dry well or in a suitable kiosk on a concrete pad and it shall contain a Crouse Hinds receptacle with reverse contacts and manual transfer switch suitable for connecting standby power at 347/600 volts and should be capable of handling the pumps with the largest impeller installed and running simultaneously. An extra power outlet for small hand tools operating at 110/220 volts is also required;

.5 sloping bottom and filleted corners in wet well to direct the flow to the pump suction inlet and prevent solids deposition;

.6 minimum 38 mm stand pipe water supply within 10 m of the station for washdown complete with a pressure reducer and a ball shutoff valve. Water supply to be installed outside the pump entrance, below the frost line, in an accessible chamber. Back flow preventers must be installed;

.7 liquid level sensing system EHN-10 float switches as provided by Flygt Canada Ltd. or an equivalent acceptable to the Village Engineer;

.8 compatible telemetering system;

.9 emergency pump-out arrangement approved by the Village Engineer;

.10 sufficient access to remove components for repair;

.11 minimum 150 mm diameter pipe vent with vandal proof insect screen on outlet for the ventilation of the wet well. Explosion-proof exhaust fan which has sufficient capacity to exchange the total volume of air inside the well with fresh air within 3 minutes;

.12 check valve and isolating valve for each pump must be provided. Where possible, locate valves in a horizontal position. Where surge pressures for the check valve would be excessive, an electric activated slow closing resilient seated eccentric plug valve, with battery standby, shall be used;

.13 a Workers' Compensation Board approved aluminum or galvanized steel ladder for access to wet well and dry well;

.14 sump pump for the interior of the dry well discharging above the TWL in the wet well;

.15 minimum 2 hour storage between the high level alarm and the start of overflow to be provided within the wet well, influent pipes and surface ponds at peak wet

weather flow. Surface ponds are only to be used on approval of the Village Engineer and must be adequately secured with chain link fencing;.

.16 the wet well shall be sized to allow a minimum of 3 minutes to elapse between successive pump starts at peak flow conditions to prevent pump burn-out;

.17 emergency overflow should prevent flooding of buildings connected to the sewer system and prevent damage of components in the lift station. Overflow should be to a confined storage area;

.18 all equipment must be CSA approved;

.19 an explosion proof light with protective cover activated by a switch inside the kiosk should be provided;

.20 gate valve on the pressure line from the pump station is required;

.21 bell mouth on pump intake required on all dry well pumps;

.22 inside deck plates to be light weight fibre glass or aluminum complete with stainless steel hinges. Open grate deck plates preferred;

.23 special flex joints shall be used at the inlet pipe such as Flex-Tend by EBAA Iron Inc. or an approved equivalent;

.24 the outlet pipe and all other connections to the station shall be brought to within 1.5 m of the expected ground line around the pump station by the use of risers either on the inside of the station or attached to the outside of the station;

.25 particular criteria for submersible and for dry well stations are to be reviewed with the Village Engineer;

.26 for each design submission to the Village, an extra set of drawings pertaining to the design of the pump station, the sanitary mains and forcemains, keyplan and a location plan shall be submitted for the maintenance department to review; and

.27 before commencement of construction, the Design Engineer shall provide five sealed sets of mechanical shop drawings and five sealed sets of electrical line diagrams for review by the Village Engineer. Two sealed copies of design calculations shall be provided for documentation. Before acceptance of the completed lift station, by the Village, the Design Engineer shall provide 3 copies of an Operation and Maintenance manual to the Village. The manual shall contain:

.1 Cover page and table of contents;
.2 As constructed shop drawings;
.3 Equipment layout drawings;
.4 Electrical, control, and alarm wiring diagrams;
.5 Operating instructions for all equipment;
.6 Maintenance instructions for all equipment, including frequency of maintenance tasks;
.7 Equipment data sheets;
.8 Certified head/capacity curves for pumps;
.9 Equipment part lists; and
.10 Emergency operating procedures.

The maintenance manuals shall be hardbacked bound documents with the name of the facility embossed on the cover. Each section of the manual shall be identified by plastic covered, tabbed dividers, with the section name identified on the tab.

2.12 Access

An all weather vehicular access shall be provided to all reservoirs and pump stations. The access roads shall conform to the following standards:

.1 minimum surface width - 6m;
.2 ditching along both sides to at least 100 mm below subgrade;
.3 300 mm pitrun gravel subbase; and
.4 50 mm crushed gravel base.

2.13 Force Mains

At the lowest pump delivery rate anticipated to occur at least once per day, a cleansing velocity of at least 0.9 m/s should be maintained. Maximum velocity should not exceed 3.5 m/s.

An automatic air relief valve shall be placed at high points in the force main to prevent air locking.

Force mains should enter the gravity sewer system at a point not more than 600 mm above the flow line of the gravity sewer.

The minimum size for mains discharging raw sewage shall be 100 mm diameter.

The materials selected for force mains shall meet Village standards and shall adapt to local conditions, such as character of industrial wastes, soil characteristics, exceptionally heavy external loadings, abrasion and similar problems. Ductile iron shall be used from the pump station to the edge of the excavation and under creeks or ditches or, if desirable, an encasement pipe shall be used.

Other than for ductile iron forcemains, a trailing wire shall be installed for the purpose of locating the force main.

All force mains shall be designed to prevent damage from superimposed loads, or from water hammer or column separation phenomena.

2.14 Tie-ins to Existing Sewer Mains

Connections of new pipe to existing mains shall be undertaken by the Village who will supply and install all materials to construct the connections. The cost of the connections will be charged to the Owner by the Village.

2.15 Pipe Class and Bedding Class

The quality of pipe and bedding shall be so selected such that the installation will adequately support the loads to be placed on it during construction and in operation. For concrete pipe, the calculations shall follow the method shown in *Water Pollution Control Federation Manual of Practice No. 9,* latest edition. A safety factor of 1.5 shall be used for concrete pipe and the bedding classifications shall be as identified on the Standard Drawing.

For PVC pipe, the calculations shall follow the methods outlined in the Uni-Bell Plastic Pipe Association publication *Handbook of PVC Pipe - Design and Construction*, latest edition.

Pipe class and bedding class must be identified on all engineering drawings. Pipe shall have at least Class B bedding.

3.0 MATERIALS

3.1 Pipe and Fittings

.1 Pipe for gravity sanitary sewer mains and for services of 200 mm in diameter and larger may be any of the following:

.1 reinforced concrete pipe conforming to ASTM C76. Pipe strength (Class III min.) shall be specified for the trench conditions under which the pipe will be installed and operated. Joints shall conform to ASTM C443;

.2 polyvinylchloride pipe up to 375 mm in diameter, S.D.R. 35, conforming to ASTM D3034 and CSA B182.2, stiffness (F/Y) of 320 kPa at 5% deflection conforming to ASTM D2412, complete with approved rubber gasket joints. Maximum pipe length shall be 4 metres.

.2 Pipe for 100 mm and 150 mm diameter and for 150 mm diameter sanitary sewer service connections.

.1 Shall be Polyvinylchloride pipe, S.D.R. 28, conforming to ASTM D3034 and CSA B182.1, complete with rubber gasket joints. Maximum pipe length shall be 4 metres.

Sewer fittings shall correspond with the respective main and service pipes and shall conform with consistent specifications for main pipe.

.3 Pipes and fitting for sanitary sewer force mains shall be as approved for watermains in accordance with Schedule D, Section 3.01.

.4 Other types of pipe may be used only with the written consent of the Village Engineer.

3.02 Pipe and Fitting Joints

Sewer pipe and fittings shall be jointed with a rubber gasket or other preformed, factory-manufactured gasket or approved material.

3.03 Service Junctions

Connection of services to new sewer mains shall be made using a wye and a 45° long radius sweep.

Service wye saddle shall only be used to connect sewer services to an existing main. Where service saddles are used, they shall be equipped with steel straps. Service saddles shall only be used with the approval of the Village Engineer.

3.04 Manholes

Precast concrete manhole sections shall conform to ASTM C478 and shall be minimum 1,050 mm diameter with 115 mm wall thickness for mains less than 450 mm diameter; for mains greater than 450 mm diameter, the precast manhole sections shall conform to the diameters specified on the Standard Drawings. Concrete for cast-in-place manholes shall have a minimum compressive strength of 20 MPa at 28 days.

Concrete for cast-in-place manhole bases and benching shall have a minimum compressive strength of 20 MPa at 28 days.

Precast manhole bases of a design and construction quality acceptable to the Village Engineer will be accepted in lieu of cast in place bases.

Cover slabs may be precast or cast-in-place concrete reinforced to withstand H-20 loading conditions.

Manhole rungs shall be 20 mm diameter steel, hot dipped galvanized after bending, or an approved aluminum alternate, at 300 mm o.c., cast into the wall of the manhole section, or set in 30 mm holes filled with epoxy cement. Rungs shall protrude 125 to 150 mm from the manhole wall. If precast manhole barrels are used having inset wire lifting lugs, the lugs shall be galvanized.

3.05 Manholes Frames and Covers

Covers and frames shall be cast iron of an approved pattern to withstand H20 loading. The cover shall have a weight of 66 kg and the frame shall be of the round base pattern having a weight of 84 kg. Bearing faces of the cover to frame shall be machined for a non-rocking pit. The cover shall have 2 - 22 mm diameter lifting holes. The lid shall be embossed with "Sanitary Sewer".

3.06 Bedding Material

Pipe bedding shall be sand or crushed rock free of clay lumps, organic and other deleterious material. Gradation shall conform to the gradation limits set out in Schedule D, Clause 3.13.

Through areas of high groundwater and/or unstable ground conditions, drain rock shall be installed to bed the pipe.

3.07 Backfill Material in Pipe Zone (Pipe Surround)

Backfill material in the pipe zone (pipe surround) shall be sand or crushed rock free of clay lumps, organic and deleterious material. Gradation shall conform to the gradation limits set out in Schedule D, Clause 3.13.

3.08 Backfill Material Above Pipe Zone

In Road Areas:

.1 Backfill material below the pavement structure for trenches in road areas may be native soil provided the native soil is free of organic or foreign matter and can be readily compacted to a minimum of 95% Standard Proctor density in compliance with ASTM D-698. Native material is not acceptable if it will not provide competent subgrade for road construction. Maximum particle size of backfill material not to exceed 200 mm.

If the native material is deemed unacceptable, the backfill material shall be imported granular material conforming to Clause 3.01 of Schedule B.

In Non-Road Surfaces:

.2 Backfill material for trenches and easements or other non-road areas may be native material excavated from the trench providing it is sufficiently free of frozen soil, roots or other objectionable material so as not to cause undue settlement. Maximum particle size of backfill material not to exceed 200 mm.

3.09 Encasement Pipe Filler Sand

To be well graded, clean sand, free from organic materials and conforming to Table E.2 to gradation limits.

TABLE E.2
ENCASEMENT PIPE FILLER SAND GRADATION LIMITS

Sieve Designation	Percent By Weight Passing
4.750 mm	100
1.360 mm	20 - 70
1.180 mm	13 - 50
0.850 mm	8 - 35
0.300 mm	5 - 25
0.150 mm	2 - 15
0.075 mm	0 - 8

4.0 WORKMANSHIP

4.01 Trench Excavation

Trenches shall be excavated to suit the cross-section shown on the Standard Drawing. Open trenches through existing paved surfaces will be allowed only with the prior express consent of the Village Engineer. When trenches through existing pavement are allowed, the pavement shall first be saw-cut by mechanical means in straight continuous lines parallel to the trench centreline.

If trenches are excavated wider than the specified widths, a higher class of pipe or special bedding may be required.

Rock excavation in trenches shall provide a minimum clearance of 150 mm below the pipe for pipes 600 mm in diameter or less, and 250 mm for pipes larger than 600 mm in diameter.

The top of the trench at ground level shall be kept to the minimum width consistent with the depth, natural angle of repose of the material and the regulations of the Workers' Compensation Board.

Excavation for manholes, fittings and other appurtenances shall be to the lines which will permit the assembly of these sections and to permit adequate backfill and compaction. Concrete for bases may be cast against the walls of the excavation, if the soil conditions are suitable.

Where an existing structure or underground installation may be affected by the works, it is the responsibility of the Owner to inform the Village of such facility sufficiently in advance that the Village may make an inspection and specify the protective measures to be undertaken.

Where an unforeseen or other obstruction is encountered which interferes with the designed alignment or grade, the construction shall cease until such time as revised proposals are approved by the Village Engineer.

The attention of the Owner is directed to the provisions of the Workers' Compensation Board safety regulations. All municipal employees have been instructed not to enter excavations which are not properly braced or which otherwise do not conform with the requirement of the Board. It follows, therefore, that approvals cannot be given to installations not inspected because of unsafe working conditions.

Any over-excavation of the trench subgrade beyond the specified depth shall be backfilled with select material and compacted to 100% Standard Proctor density.

In rock excavation the depth of compacted bedding material below the pipe shall be a minimum of 150 mm for pipe of 600 mm diameter or less and 250 mm for pipe in excess of 600 mm diameter. This depth shall exist for the full wall-to-wall width of the trench.

Where the bottom of any excavation as uncovered is soft and is in the Design Engineer's opinion unfit to support the pipes or structures, a further depth shall be excavated and refilled to the correct shape, grade and elevation as directed by the Design Engineer.

When the bottom of a trench is found to consist of unstable material which, in the opinion of the Design Engineer, cannot be removed and replaced with bedding material, a pile foundation or other structural support in accordance with plans prepared by the Design Engineer shall be constructed.

In areas of clay or other impermeable soils, where overexcavation of the trench subgrade is required, the overexcavation shall continue to a point where ponding of water in the trench bottom will be avoided.

Open cut trenches shall be sheeted and braced as required by the Workers' Compensation Act, as may be necessary to protect life, property, or the work, unless the trench excavation is sufficiently wide at the top to be naturally stable. When close sheeting is required, it shall be driven so as to prevent the soil from entering the trench either from below or through such sheeting. A minimum distance or 150 mm from the closest point of the pipe to the sheeting shall be maintained.

When possible, vertical trench timber or sheeting shall be placed so that it does not extend below the level of the bottom of the excavation. Sheeting driven below the pipe grade shall

not be removed unless the sheeting can be removed without causing settlement or lateral displacement of the pipe.

Unless otherwise indicated in the drawings or specifications, or unless approval to leave it in place is received from the Village Engineer, trench sheeting and bracing shall be removed when backfilling has been completed or has reached a level which will permit its safe removal without causing injury to persons or damage to the works. When sheeting and bracing is left in place, it shall be cut such that no sheeting remains closer than one metre to the established sub-base road grade or the existing ground surface, whichever is the lower.

Particular caution will be taken to ensure that pipe bedding is not disturbed such that settlement of the pipe results.

Timber supports or sheeting shall be left in place when its removal would endanger adjacent structures or result in a shifting of pipe bedding material and a displacement of the pipe. The Village Engineer may require the pipe to be bedded in concrete (Class A Bedding) when, in his opinion, the removal of sheeting would disturb the pipe bedding. Discharge from trench pumps, well points, or other dewatering aids, shall be located and controlled in such a manner as to not cause loss or damage to public or private property, nuisance on roads or walks, or injury to the public.

4.02 Tie-Ins to Existing Sanitary Sewer

Tie-ins to existing sanitary sewer mains shall not be made until after new lines have been flushed and tested.

The Owner shall install plugs in the nearest manhole to each connection so that no water enters the existing sewer system. The plugs shall be left in place until final connection and acceptance of the new works by the Village. No turning in of sewage to the new system shall be done until the new works have been flushed and approval obtained from the Village. The Owner shall be charged a minimum of $500.00 for each time he allows water or sewage from the new system to enter the existing system plus any additional costs for cleaning the existing sewers or any additional costs for cleanup or for repair of damage to the existing sewers, appurtenances, flooded buildings, or the sewage treatment plant.

4.03 Pipe Installation

Prior to installing pipe all standing water shall be drained or pumped from the trench.

Pipe shall be carefully lowered into the trench in a manner that will prevent damage to the pipe. Pipe shall be jointed in strict accordance with the manufacturer's recommended practice. When pipes are not being installed, the open end of the newly laid pipeline shall be protected with a suitable bulk head to prevent the entry of any foreign material.
Trench conditions shall be such that pipe jointing can be accomplished without getting muck, silt, gravel and other foreign material into the pipe.

The grade of every pipe length shall be checked before the pipe is backfilled. Any part of the trench excavated below grade shall be regraded with approved material thoroughly compacted.

All pipe must be laid to the design lines and grades within the following tolerances:

.1 horizontal deviation from the approved alignment shall not exceed 60 mm and the rate of deviation shall not exceed 40 mm in 10 metres; and

.2 vertical deviation from true grade varies with the grade and shall not exceed the limits shown in Table E.3.

TABLE E.3
SANITARY SEWER MAIN VERTICAL TOLERANCE LIMITS

Grade	Max. Departure From Design Elevation	Max. Rate of Deviation
Over 5%	30 mm	20 mm in 10 metres
2% to 5%	15 mm	10 mm in 10 metres
Less than 2%	6 mm	10 mm in 10 metres

4.04 Granular Bedding and Backfill in Pipe Zone

The pipe zone is considered as being the depth of trench between the trench bottom and a level 300 mm above the top of the pipe.

The pipe zone backfill shall be hand placed and thoroughly compacted to a density of 95% Standard Proctor Density in layers not exceeding 150 mm using hand tampers.

4.05 Backfill Above Pipe Zone

<u>In Road Areas:</u>

.1 In road areas trench backfill material shall be placed in layers not exceeding 300 mm in thickness and compacted by mechanical means to a minimum of 95% Standard Proctor density.

The water content of the material shall be controlled to achieve the required density.

<u>In Non-Road Areas:</u>

.2 In easements and other non-roads areas, native trench material may be used for trench backfill above the pipe zone. Backfill shall be placed and compacted to 90% Standard Proctor Density.

4.06 Manholes

Manholes shall be constructed in accordance with the applicable Standard Drawings.

All water shall be removed from the excavation prior to placing concrete. Concrete shall be placed only on a firm base. If the bottom of the excavation is unsuitable for support, it shall be excavated to a firm base and backfilled to the required grade with pipe bedding material.

'GU' liners shall be installed in all manholes.

Precast sections shall be placed plumb with joints mortared with a bitumastic caulking to seal the entrance of groundwater.

Drop structures shall be constructed as shown on the applicable Standard Drawings.

4.07 Stubs

Blind stub sections for connection of future sewers to the manholes shall be installed as directed by the Village Engineer. The stub shall be plugged at the end with a watertight removable plug.

4.08 Service Connections

Service connections shall be installed as shown on the applicable Standard Drawings.

Service connections shall be capped and shall be tested with mains where main testing is required.

A 50 x 100 mm marker stake shall be set with the bottom flush with the invert of the end of the service connection and against the cap and with the top projecting a minimum of 1,000 mm above the ground surface. Marker stakes shall be painted "green", be cut to an even 200 mm length and the depth from top of stake to the invert of pipe shall be clearly marked on the stake with yellow, painted stencilled letters and numbers.

Information as to size of service pipe and type of service shall also be indicated on the stake.

4.09 Pipe Casings

Pipe casings shall be installed as shown on the Standard Drawings. The sewer pipe shall be blocked at each joint to ensure line and grade is maintained and the casing is to be sealed at both ends with joint filler with proper care taken to ensure that the pipe remains on line and grade and does not float. The annular space between the sewer pipe and the casing pipe shall be filled with 14 mm sand, as specified in Section 3.09.

A length of 6 mm polypropylene rope shall be laid alongside the carrier pipe inside the casing to assist future retrieval.

4.10 Asphalt Restoration

If the edges of the cut asphalt have become ragged as a result of the construction operation, asphalt shall be recut to form a straight line prior to placing new asphalt. The edges of the existing asphalt shall be thoroughly cleaned and coated with an approved bituminous bonding agent prior to placing the hot asphalt mix. The finished grade of the asphalt surface shall conform with that of the existing surface such that no rises, depressions or ridges result from the repaving process.

4.11 Cleaning and Flushing

Prior to testing, the sanitary sewer pipe shall be cleaned by flushing, or the use of mechanical equipment as necessary to remove all foreign material from the pipe. After paving and landscaping and before subdivision acceptance, the sanitary lines shall be flushed to remove any deleterious material deposited by associated construction works. No water from the flushing and cleaning process shall enter the existing service system.

4.12 Force Mains

Force mains shall be constructed and tested in accordance with the standards for watermains as specified in Schedule D or as specified by the Village Engineer.

4.13 Testing

Lamping

Sewer mains shall be lamped from manhole to manhole to check alignment and grade of the sewer pipe. Variations in line or grade from that shown on the approved construction drawings and any jointing, pipe cleaning, or other deficiencies discovered shall be rectified. Manholes shall be inspected and any defects or deficiencies found shall be rectified.

4.14 Leakage Tests

Sewer Mains

Sewer mains shall be tested by a low pressure air test.

Pipe mains and services shall be clean and plugged in preparation for the test. An air supply system should have adequate valves to isolate the test section and to vent off excess air. Pressure gauges should be clean and functional. Adequate blocking shall be placed behind all plugs to prevent plugs from blowing out. Blocking should allow the plugs to move approximately 6 mm.

If the ground water level with respect to the pipe is not known, this level shall first be determined at the lowest point of the line under test. The external ground water pressure shall then be calculated (depth of ground water in meters above invert of pipe multiply by 9.8 = pressure in kPa).

The section of pipeline under test shall be gradually surcharged to a pressure of 27.6 kPa above ground water pressure as determined above. Time will be allowed for the air temperature to stabilize (not less than 5 minutes). If the pressure drops below 24.2 kPa (pressure refers to the amount of pressure above ground water pressure), the 24.2 kPa pressure shall be maintained from the make-up air supply. If the pressure does not drop to 24.2 kPa during the period of stabilization, the air shall be released slowly until the pressure drops to 24.2 kPa.

The time is then measured for the period that the resultant air pressure drops 6.9 kPa from 24.2 to 17.3 kPa. If the time measured equals or exceeds the specified time, the test may be stopped, the readings recorded, including pressure readings, and the test considered satisfactory.

The time specified shall be as per Table E.4. If the time measured does not equal or exceed the specified time, the section of sewer main shall be checked for excessive leakage, and after repairs are made the pipeline shall be re-tested in the same manner.

TABLE E.4
MINIMUM AIR PRESSURE/LEAKAGE TEST TIME

Pipe Diameter (mm)	Time in Minutes
100	2 min. 30 sec.
150	3 min. 45 sec.
200	5 min. 00 sec.
250	6 min. 16 sec.
300	7 min. 30 sec.
375	9 min. 32 sec.
450	11 min. 15 sec.
525	13 min. 08 sec.

Manholes

Upon the entire completion of the manhole installations, watertight plugs or seals shall be inserted on inlets and outlets of each new sanitary sewer manhole. The manhole filled to the underside of the top concrete slab. The water level shall be recorded at the beginning and end of the 2 hour test period and the leakage shall not exceed 0.3% of the manhole volume per hour. If the permissible leakage is exceeded, defects shall be corrected and the test repeated until the installation is acceptable. Plugs and water shall be removed after the test.

4.15 Materials Testing

The Village shall be provided with copies of all sieve compaction test results pertaining to bedding, backfill and road restoration.

4.16 Video Inspection Tests

Before paving of asphalt surfaces, all sewer mains shall require a closed circuit televised inspection by the Owner to check jointing, possibility of debris in the pipe, leakage, alignment and grade of the sewer pipe. Any deficiencies discovered shall be rectified prior to paving.

Television equipment shall consist of a self contained camera and a monitoring unit connected by a coaxial cable. This equipment shall be specifically designed and constructed for such inspection purposes. The camera shall be mounted on adjustable skids to facilitate the inspection of different sizes of pipe. The camera and skids shall be small enough to insure passage through a 150 mm diameter sewer. The camera shall be waterproof and shall have a remotely controlled adjustable self-contained lighting system capable of producing at least 100 foot candles of light. The lighting system shall be capable of lighting the entire periphery of the pipe.

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 Village Engineer.

Measurement of defects shall be made by devises having a proven accuracy of plus or minus one percent. Cable markings if used, shall not be spaced at a distance of more than 600 mm along the length of the cable. Any type of measurement system used shall be subject to inspection by the Village Engineer.

Direct voice communication shall be established between the monitoring station and the camera towing device. This may be accomplished by a direct line of communication or radio. No loudspeaker devices shall be allowed.

Equipment shall be mounted in an appropriate type vehicle. Electrical power for the system shall be self-contained and shall not require removal for each set-up. External power sources from public or private residences shall not be permitted. Ample sound dampening shall be applied to the vehicle and equipment.

A television work report, in log form, shall be maintained during the inspection. This log shall show the exact location of each leak or fault discovered by the television - e.g. open joints, broken, cracked or collapsed pipe, presence of grease, roots, debris, accumulation, obstructions, infiltration, water depth variations, and other points of significance. The reference location shall include the distance away from the reference manhole and also the position of the leak or fault as referenced to the crown of the pipe using clock face notation.

The report shall include the location of all service connections together with a statement of opinion as to whether or not the service connections are leaking. Protrusions of the service connections into the mainline shall be noted with reference to the degree of protrusion.

Photographs of all sewer defects shall be taken. The photographs shall be co-ordinated with the written report by reference numbers. A minimum of one photograph per line shall be taken to show a representative view of the workmanship, as well as additional photographs of deficiencies as required.

Each manhole section of pipe shall be located on the report form in such a way as to be readily identifiable. Identify such items as name of subdivision, street names, manhole numbers, type of pipe, joint length, direction of flows, pipe diameter, manhole depth, inspection date, names of the inspection technician, persons viewing, and video tape identification numbers.

Three copies of a final typewritten report with corresponding photographs and one copy of video tapes shall be furnished to the Village Engineer within two weeks after the completion of the inspection. This report shall contain no less than one photograph per

manhole section inspected and additional photographs as required to show line faults and representative line conditions.

Full colour video tapes shall be of a format acceptable to the Village Engineer. All video tapes shall be numbered and cross indexed to the typewritten report. Video tape footages to fault locations shall also be cross indexed to the typewritten report, as well as referenced to the description of the fault included on the video tape. Tapes shall be in the VHS format.

To insure photographic quality 35 mm still photographic cameras shall be designated. Polaroid or similar cameras that do not produce negatives for rapid reproduction will not be acceptable. All still photographs shall be in colour.

If, during the inspection procedures the television camera will not pass through the entire manhole section, the equipment shall be reset in a manner so that the inspection can be performed from the opposite manhole.

Prior to inspection, all lines shall be cleaned thoroughly to remove dirt, grease, sand and other foreign and objectionable debris from inside the pipe and manholes so that cracks and other faults may be observed.

A small diameter poly rope or similar line shall be installed in the sewer in advance of the inspection in order that the camera traction cable may be drawn through the sewer. This line shall be installed on a manhole to manhole basis with the line being tied off at each individual manhole to facilitate the quick removal of any portion of this line should the need arise due to mainline sewer blockages or other emergency situations.

Interference to the normal flow of traffic shall be kept to a minimum. The equipment shall be arranged so that one lane of traffic is maintained at all times.

4.17 As Constructed Drawings

Prior to final acceptance, the Owner shall deposit with the Village one computer diskette (3½") in AutoCAD (latest release) format and one set of original as-constructed mylar drawings showing all the information requested by this schedule and conforming to the criteria set out in Schedule I.

SCHEDULE F

REGULATIONS, STANDARDS, AND SPECIFICATIONS FOR THE DESIGN AND INSTALLATION OF DRAINAGE SYSTEMS

This is Schedule F of the Corporation of the Village of Valemount Subdivision and Development Servicing Bylaw No. 450, 1998.

_____

Clerk

SCHEDULE F

REGULATIONS, STANDARDS, AND SPECIFICATIONS FOR THE DESIGN AND INSTALLATION OF DRAINAGE SYSTEMS

1.0 GENERAL

Where the provisions of Schedule A of this Bylaw require the construction of a storm drainage system, the Owner shall provide a storm drainage system including sewer mains, manholes, service connections, and all related appurtenances consistent with the standards and specifications contained in this Schedule.

1.01 Approval of Engineering Drawings Required Prior to Construction

Engineering drawings and design calculations which show detailed design of the necessary works shall be submitted to the Village Engineer for approval prior to the commencement of construction. The drawings shall show overland drainage systems, the alignment and size of pipes, proposed grades, distances between manholes, manhole invert elevations, existing ground line, proposed final ground line over the pipe, location of all service connections to the property line, all easements, pipe bedding requirements and all other details as may be required.

1.02 Where Storm Drainage Collection System Not Required

Where storm drainage facilities are not required at the time of development, the Corporation of the Village of Valemount may require rights-of-way to be provided by the Owner to allow for the eventual installation of these facilities. Such rights-of-way shall be registered in favour of the Corporation of the Village of Valemount at the Owner's expense. In this instance, the Owner will be required to provide for surface drainage as required by the Village Engineer, with all catch basins and other appurtenances designed to facilitate connection to the future storm sewer system.

1.03 Stormwater Drainage Plan

All drainage systems in the Corporation of the Village of Valemount shall be designed in accordance with the primary purpose to limit the effect of peak flows and volumes of runoff on private and public property, receiving streams, and watercourses. The Owner’s Engineer shall prepare a Stormwater Drainage Plan at a maximum 1:1000 scale, that will explicitly indicate existing and proposed drainage courses and drainage areas, together with estimated runoff flows and proposed drainage works.

1.04 Minor and Major Drainage Systems

The drainage system shall consist of two components, the minor and the major systems. The minor system will consist of underground conduits, open channels and watercourses designed to convey a 10 year return period flow for residential, industrial, commercial, institutional, and high density residential areas. The major system will consist of surface flood paths, roadways and watercourses designed to convey the 100 year return period flow. In special conditions where surface flood paths cannot be established, pipes and culverts of the minor system may be enlarged to accommodate the major system flow.

1.05 Adequate Drainage

All subdivisions shall be adequately drained throughout the year. Where the whole or part of any proposed subdivision is wet or subject to intermittent or periodic flooding, approval of the subdivision will be withheld until the Village Engineer is satisfied that appropriate steps have been taken to drain the land or otherwise remedy such wet or flooding conditions.

1.06 Existing and Natural Watercourses

Where a subdivision is traversed by a watercourse, drainage way or stream, a right-of-way shall be provided along such watercourse or its planned re-alignment of a width deemed necessary by the Village Engineer for construction, maintenance, conservation, and beautification purposes.

No natural drainage course shall be altered or diverted unless such alteration or diversion has been approved by the Corporation of the Village of Valemount and the Provincial Ministry of the Environment.

Storm water shall only be discharged from a subdivision to a drain, ditch, watercourse, stream or other waterway as may, in the opinion of the Village Engineer, be adequate to receive the discharge therefrom, or which has been declared a part of the Village drainage system.

1.07 Drainage Systems Through Private Property

Where it is necessary to construct a drainage system through privately-owned land, the Owner shall obtain or grant a right-of-way in favour of the Corporation of the Village of Valemount to guarantee the right of access, to the drain area facility in perpetuity.

2.0 DESIGN CRITERIA

2.01 Sizing of Systems

The system shall be of sufficient capacity to accommodate all tributary areas as defined by the Village. For drainage areas 20 hectares and smaller, the Rational formula shall be used,

Q = KCIA, where:

.1 Q = Flow in m^3/s;
.2 K = Constant to establish units of compatibility (.00278);
.3 C = Dimensionless runoff coefficient;
.4 I = Rainfall intensity in mm/hr; and
.5 A = Runoff area in hectares.

Rainfall intensities shall be calculated according to the following equation,

$I = A \times T^B$, where:

.1 T = the time of concentration in hours; and
.2 A and B are coefficients as specified in Table F.1.

TABLE F.1
RAINFALL INTERPOLATING EQUATION COEFFICIENTS

Rainfall Frequency	A	B
10 Year Storm	18.4	-0.711
100 Year Storm	27.3	-0.739

For the minor system, the 10 year frequency curve shall be used. For the major system, and for special structures such as in the design of storm retention basins, underpass drainage or arterial roads, the 100 year rainfall curve shall be used.

The time of concentration, or inlet time, will vary with topography and the nature of the drainage areas, but will generally be fifteen minutes or greater for residential areas. Inlet times shall be determined by the Design Engineer.

Runoff coefficients for storm sewer design shall be assumed to be not less than the values specified in Table F.2.

TABLE F.2
RUNOFF COEFFICIENTS

Description of Area	Runoff Coefficient
Commercial	
• Downtown	0.82
• Neighbourhood	0.60
Industrial	
• Light area	0.65
• Heavy area	0.75
Residential	
• Suburban	0.30
• Single - family	0.40
• Multiunits - detached	0.55
• Multiunits - attached	0.65
• Apartment dwelling area	0.60
Parks, cemeteries	0.15
Playgrounds	0.25
Unimproved areas	0.15

Runoff coefficients other than those specified in this section shall be used only with the express written consent of the Village Engineer.

For tributary areas greater than 20 hectares, the method used by the Design Engineer to calculate storm flows shall be approved by the Village Engineer.

2.02 Design Grade

The minimum design grade shall be calculated by use of the Manning Formula such that a minimum velocity of 0.6 m/s shall be maintained during the design flow.

Pipes shall be designed to carry the required quantity when flowing 3/4 full for pipes sized 450 mm and smaller. Pipes sized 525 mm or larger shall be sized to carry the required quantity when flowing full.

2.03 Roughness Coefficients

Roughness coefficients for use with the Manning's Formula shall be as specified in Table F.3.

TABLE F.3
ROUGHNESS COEFFICIENTS

Pipe or Channel Material	Roughness Coefficient
Concrete Pipe	0.013
PVC Pipe	0.011
Corrugated Metal Pipe	
• Unpaved	0.024 - 0.033
• 25% paved	0.021 - 0.028
• 100% paved	0.013
Smooth Asphalt	0.012
Asphalt or Concrete Paving	0.014
Packed Clay	0.030
Light Turf	0.200
Dense Turf	0.350
Dense Shrubbery	0.400

Minimum velocity of pipes, flowing full, shall be 1.0 m per second.

There are no maximum allowable velocities except that the designer shall ensure that supercritical flow does not occur. Where grades exceed 15%, scour protection may be needed and anchor blocks will be required. These criteria may be modified by the Village Engineer to meet local conditions.

2.04 Minimum Pipe Size

Minimum pipe size shall be 250 mm for mains, 200 mm for catch basins leads, 100 mm for residential service connections, and 150 mm for non-residential service connections. The minimum pipe size for mains accepting flows from open ditches shall be 400 mm and suitable silt traps shall be provided.

2.05 Culverts

Where an open ditch system is required to cross a road, street or driveway, the ditch shall be enclosed by means of a culvert. All culverts shall be of sufficient size to properly drain all of the area naturally draining into the channel or ditch feeding into the culvert but shall be a minimum 300 mm diameter. Allowance shall be made for future flows as a result of full development of the upstream tributary area.

2.06 Location of Storm Mains

Storm sewer mains shall, wherever possible, be located in the road right-of-way as shown on the Standard Drawings. Where the location of the sewer main within the road right-of-way is not practical due to topography or other factors, the sewer main shall be located in a utility right-of-way registered in favour of the Corporation of the Village of Valemount and having a width of not less than 6.0 metres. The Village Engineer may require a utility right-of-way wider than 6.0 metres in the case where services in addition to storm sewer will be placed in the same right-of-way or where the depth of the sewer main requires a wider easement. There shall be a minimum clear lateral distance between the outside walls of storm sewers and sanitary sewers of 0.75 m.

2.07 Alignment of Storm Mains

Storm sewer mains shall generally be designed to follow a straight alignment between manholes. Curved alignments within rights-of-way shall be subject to the approval of the Village Engineer and provided that the pipe is set at a grade greater than the specified minimum and pipe alignment is at a parallel offset with an established boundary. In these cases, the radius of curvature shall be not less than 65 metres, or twice the minimum radius recommended by the pipe manufacturer, whichever is the greater.

2.08 Depth of Cover

The minimum depth of storm sewer mains shall be sufficient to provide all service connection piping with a minimum cover of 1.5 m to the top of the service, anywhere within the finished right-of-way. In no instance shall the cover over the crown of the main be less than 1.5 m.

2.09 Manholes

Manholes shall be installed at a maximum spacing of 120 metres and in the following locations:

.1 All changes in grade;
.2 All changes in alignment, including non-curvilinear sewers;
.3 All changes in pipe size;
.4 All pipe junctions; and
.5 All intersections.

Where, in the opinion of the Village Engineer, the grades of sewer pipes are sufficient to provide proper cleaning, the maximum spacing of manholes may be increased to 150 metres.

'GU' liners shall be installed in all manholes in accordance with the details as shown on the Standard Drawings. In cases where these details will not suffice, a detailed design drawing must be approved by the Village Engineer.

The relative elevations of storm sewers entering and leaving a manhole are to be such as to ensure that the manhole does not substantially reduce the hydraulic capacity of the system. Minimum fall through the manhole shall be 30 mm.

There shall be no change in the grades of pipe between manholes.

2.10 Catchbasins

Catchbasins shall be constructed as shown on the applicable Standard Drawings.

Catchbasins shall be located at a maximum spacing of 75 m along the drainage path, at all intersections, at all low points, or spaced at intervals such that not more than 10% of the gutter flow reaching each inlet will pass on to the next inlet downstream, provided this carry-over is not objectionable to pedestrian or vehicle traffic and the inlet is not in a sump. Catch basins shall be located at intervals such that surface drainage does not exceed gutter or flow channel capacities, to eliminate overflow to driveways, boulevard, margins, sidewalks, or private property.

2.11 Catchbasin Leads

Catch basin leads shall discharge into a manhole and not directly into the storm sewer pipe wherever possible.

Catch basin leads shall have a minimum cover of 0.7 m.

2.12 Service Connections

Storm sewer service connections shall only be used for foundation perimeter drains and roof drains unless otherwise approved by the Village Engineer.

The diameter of storm sewer service connections shall be determined by the Design Engineer, but shall be 100 mm diameter minimum for a single family residential service and in no case shall a non-residential service connection be less than 150 mm.

Service connections shall be made with an approved branch wye and be installed in a straight line and at a uniform grade from the terminus at the property line to the 45 degree long radius bend at the main. An approved wye saddle may be used to connect a 100m diameter service to an existing main. The minimum pipe grade for sewer service pipes shall be:

.1 2% for 100 mm service pipe; and

.2 1% for 150 mm service pipe.

For services 150 mm and larger, a manhole shall be installed at the intersection of the main and service.

Sewer services shall be installed 4.0 metres from the lot corner in accordance with the Standard Drawings and shall be installed, wherever possible, in common trench with the water and sanitary sewer services.

A cleanout shall be installed 300 mm from the property line on all services.

2.13 Pipe Class and Bedding Class

The quality of pipe and bedding shall be so selected such that the installation will adequately support the loads to be placed on it during construction and in operation. Pipe class and bedding class must be identified on all engineering drawings. Pipe shall have at least Class B bedding, as defined by the Standard Drawings.

For concrete pipe, the calculations shall follow the method shown in the latest edition of the *Water Pollution Control Federation Manual of Practice No. 9.* A safety factor of 1.5 shall be used for concrete pipe and the bedding classifications shall be as identified on the Standard Drawing.

For PVC pipe, the calculations shall follow the methods outlined in the latest edition of the Uni-Bell Plastic Pipe Association publication *Handbook of PVC Pipe - Design and Construction.*

For CSP pipe, the calculations shall follow the methods outlined in the latest edition of the American Iron and Steel Institute publication *Handbook of Steel Drainage & Road Construction Products.*

2.14 Major Flow Routing

All overland flows in excess of 0.05 cu.m./sec shall have specifically designed flow routes, that are protected and preserved by restrictive covenants or rights-of-way. The major flow routing shall normally be provided along roads and in natural watercourses. In some cases, the major flow may also be carried alongside the road in grassed swales, across country in rights-of-way and along public walkways.

In special circumstances, or where desired to enable lower building elevations, the pipes and culverts, which form a part of the minor system, may be enlarged or supplemented to accommodate the major flow. All habitable areas of buildings shall be above the major flow hydraulic grade line, except where specific flood prevention measures have been taken and which are acceptable to the Village Engineer.

The proportion of flow to be carried along the major routing shall be the total major flow less the flow carried in the minor system.

Where the road is used to accommodate major flow, it shall be formed, graded and sufficiently depressed below the surrounding property lines to provide adequate hydraulic capacity. On arterial roads, the 100 year hydraulic grade shall not be higher than centreline of the pavement with the maximum flow depth not to exceed 300 mm. On collector and local roads, the entire roadway may be used as a major flood path with the maximum flow depth not to exceed 300 mm.

Where roadways used for major flows intersect, care shall be taken to lower the intersection to allow flows to pass over the cross street. Where major flow routes turn at intersections, similar care in the road grading design is required.

In areas where surface major flow routes cannot be provided, a pipe system will be designed to accommodate the required major flow, and sufficient inlet capacity will be provided to accommodate introduction of the major flow into a piped system.

Major flow routing over 0.05 cu.m./s shall be shown on the engineering drawings and sufficient design shall be carried out to provide assurance to the Village Engineer that no property damage or endangering of public safety will occur under major flow conditions. The Design Engineer shall provide the Village Engineer with the depth of flow along the major flow route and shall show on the Design Drawings the hydraulic grade line above the design curb and gutter or above the finished surface of other drainage courses. The discharge point from the development for the major flow route shall be coordinated with the downstream routing to outfalls as determined by the Village of Valemount. Where major flow outfalls to a receiving watercourse, the velocity shall not exceed 1.5 m/s, or energy dissipaters shall be provided to minimize erosion.

The use of catchbasin inlet control devices to separate major and minor hydraulic grade lines may be allowed, subject to the satisfaction of the Village Engineer regarding the suitability of such control devices. Where catchbasin inlet control devices are used, building elevations may be controlled by the hydraulic grade line occurring in the minor system.

2.15 Drainage Drywells

Where drainage drywells are used as a means for disposal, drainage drywell wall surface areas shall be sized using Darcy's empirical law,

Q = A K i, where:

.1 Q = rate of flow in m^3/s;
.2 A = cross-sectional area of soil through which flow takes place in m^2;
.3 K = coefficient of permeability in m/s; and
.4 i = hydraulic gradient over a given flow distance.

Typical values for the Coefficient of Permeability, K, are presented in Table F.4.

TABLE F.4
TYPICAL VALUES OF COEFFICIENT OF PERMEABILITY

Typical Soil	Relative Permeability	Typical Value of K, m/s
Coarse Gravel	High Permeability	over 10^{-3}
Sand, Fine Sand	Medium Permeability	10^{-3} to 10^{-5}
Silty Sand, Dirty Sand	Low Permeability	10^{-5} to 10^{-7}
Silt	Very Low Permeability	10^{-7} to 10^{-9}
Clay	Practically Impervious	Less Than 10^{-9}

Upon determination of permeability factor, a safety factor of 2 shall be applied.

Drainage drywells shall, unless otherwise approved by the Village Engineer, or Public Works Superintendent, be located in the road boulevard or in other lands dedicated to the Village for the purpose of drainage disposal.

The depth of the drywell will vary in accordance with the requirements derived from Darcy's empirical law.

Drainage drywells shall be constructed as shown on the applicable Standard Drawings.

3.0 MATERIALS

3.1 Pipe and Fittings

.1 Pipe for gravity sanitary sewer mains and for services of 200 mm in diameter and larger may be any of the following:

.1 reinforced concrete pipe conforming to ASTM C76. Pipe strength (Class III min.) shall be specified for the trench conditions under which the pipe will be installed and operated. Joints shall conform to ASTM C443; or

.2 polyvinylchloride pipe up to 375 mm in diameter, S.D.R. 35, conforming to ASTM D3034 and CSA B182.2, stiffness (F/Y) of 320 kPa at 5% deflection conforming to ASTM D2412, complete with approved rubber gasket joints. Maximum pipe length shall be 4 metres.

.2 Pipe for sanitary sewer connections of 100 mm and 150 mm diameter and for 150 mm diameter sewer mains shall correspond in material to that used for the main sewer and shall be one of the following:

.1 non-reinforced concrete pipe conforming to ASTM C-14, Class III. Joints shall conform to ASTM C-443; or

.2 Polyvinylchloride pipe, S.D.R. 28, conforming to ASTM D3034 and CSA B182.1, complete with rubber gasket joints. Maximum pipe length shall be 4 metres.

Sewer fittings shall correspond with the respective main and service pipes and shall conform with consistent specifications for main pipe.

.3 Pipes and fitting for sanitary sewer force mains shall be as approved for watermains in accordance with Schedule D, Sections 3.01 and 3.02.

.4 Other types of pipe may be used only with the written consent of the Village Engineer.

3.02 Pipe and Fitting Joints

Sewer pipe and fittings shall be jointed with a rubber gasket or other preformed, factory-manufactured gasket or approved material.

3.03 Service Junctions

Connection of services to the sewer shall be made using wye or service saddle fittings. The type of joint of the service connection pipe to the sewer main shall conform with the type of joints on the sewer main.

Service wye saddle shall only be used to connect a 100 mm diameter service to an existing main. Where service saddles are used, they shall be equipped with steel straps. Service saddles shall only be used with the approval of the Village Engineer.

3.04 Manholes

Precast concrete manhole sections shall conform to ASTM C478 and shall be minimum 1050 mm diameter with 115 mm wall thickness for mains less than 450 mm diameter; for mains greater than 450 mm diameter, the precast manhole sections shall conform to the diameters specified on the Standard Drawings. Concrete for cast-in-place manholes shall have a minimum compressive strength of 20 MPa at 28 days.

Concrete for cast-in-place manhole bases and benching shall have a minimum compressive strength of 20 MPa at 28 days.

Precast manhole bases of a design and construction quality acceptable to the Village Engineer will be accepted in lieu of cast in place bases.

Cover slabs may be precast or cast-in-place concrete reinforced to withstand H-20 loading conditions.

Manhole rungs shall be 20 mm diameter steel, hot dipped galvanized after bending, or an approved aluminum alternate, at 300 mm o.c., cast into the wall of the manhole section, or set in 30 mm holes filled with epoxy cement. Rungs shall protrude 125 to 150 mm from the manhole wall. If precast manhole barrels are used having inset wire lifting lugs, the lugs shall be galvanized.

3.05 Manholes Frames and Covers

Covers and frames shall be cast iron of an approved pattern to withstand H20 loading. The cover shall have a weight of 66 kg and the frame shall be of the round base pattern having a weight of 84 kg. Bearing faces of the cover to frame shall be machined for a non-rocking pit. The cover shall have 2 - 22 mm diameter lifting holes. The lid shall be embossed with "Sanitary Sewer".

3.06 Pipe

CSP shall be used for culverts only and shall consist of galvanized corrugated steel pipe designed to carry H-20 loading in accordance with the *American Iron and Steel Institute* "Handbook of Steel Drainage and Highway Construction Products", latest edition.

3.07 Drainage Drywells

Drywells shall be 1,200 mm diameter and shall be as per Article 3.04 and the Standard Drawings. Drywells shall have 75 mm x 150 mm holes through the walls spaced vertically 150 mm on centre and horizontally 200 mm on centre.

3.08 Pipe and Fitting Joints

Under certain approved conditions, storm sewer mains may be installed without gaskets or grouting to facilitate infiltration of ground water.

Suitable precautions such as shimming must be taken on these installations to ensure pipe to pipe alignment with no projecting inside edges or pipe misalignment.

3.09 Catch Basins

Catch basin barrels shall be pre-cast concrete conforming to ASTM C478. All catch basin barrels shall be 900 mm in diameter. Concrete cover slabs shall be designed to withstand H-20 loading conditions. Catch basins shall be fitted with "Sur-Trap" trapping hoods, or equivalent.

Cast iron frames, grates and side inlets shall be Dobney Foundry or as approved by the Village Engineer.

3.10 Headwalls

Headwalls for storm sewer inlets and outlets shall be designed by the Design Engineer and subject to the approval of the Village Engineer. As a minimum, the design shall include reinforced concrete slab, wingwalls and headwall, 30 MPa concrete at 28 days, 38 mm diameter galvanized pipe handrail, hinged and galvanized trash grate.

4.0 WORKMANSHIP

Storm sewer systems shall be installed in the manner described in Schedule E of this Bylaw except as modified herein.

4.01 Testing

Lamping

The storm sewer system shall be lamped as specified in Section 4.14 of Schedule E of this Bylaw and may be tested for leakage to Section 4.15 of Schedule E of this Bylaw at the discretion of the Village Engineer.

Materials Testing

As per Schedule E, Section 4.16.

Video Inspection Tests

As per Schedule E, Section 4.17, at the discretion of the Village Engineer.

4.02 Head Walls and Aprons

Cleaning and flushing as per Schedule E, Section 4.11 of this Bylaw.

SCHEDULE G

REGULATIONS, STANDARDS, AND SPECIFICATIONS FOR THE INSTALLATION OF STREET LIGHTING

This is Schedule G of the Corporation of the Village of Valemount Subdivision and Development Servicing Bylaw No. 450, 1998.

_____

Clerk

SCHEDULE G

REGULATIONS, STANDARDS AND SPECIFICATIONS FOR THE INSTALLATION OF STREET LIGHTING

1.0 GENERAL

1.01 Street Lighting To Be Provided By Owner

Where the provisions of Schedule A require the provision of street lighting, the Owner shall provide street lighting including all service wiring, bases, poles, luminaires, lamps, photo cells, control equipment and all related appurtenances consistent with the regulations, standards and specifications set out in this Schedule and the requirements of the Provincial Inspector of Electrical Energy.

1.02 Approval of Engineering Drawings Required Prior To Construction

Engineering drawings showing detailed design of the necessary works shall be approved by the Village Engineer before commencement of construction.

The street lighting system shall be designed in accordance with the Canadian Standard Practice For Street and Highway Lighting.

1.03 Permit Fees To Be Paid By Owner

The Owner shall be responsible for obtaining all required electrical permits, arranging for all electrical inspections covering his work and paying all fees for such permits. A copy of the permits are to be submitted to the Village at the time of application for final approval.

2.0 DESIGN CRITERIA

2.01 Levels of Illumination

The average levels of illumination in lux shall be as described in Table G.1:

TABLE G.1
ILLUMINATION FOR VARIOUS HIGHWAY CLASSIFICATIONS

	Residential Areas	Commercial and Industrial Areas
Downtown/Frontage/ Commercial	10.0	21.5
Collector	6.5	11.0
Local	4.5	10.0

The maximum uniformity ratio for local residential highways shall be 6:1; all other highways shall be 3:1.

2.02 Pole Locations

In general, poles shall be installed as follows:

.1	downtown/frontage/commercial	-	opposite or staggered spacing;
.2	collector highways	-	staggered spacing; and
.3	local highways	-	spaced one side of streets behind the sidewalk.

Poles shall be located within 0.6 metres of the property corners and shall be checked for conflict with driveways, underground services and fire hydrants.

2.03 Rules and Regulations

Equipment, installation, wiring methods, and materials used shall be in accordance with the latest edition, including amendments, of the Rules and Regulations for the installation and maintenance of electrical equipment as issued by the Province of British Columbia and all bulletins issued thereto. Work shall also be in accordance with all applicable Municipal codes and regulations, Provincial Statutes in effect at the site, and the Fire Marshall and Workmen's Compensation Acts, hereinafter called the Rules and Regulations.

Wherever the drawings or specifications call for material, workmanship, arrangement or construction of a superior quality than is required by the rules and regulations, the drawings and specifications shall prevail. Otherwise, should there be a conflict between the rules and regulations and the drawings and specifications, the rules and regulations shall prevail. The Owner shall obtain, and pay for all permits, and arrange for all electrical inspections covering his work, and pay all other fees and charges, and make all deposits that are in any way connected with the installation of the systems specified as shown on the Standard Drawings. He shall give all necessary notices to authorities having jurisdiction, and shall be responsible for keeping all applicable public ordinances.

Scheduling B.C. Hydro and Power Authority shall be the Owner's responsibility. Systems shall be compatible with power services available. Where costs are incurred with B.C. Hydro and Power Authority in installing the light system, these shall be considered as part of the cost of the system.

Before acceptance of any part or all of the system, it shall meet the requirements of Schedule H. As built drawings of the street lighting system shall be furnished to the Village Engineer prior to acceptance. The information shown shall be pole locations and locations of all conduits, together with any other pertinent information.

Before acceptance of any work by the Village Engineer, he shall have received a Certificate of Inspection by the governing electrical authorities showing that the installation is unconditionally approved.

2.04 Connection to Utility

An allowance for a minimum of 8 street lights per electrical connections shall be made and future extension of the street lighting system should accommodate this requirement.

Each connection to B.C. Hydro will be made to a service box located at a lamp standard as shown on the Standard Drawings.

3.0 MATERIALS

3.01 General

Electrical materials used in the street lighting system shall be new and shall be approved by and bear the label of the Canadian Standards Association.

3.02 Street Light Poles

Poles shall be as shown on the Standard Drawing and shall be a minimum 11 gauge octagonal steel anchor base type with 1.8, 2.5 or 3.0 m davit and a minimum height of 7.9 m for local highways and 9 m for collector and arterial highways as shown on the applicable Standard Drawing. Poles shall be complete with anchor bolts, nuts and nut covers, handhole and water tight cover assembly, grounding stud and fuse and terminal block assembly as shown on the Standard Drawing. Poles shall be factory hot dipped galvanized coat in accordance with CAN/CSA-S16.1 and CAN/CSA-G164.

3.03 Conductors

All conductors shall be copper and if larger than 10 AWG, shall be stranded.

All insulated conductors shall be colour coded. White shall be used for the mutual conductor.

Conductors run in rigid PVC conduit or in the interior of street light poles shall be wire type as listed in Table 19 of the Canadian Electrical Code for use in raceways (wet location). Adequate slack shall be provided in the pole to permit removal of connected wires and fusing through the handhole for maintenance.

In no case shall the conductor be less than 10 AWG.

3.04 Conduit

Rigid PVC conduit shall be acceptable provided that it bears a CSA Certification label and all fittings shall be CSA Certified. PVC conduit shall be installed in strict accordance with the Manufacturer's recommendation, using CSA certified cement. The conduit shall not be bent in the field. Only factory bends shall be acceptable. The minimum conduit size shall be 32 mm diameter.

3.05 Luminaries and Lamps

Luminaries shall be High Pressure Sodium Cobra Head Fixtures, 100 watt Landmark 100 - L2HS100P2V, 120/240 volt for local roads and 150 watt Landmark 150-L2HS150P2Y, 120/240 volt on collector and arterial roads, or as otherwise approved by the Village Engineer. Photocells shall be Fisher Pierce 6660 or 6690 or equivalent. There shall be one photocell per luminaire.

On local and cul-de-sac highways, a Cooper Industries Crouse-Hinds Lighting Promenade Type PR, 100 watt, HPS Post Top, poly carbonate, type 3 distribution luminaire may be used. Photocells shall be Fisher Pierce 6660 or 6690 or equivalent. There shall be one photocell per luminaire.

3.06 Junction Boxes

Junction boxes shall be PVC or concrete. PVC boxes with street lids shall be used in sidewalk areas only. Concrete boxes with street lids shall be used in all areas subject to vehicle traffic. Concrete lids may be used in areas not subject to vehicle traffic. There will be one junction box per street light.

3.07 Ground Rods

Ground rods shall be 19 mm diameter steel with hot forged point, full length galvanized or copperweld and located in the junction box adjacent to each pole.

3.08 Connectors

Insulated connectors shall be Scotchlok as manufactured by Minnesota Mining and Manufacturing Co. Ltd., or as otherwise approved by the Village Engineer. For conductor combinations too large to use Scotchlok connectors, a solderless line connection shall be used, such as connector CL2 manufactured by Thomas & Betts Ltd., or approved equal. Bare copper lug used for connecting ground conductor to ground stud in lighting pole handhole shall be Thomas & Betts 54106 full compression lug, or approved equal. The connector serving a ground rod shall be Burndy type GAR, or approved equal.

3.09 Pole Bases

Concrete bases for poles shall be as shown on the applicable Standard Drawing.

3.10 Fusing

There shall be one in-line (cartridge type) fuse per street light, located within each pole and accessible through the handhole.

4.0 WORKMANSHIP

4.01 Installation

Conduits shall be installed in accordance with the applicable Standard Drawing at a constant depth and on the alignment shown on the approved construction drawings. Conduits under existing paved roads, driveways or sidewalks shall be installed by tunnelling, unless the Village Engineer gives his express written consent for open trench construction. Service line conductors and all other electrical components shall be installed in conformance with the standard drawings in the B.C. Electrical Code. A conduit under curb or sidewalk shall be buried in a trench with the centre line not less than 750 mm below top of curb or sidewalk.

If no curb or sidewalk is installed, the conduit shall be buried 900 mm below finished grade of centreline of road; and all road, lane and industrial and commercial driveway crossings, the conduit shall be buried not less than 900 mm below top of crossing. If the top of crossing is covered by concrete slab, the depth of trench may not be less than 750 mm below the top of crossing.

In all trenches, the conduit shall be snaked slightly to permit expansion and contraction.

All ducts shall be sand bedded.

Bases shall be constructed and installed as shown on the Standard Drawings. The standards shall be erected plumb, using shims if required.

Luminaries shall be securely fastened to the lighting poles and oriented to produce the required light distribution.

4.02 Restoration

All roadways, lanes, driveways, boulevards, and other areas traversed by trenches shall be returned to their original conditions or better by the Owner.

SCHEDULE H

REGULATIONS, STANDARDS, AND SPECIFICATIONS FOR THE INSTALLATION OF ELECTRICAL AND COMMUNICATIONS WIRING AND GAS DISTRIBUTION SYSTEM

This is Schedule H of the Corporation of the Village of Valemount Subdivision and Development Servicing Bylaw No. 450, 1998.

_____

Clerk

SCHEDULE H

REGULATIONS, STANDARDS, AND SPECIFICATIONS FOR THE INSTALLATION OF ELECTRICAL AND COMMUNICATIONS WIRING AND GAS DISTRIBUTION SYSTEM

1.0 GENERAL

1.01 Standards and Specifications to Apply to All Electrical and Communications Wiring

Underground electrical and telephone systems shall be provided to serve each parcel within the subdivision consistent with the standards and specifications set out in this Schedule and Schedule A. Where it is proposed to develop a natural gas distribution system, the system shall be designed and constructed consistent with the provisions of this Schedule. Where it is proposed to develop a cablevision system, the system shall be designed and constructed consistent with the provisions of this schedule.

1.02 Approval of Engineering Drawings Required Prior to Construction

Engineering drawings showing detailed design of the necessary works shall be submitted to the Village Engineer for approval. No construction of the works shall commence until the design drawings have been approved by the Village Engineer. The engineering drawings shall clearly indicate the locations of poles, structures, conduits, pipes and any other facilities required.

1.03 Construction In Compliance With Engineering Drawings

All poles, structures and facilities shall be constructed or installed in compliance with the engineering drawings approved by the Village Engineer.

1.04 Construction In Accordance With B.C. Hydro and B.C. Telephone

Underground Electrical and Telephone services shall be installed in accordance with the requirements of the B.C. Hydro and Power Authority and the B.C. Telephone Company, supplying the subdivision and the Inspector of Electrical Energy of the Province of B.C. Natural gas distribution works, if applicable, shall be installed in accordance with the requirements of the natural gas distribution company.

1.05 Underground Electrical Systems

Underground systems shall include the supply and installation of all necessary conduits, wiring, transformers, service runs and connections for a complete and fully operative underground electrical system as laid out by the B.C. Hydro and Power Authority and approved by the Village Engineer and the Inspector of Electrical Energy of the Province of B.C.

1.06 Underground Telephone

Underground telephone and cable vision shall include the supply and installation of the necessary conduits, wiring, service runs and connections for a complete and fully operative underground telephone system as laid out by the B.C. Telephone Company serving the subdivision and approved by the Village Engineer.

2.0 DESIGN CRITERIA

2.01 Horizontal Location

Horizontal location of underground ducting and gas main piping shall be as shown on the applicable Standard Drawing. Systems shall be laid out with due regard for other utilities, and shall have the approval of the Village Engineer as well as the utility company involved. Where overhead distribution is specified, pole locations and any anchor easements shall be approved by both the Village Engineer and the appropriate utility company. Care shall be taken to eliminate any aerial trespass.

2.02 Vertical Location

All conduit and gas main piping to have a minimum of 750 mm cover or to the depths specified by the local authority, whichever is greater.

2.03 Detailed Design

Details of design such as vertical and horizontal location of service boxes, size and type of conduits and gas mains, kiosk dimensions and ducting and all wiring details shall be as per specifications and drawings provided by B.C. Hydro and Power Authority and B.C. Telephone Company.

3.0 MATERIALS

3.01 B.C. Hydro

All materials used in the underground or overhead electrical distribution system shall be as specified by B.C. Hydro and Power Authority.

3.02 B.C. Telephone Company

All materials used shall be as specified by the B.C. Telephone Company.

4.0 WORKMANSHIP

4.01 Underground Installation

Installation requirements such as trenching, installation of ducting and backfilling shall be according to specifications supplied by the appropriate utility company.

4.02 Clean-up

After installation of all underground ducting service boxes, kiosks, etc. the boulevard area shall be shaped to grade and all debris shall be removed.

SCHEDULE I

STANDARDS FOR THE PREPARATION OF DESIGN AND AS-BUILT DRAWINGS

This is Schedule I of the Corporation of the Village of Valemount Subdivision and Development Servicing Bylaw No. 450, 1998.

_____

Clerk

SCHEDULE I

STANDARDS FOR THE PREPARATION OF DESIGN AND AS-BUILT DRAWINGS

1.0 GENERAL REQUIREMENTS

These requirements pertain to the preparation of drawings for: sanitary sewers; storm sewers; water; gas; underground power; telephone; cablevision; street lighting; roads; curbs and gutters; sidewalks; culverts; bridges; and other permanent structures.

Where no standard is defined in this schedule for the preparation of a drawing to portray a particular service, structure, or other items, instructions and requirements may be obtained by discussion with the Corporation of the Village of Valemount, or its appointed representative.

As-built plans are to be completed and approved before securities are released.

As-built drawings are to be submitted within four (4) weeks of the completion of all services to be installed by the Owner. The Design Engineer shall deliver as-built drawings as specified in this schedule to the Village Engineer. These drawings shall be signed and sealed by the Village Engineer.

A plan profile is a detailed engineering drawing record containing the permanent and temporary features within a public right-of-way. The plan profile is divided into two parts:

.1 Part One: The top profile shows, elevations, chainages, surface and utility grades with related data.

.2 Part Two: The bottom plan view shows all surface features, legal descriptions and bordering property data, all underground utilities and their locations within the public right-of-way and related data.

2.0 DRAWING STANDARDS

2.01 Sheet Size

Pre-cut sheets to be 841 mm x 594 mm (A-1 sheet size).

2.02 Sheet Material

3 mil mylar matte both sides with half plan and half profile.

2.03 Grid Standards

2 mm x 10 mm profile grid.

2.04 Sheet Border

Border line width to be 1.0 mm. Top, bottom and right border to be 15 mm respectively from edge of sheet. Left border to be 42 mm from edge of sheet.

2.05 Title Block

.1 Located along the bottom of the sheet.

.2 Size of the title block is 46 mm wide.

.3 Title block to be pre-printed. Stick-on type is not acceptable.

.4 Title block shall describe the contents of the drawing (eg. key plan, roadworks, etc.) and shall clearly indicate the location of the works by road name(s) and/or legal description.

.5 Lettering to be an open style of Vertical Gothic - Leroy or AutoCAD. If using AutoCAD, use text font Roman. If using some other computer graphic system, it should be compatible with AutoCAD. See sample sheet for lettering height and pen size.

.6 Design Engineers must use the Corporation of the Village of Valemount A-1 standard sheets. Design Engineers identifications are to be placed on each drawing.

.7 A sample of a prepared plan/profile sheet, and an AutoCAD disk of the Standard Drawing block shell may be obtained by contacting the Corporation of the Village of Valemount.

3.0 PREPARATION OF DRAWING

Drawings shall be prepared in accordance with the standard plan/profile sheet furnished upon request from the Village.

3.02 Sheet Layout

.1 Maintain a minimum clearance of 40 mm from all borders.

.2 The profile SHALL NOT be drawn over the title block.

.3 Place north arrow close to the top right hand side of the sheet whenever possible.

.4 North arrow shall point either towards the top of the page or towards the left hand edge of the page. The north arrow may point not more than 60° to the right hand side of the page.

.5 Show distances and location dimensions in metres and to 3 decimal places.

.6 Show pipe sizes in mm as per A.S.T.M. specifications using 1" = 25 mm.

.7 Existing imperial dimensions except for pipe sizes are to be soft converted using the factor:

.1 inch (1") = 25.4 cm; and
.2 foot (1') = 0.3048 m.

3.03 Lettering

.1 Lettering is to be an open style of Vertical Gothic (eg. Leroy or AutoCAD - Romans) minimum height being 1.8 mm. The standard lettering height is 2.5 mm.

.2 Lettering to be applied by using a Leroy, a computer graphics system compatible to AutoCAD, or equivalent.

.3 Use BLACK INDIA ink on all as-built drawings.

3.04 Scales

Use metric scales:

.1	PLAN VIEW SCALE		1:500; and
.2	PROFILE VIEW SCALE	Horizontal	1:500
		Vertical	1:50.

3.05 Plan View

.1 Show utility and utility access R.O.W.'s.

.2 In case of R.O.W.'s less than 6.0 m larger scales may be permitted.

.3 Show control station monuments with identification number.

.4 The PLAN VIEWS should not be fragmented or broken due to slight curves in the road right-of-way.

.5 The PLAN VIEWS shall be fragmented or broken if the vertical alignment of the utilities in the PROFILE SECTION when shown at true length and when projected above to the utilities in the PLAN VIEW cannot be maintained in as close a relationship as possible without too much discrepancy.

.6 If using co-ordinates for layouts, calculate and plot distances at SEA LEVEL, but show ground level distances on the plan.

.7 Show the legal layout, dimensions, bearings, lot numbers, block numbers, legal plan numbers, street names, sidewalks with related data and catch basin installations with elevations.

.8 All lots need not be numbered providing they are in sequence. Show first and second and next to last and last lots. If not in sequence, all lots shall be numbered.

.9 All lot dimensions shall be given in metres and to three (3) decimal places. If the lots are of same dimensions and side by side, only the two outside lots need have the dimensions shown, the remainder with ditto marks.

.10 Curb information should be shown and should include radius, delta angle, tangent length, and arc length

.11 Face of curb information must be complete.
ie. Rollover Face of Curb - Roll F.C.

If other than concrete face of curb specify material used.
ie. Rollover Asphalt Face of Curb - Roll Asph F.C.

.12 Show Right of Way road widths and the actual roadway widths between curbs or between curbs and edge of pavement.

.13 Show all utilities such as sanitary and storm sewers, water, hydro, telephone, gas, cable TV, manholes, valves, cleanouts, hydrants, service boxes, etc.

.14 Reference each utility to the nearest property line or boundaries of right-of-ways.

.15 Show flow directions of sewers.

.16 Manholes in midblock shall be referenced to the nearest lot line (I.P)

.17 Lot services (sanitary, storm, water) shall be shown and referenced to the nearest or convenient lot line of said lot.

3.06 Profile

.1 The profile and related data are shown on the bottom half of the sheet. Establish 0+00 station on accented vertical grid line.

.2 The original groundline (centreline) and related data prior to construction should be shown, along with date surveyed.

.3 The profile shall be shown at true centreline length and projected above to the PLAN VIEW in as close a relationship as possible.

.4 Show as constructed centreline for streets and lanes and date constructed.

.5 Show centreline percent grade to two (2) decimal places, together with the following information on vertical curves:

.1 the chainage and elevations of B.C., E.C., and V.P.I.;

.2 the external value, "e";

.3 the length of vertical curve;

.4 the chainage and elevation of the low spot of sag curves or high point of crest curves; and

.5 on super elevated curves and crossfall sections, percent crossfall, transition length and crown should be noted.

.6 Show profiles of invert and crown of pipes for sanitary, storm, and water mains as well as length, size, type, grade, and class of pipe (eg. 75 m - 200 mm SAN SDR 35 PVC).

.7 Show manholes with rim elevations, and invert elevations at both inlet and outlet.

.8 Crown of pipes shall be shown at all locations where there is the possibility of conflicts with other utilities.

.9 Show location type and elevation of all crossing utilities.

.10 Elevations are placed at the right and left hand side of the profile and repeated when there is a break in the profile.

.11 Elevations are to be shown at every even metre graduation and placed on the heavy accented line.

.12 All elevations shall be relative to GEODETIC DATUM and in metric.

4.0 DRAFTING GUIDELINES

The format of the Technical Legend places the symbol as it appears on the drawing on the left hand page with drafting guidelines on the right hand page.

The symbols presented in the Legend are sized for use on Plan Profile drawings. Dimensions used are given in millimetres. Pen and template sizes refer to the widely used Leroy equipment. Metric pen and template sizes are given in millimetres along with their imperial equivalent.

5.0 CERTIFICATION REPORTS

Prior to acceptance of the Works, the Design Engineer shall submit 3 bound copies of System Certification Reports to the Village Engineer. Certification reports shall fully indicate the as-constructed aspects of each system as well as all required operation and maintenance information. As a minimum, reports shall include the following:

.1 complete set of constructed drawings at the same scale and in the same format as the construction drawings;

.2 as-constructed AutoCAD files saved in the format as requested by the Village Engineer;

.3 copies of all test reports and results;

.4 all shop drawings;

.5 a list of contractors and major subcontractors by work item; and

.6 operating and Maintenance Manuals.

6.0 ABBREVIATIONS

Technical Legend	**Plan Profile Abbreviations**
ABANDONED	ABAND.
ABBREVIATION	ABBREV.
ACRE	AC.
ASBESTOS CONCRETE	A.C.
ASPHALT	ASPH.
ASPHALT WALK	ASPH.W.
AIR VALVE	A.V.
AVENUE	AVE.
AVERAGE	AVG.

Technical Legend	**Plan Profile Abbreviations**
BACK OF CURB	B.O.C.
BACK OF WALK	B.O.W. or B.W.
BASEMENT	BSMT
BEARING	BRG.
BEDDING	BED.
BEGINNING OF CURVE	B.C.
BENCH MARK	B.M.
BETWEEN	BTWN
BLOCK	BLK
BOTTOM	BTM
BOTTOM OF PIPE	B.O.P.
BOULEVARD	BLVD.
BOUNDARY	BDY
BUILDING	BLDG
BEGINNING OF VERTICAL CURVE	B.V.C.
CABLE TELEVISION	T.V.
CALCULATED	CALC
CANADIAN NATIONAL RAILWAY	C.N.R.
CANADIAN PACIFIC RAILWAY	C.P.R.
CANADIAN STANDARDS ASSOCIATION	C.S.A.
CAPACITY	CAP
CAST IRON	C.I.
CATCH BASIN	C.B.
CATHODIC PROTECTION	C.P.
CENTIMETER	CM
CENTRE LINE	
CHECKED	CHKD
CHECK VALVE	C.V.
CHORD	CH
CIRCLE	CIR
CLASS	CL
CLEAN OUT	C.O.
CONCRETE	CONC
CONCRETE WALK	C.W.
CONDUIT	COND
CONSTRUCTION/CONSTRUCT	CONSTR or CONST
CONTOUR	CONT
CONTRACTOR	CONTR
COPPER	CU
CORNER	COR.
CORRUGATED METAL PIPE	C.M.P.
COUPLING	CPLG
COURT	CT

Technical Legend **Plan Profile Abbreviations**

CREEK	CR
CRESCENT	CRES
CROSSFALL	X-FALL
CROSS SECTION	X-SECTION
CULVERT	CULV
CURB AND GUTTER	C & G
DEGREE	DEG or °
DELTA	
DEPARTMENT	DEPT
DIAMETER	DIA. or
DIMENSION	DIM
DISTANCE	DIST
DITCH	D
DOUBLE	DBL
DRAWING	DWG
DRIVEWAY	DWY
DRY WELL	D.W.
DRIVE	DR
DUCTILE IRON	DI
DWELLING	DWLG
EASEMENT	ESMT
EAST	E
EDGE OF MEDIAN	E.M.
EDGE OF PAVEMENT	E.P.
EDGE OF SHOULDER	E.S.
ELECTRIC	ELEC
ELECTRIC LIGHT	E.L.
ELEVATION	ELEV
END OF CURVE	E.C.
END OF VERTICAL CURVE	E.V.C.
ESTIMATE	EST.
EXISTING	EXIST
FACE OF CURB	F.C. (Roll F.C., Std. F.C., Asph.
(Rolled, Standard, Asphalt)	F.C.)
FACE OF WALK	F.W.
FEET OR FOOT	FT
FLANGE	FLG
FLANGED OUTLET	F/O
FLOOR	FLR
FOOTING	FTG
FORCE MAIN	F.M.

Technical Legend **Plan Profile Abbreviations**

FOUND	FD
GALVANIZED	GALV
GARAGE	GAR
GARDEN	GDN
GRAVEL	GRAV
GRADE	GR
GUARD RAIL	GDR
HECTARE	HA
HECTOMETRE	HM
HEIGHT	HT
HIGHWAY	HWY
HORIZONTAL	HOR
HORIZONTAL CURVE	HOR
HOSPITAL	HOSP
HYDRANT	HYD
INCH	IN or "
INLET CHAMBER	I.C.
INSIDE DIAMETER	I.D.
INTERSECTION	INT
INVERT	INV
IRON PIN, FOUND IRON PIN	I.P., F.I.P.
INSULATE	INS
INTAKE STRUCTURE	I.S.
JOINT	JT
KILOGRAM	KG
KILOMETRES	KM
KILOMETRES PER HOUR	KM/H
LATERAL	LAT
LEAD	L
LENGTH	LGTH
LENGTH OF CURVE	L.C.
LIFT STATION	L.STA
LIGHT STANDARD	L.S.
LIP OF GUTTER	L.G.
MAIN VALVE	M.V.
MANHOLE	M.H.
MANHOLE RIM	M.H.R.
Technical Legend	**Plan Profile Abbreviations**
MAXIMUM	MAX

MECHANICAL JOINT	M.J.
METRE	m
METRE CHAMBER	M.C.
MEDIAN	M. or MED
MILES PER HOUR	M.P.H.
MILLIMETRE	mm
MINIMUM	min
MINISTRY OF TRANSPORT	M.O.T.
MONOLITHIC SIDEWALK	MONO
MONUMENT	MON
MORTAR JOINT	M.J.
MINUTES	MIN or '
NORTH	N
NORTH SIDE	N/S
NOT TO SCALE	N.T.S.
NUMBER	NO. or #
OBLITERATED	OBL
ON CENTRE	O.C. or O/C
ORIGINAL GROUND	O.G.
OPPOSITE FACE	O.F.
OUTLET CHAMBER	O.C.
OUTSIDE DIAMETER	O.D.
PARALLEL	PAR
PARKWAY	PKWY
PAVEMENT	PVMT
PER	/
PERCENT	%
PHASE	PH
PIPE	P
PLACE	PL
PLAN PROFILE	P.P.
PLUG	PLUG
POINT	PT
POINT ON CURVE	P.C.
POINT ON COMPOUND CURVE	P.C.C.
POINT ON TANGENT	P.T.
POINT ON INTERSECTION	P.I.
POUNDS	lbs
POUNDS PER SQUARE INCH	P.S.I.
POWER POLES	P-P

Technical Legend **Plan Profile Abbreviations**

PRESSURE REDUCING VALVE	P.R.V.
PROPERTY LINE	P.L.

PROPOSED	PROP
PUMP STATION	P.S.
QUANTITY	QTY
RADIUS	RAD OR R
RAILWAY	RWY
RAISED FACE	R.F.
RECTIFIER	RECT
REDUCER	RED
REFERENCE	REF
REGISTERED PLAN	R.P.
REINFORCED	REIN
RESTORED	RSTD
REPLACEMENT	REPL
RESERVOIR	RES
REVISION	REV
RIGHT	RT
ROAD	RD
ROUND	
RIGHT OF WAY	R/W or R.O.W.
SANITARY	SAN
SECOND	SEC
SECTION	SECT
SERVICE	SERV
SERVICE ROAD	SERV.RD.
SET IN FIELD	S.I.F.
SIDEWALK PROFILE	S.W.P.
SLOPE	SLP
SOUTH	S
SOUTH SIDE	S/S
SPECIFICATION	SPEC
SPIRAL TO CURVE	S.C.
SQUARE	SQ OR
STANDARD	STD
STATION	STA
STEEL	STL
STORM	STM
STREET	ST
STRUCTURE	STR
SUPPLY	SUP
Technical Legend	**Plan Profile Abbreviations**
SWALE	SWL
SYMBOL	SYM

TANGENT	TAN
TANGENT TO SPIRAL	T.S.
TECHNICAL	TECH
TEMPERATURE	TEMP
TEMPORARY	TEMPO
TEST HOLE	T.H.
TONGUE AND GROOVE	T.G.
TOWNSHIP	T.W.P.
TOP OF CURVE	T.O.C.
TOP OF PIPE	T.O.P.
TRAFFIC CONTROL	T.C.
TRAIL	TR.
TRANSFORMER	TRANSF
TRANSITE	TRANS
TYPICAL	TYP
UNDERGROUND	U.G. or U/G/
UNDER CONSTRUCTION	U/C
VELOCITY	VEL
VERTICAL	VERT
VERTICAL CURVE	V.C.
VOLUME	VOL
WALL THICKNESS	W.T.
WASH OUT	W/O
WATER	W
WEST	West
WEST SIDE	W/S
WEEPING TILE	W.TILE
WEIGHT	Wt
WIDTH	WDTH
WITNESS PIN	W.PIN
WOODEN POST	W.P.
YARD	YD2

SAMPLE AGREEMENT A

STANDARD DEVELOPMENT AGREEMENT DOCUMENT

THIS AGREEMENT made this _____ day of _____ A.D., 19___.

BETWEEN: THE CORPORATION OF THE VILLAGE OF VALEMOUNT, a body corporate, duly incorporated under the laws of the Province of British Columbia, having an office at 99 Gorse Street, Village of Valemount, Province of British Columbia, VOE 2Z0

(hereinafter called the "Village ")

OF THE FIRST PART

AND:

(hereinafter called the "Owner")

OF THE SECOND PART

WHEREAS:

A. The Owner is the registered owner or holder of a Registered Right to Purchase lands and premises situate, lying and being in the Corporation of the Village of Valemount, Province of British Columbia, and more particularly known and described as:

(hereinafter called the "Land");

B. The Owner wishes to subdivide or develop the Land, or part thereof, in the manner shown on a Plan of Subdivision or Building Permit which has been submitted by the Owner to the Approving Officer or Building Inspector of the Village of Valemount for approval, a copy of which such plan is attached hereto as Schedule "One", and is hereinafter called the "Subdivision Plan" or “Building Permit Plan”;

C. The Owner is desirous of entering into this Agreement with the Village pursuant to the provisions of Section 940 of the Municipal Act, in order to obtain approval from the Approving Officer of the Subdivision Plan or Building Inspector for the Building Permit prior to completion of the construction and installation on the Land of all works and services required by the Village to be constructed and installed on the Land by the Owner.

NOW THIS AGREEMENT WITNESSETH that in consideration of the premises and of the mutual covenants and agreements herein contained, the parties hereto covenant and agree as follows:

1. In this Agreement, unless the context otherwise requires:

> "Work" shall be construed to mean and include all works, services, roads and any other improvement required to be constructed and erected or installed, both on and off the Land, by the Owner under provisions of this Agreement.
>
> "Complete" or "Completion" or any variation of these words, when used with respect to the work referred to herein, shall mean completion of the work, or a part thereof as the context requires, in accordance with the provisions of this Agreement and to the satisfaction of the Village Engineer when so certified by him in writing.
>
> "Village Engineer" shall mean the Village Engineer for the Village or his deputy.
>
> "Approving Officer" shall mean the Approving Officer or his deputy as appointed by the Council of the Village.
>
> "Contractor" shall mean and include contractors and sub-contractors employed by the Owner, directly or indirectly, in the construction and installation of the work.
>
> “Building Inspector” means the Building Inspector for the Village of Valemount.

2. The Owner covenants and agrees to construct and install on the Land and off-site as the case may be, in accordance with the plans and specifications initialled by each of the parties hereto for identification, the following work:

.1 Drainage works and services;
.2 Sewage works and services;
.3 Water works and services;
.4 Boulevards;
.5 Curbs, gutters and sidewalks;
.6 Highways and lanes;
.7 Street lighting; and
.8 Underground electrical, telephone and cablevision works;

Each of the parties hereto acknowledge having in its or his possession a true copy of the aforesaid plans and specifications (herein called the "Approved Engineering Plans"), and acknowledge and agree that the Approved Engineering Plans are hereby incorporated into and made part of this Agreement and are attached as Schedule "Two".

3. All work shall be carried out by the Owner or his contractors in accordance with the Approved Engineering Plans, and in accordance with the provisions of the Subdivision and Development Servicing Bylaw of the Village of Valemount and as amended from time to time in force. Wherever the provisions of the plans and specifications and the said Subdivision and Development Servicing Bylaw shall conflict, the Village Engineer shall determine and consent in writing the provisions which shall be enforced and constructed.

4. The cost of all work herein shall be borne by the Owner, and the Owner shall employ only bonded contractors to carry out and complete the work.

5. The Owner shall obtain and provide to the Village upon request and free of charge true copies of all contracts and sub-contracts entered into by the Owner or its contractors and relating to the work.

6. The decision of the Village Engineer shall be final and binding on all parties hereto in determining whether or not the work or any part thereof has been carried out and completed in accordance with the provisions of this Agreement.

7. As soon as the Owner is satisfied that he has caused the work to be completed, and prior to final approval or permit, the Owner shall submit to the Village Engineer final as-built mylar drawings of all work constructed hereunder, sealed by a Professional Engineer. Where the as-built drawings have been completed using AutoCAD (latest release) or a similar computer drafting software, one copy of the diskette containing the as-built drawing files shall also be provided. Until the owner submits the final as-built mylar drawings, the Village will hold $200 per sheet for drafting deficiencies.

8. The Owner shall cause all work herein to be carried out and completed not later than the ____ day of _____, 19___ (hereinafter called the "Completion Date").

9. Prior to obtaining approval of the Subdivision by the Approving Officer or Building Permit by the Building Inspector, the Owner:

   .1 Shall pay all arrears of property taxes chargeable against the Land by the Village; and
   .2 Shall pay all current assessed property taxes levied against the Land by the Village.

10. The Owner further covenants and agrees to pay to the Village, prior to commencement of the subdivision or development, charges for the inspection of the works in the amount of _____, ($_____) the cost of connecting the work to the Village's drainage and sewage collection systems and, where applicable, the Village waterworks.

11. Prior to approval of the Subdivision Plan by the Approving Officer or the Building Permit by the Building Inspector, and as security for the due and proper performance by the Owner of all his covenants and agreements herein contained, the Owner shall deposit with the Village an unconditional, irrevocable Letter of Credit drawn on a chartered bank in Canada for a term of not less than twelve (12) months, in the amount of _____ ($), which is equal to One Hundred and Ten percent (110%) the cost of constructing and providing all of the work required to be constructed and installed by the Owner under the terms of this Agreement, as estimated by the Village Engineer, and containing such terms and provisions as may be required by the Village Engineer.

The Owner agrees that if the work or any part thereof is not completed in accordance with the provisions of this Agreement and by the Completion Date, or if the Owner shall be in default of any of his covenants herein contained, and such default shall continue for a period of fourteen (14) days after notice thereof has been given as per paragraph 15 by the Village to the Owner, the Village may call for and receive the funds secured by the Letter of Credit and the Village may complete the work at the cost of the Owner and deduct from any fund held by the Village as security hereunder, the cost of such completion, and the balance of the deposit, if any, shall be returned to the Owner less any administration fees required by the Village.

If there is insufficient money on deposit with the Village under the Letter of Credit, then the Owner shall pay such deficiency to the Village immediately upon receipt of the Village's bill for completing the work. It is understood and agreed that the Village may do such work either by itself, or by contractors employed by the Village. Any bill rendered by the Village to the Owner under the provisions of this paragraph, shall be regarded as charges for work done or service provided under the provisions of Section 435 of the Municipal Act and may in addition to any other remedy available to the Village, be collected in the same manner and with the like remedies as ordinary taxes upon Land and improvements are collected under the said Act.

12. The Village will consent to reduction in the amount secured by the Letter of Credit, or cash, from time to time, and in accordance with the following:

.1 the percentage of the credit reduction will be equal to the percentage of the cost of the work done and approved by the Village Engineer;
.2 no reduction will be allowed for any amount less than 10% of the total cost of the construction and installation of the work;
.3 notwithstanding .1 and .2 herein, the Village will not refund an amount whichever is the lessor of 10% of the total cost of the constructing and installing of the work or $50,000.00 until the expiry of one (1) year following the full and final completion of all the work; and
.4 upon the expiry of the aforesaid one (1) year period, and provided that the Owner is not then in default under any of his covenants herein contained, and upon final approval of the work by the Village Engineer, the Village will as soon as possible, reduce the remaining security to zero (nil).

13. the Owner covenants and agrees to indemnify and save harmless the Village and its servants, agents and employees from and against all actions, proceedings, costs, damages, expenses, claims and demands whatsoever and by whomsoever brought or made against the Village or its said servants, agents and employees, resulting directly or indirectly from the construction or installation of the work.

14. in consideration of due and proper performance by the Owner of his covenants herein contained, the Village covenants and agrees to permit the Owner to carry out and perform the work.

15. any demand or notice required or permitted to be given under the provisions of this agreement shall be in writing and may be given by mailing such notice by prepaid registered post to the party concerned at the address for such party first above-recited, and any such notice or demand mailed as aforesaid shall be deemed to have been received by the party to whom it is addressed on the second business day after the date of posting thereof.

16. the Owner acknowledges and agrees that immediately upon issuance by the Village Engineer of his certification stating that the work has been completed, all right, title and interest in and to the work shall immediately pass to and vest in the Village, but nothing herein contained shall derogate from the obligation of the Owner to maintain the work for a period of one (1) year following completion as aforesaid.

17. it is understood and agreed that the Village has made no representations, covenants, warranties, guarantees, promises or agreements (oral or otherwise) with the Owner other than those contained in this Contract.

18. wherever the singular or masculine is used herein, the same shall be construed as meaning the plural, feminine or body corporate or politic where the context or the parties so require.

19. this Agreement and the terms, covenants and conditions herein contained shall ensure to the benefit of and be binding upon the parties hereto and their respective heirs, executors, administrators, successors and assigns.

IN WITNESS WHEREOF the parties hereto have executed this Agreement at the Corporation of the Village of Valemount, Province of British Columbia, the day and year first above written.

THE CORPORATION OF
THE VILLAGE OF VALEMOUNT)
)
)
)
_____)
Mayor:) C/S
)
)
)
_____)
Clerk:)
)
)
)
_____) C/S
Owner:) (if a corporation)
)
)
)
_____)
Owner:)

SAMPLE AGREEMENT B

STANDARD STATUTORY RIGHT-OF-WAY DOCUMENT

THIS INDENTURE made the ____ day of _____ , 19___.

BETWEEN:

(hereinafter called the "Grantor")

OF THE FIRST PART

AND:

CORPORATION OF THE VILLAGE OF VALEMOUNT

(hereinafter called the "Grantee")

OF THE SECOND PART

WHEREAS the Grantor is the registered owner or is entitled to become the registered owner of an estate in fee simple of ALL AND SINGULAR those certain parcels or tracts of land and premises situate, lying and being in the Corporation of the Village of Valemount, in the Province of British Columbia, and being more particularly known and described as:

(hereinafter called the "Lands of the Grantor")

AND WHEREAS the Grantor and Grantee have agreed to enter into this agreement pursuant to Section 214 of the Land Title Act, R.S.B.C. 1979, Chapter 219 and amendments thereto;

AND WHEREAS it is necessary for the operation and maintenance of the Grantee's undertaking, hereinafter described, to install and maintain a system of sewerage works, and/or water works, and/or drainage works, and/or gas works including all pipes, valves, fittings, buildings and facilities in connection therewith and/or hydro electric works including all wires, poles, conduits and other facilities in connection therewith;

(hereinafter called the "Works")

The Grantor has agreed to permit the construction by the Grantee of the aforementioned works on a portion of the said Land and to grant for that purpose the right-of-way hereinafter described;

NOW THEREFORE THIS INDENTURE WITNESSETH that in consideration of the sum of _____Dollars ($) of lawful money of Canada, now paid by the Grantee to the Grantor (the receipt and sufficiency of which is hereby acknowledged by the Grantor), and in consideration of the covenants and conditions hereinafter contained to be observed and performed by the Grantee and for other valuable consideration:

1.0 THE GRANTOR DOTH HEREBY:

1.1 Grant, convey, confirm and transfer, in perpetuity, unto the Grantee the full, free and uninterrupted right, licence, liberty, privilege, permission and right-of-way to lay down, install, construct, entrench, operate, maintain, inspect, alter, remove, replace, bury, cleanse, string and otherwise establish one or more systems of Works upon, over, under and across that part of the Land of the Grantor as shown outlined in heavy black on right-of-way Plan Number:_____ and designated as _____.

(hereinafter called the "Perpetual Right-of-Way")

1.2 Covenant and agree to and with the Grantee that for the purposes aforesaid and upon, over, under and across the Perpetual Right-of-Way the Grantee shall for itself and its servants, agents, workmen, machinery, vehicles, equipment and materials be entitled at all time to enter, use, pass and repass, labour, construct, erect, install, dig, carry away soil or other surface or subsurface materials, clear of all trees, growth, buildings or obstruction now or hereafter in existence, as may be necessary, useful, or convenient in connection with the operations of the Grantee in relation to the Works;

1.3 Grant, convey, confirm and transfer unto the Grantee for itself and its servants, agents, workmen, contractors and all other licensees of the Grantee, together with machinery, vehicles, equipment and materials the right at all reasonable times to enter upon and to pass and repass over such of the Lands of the Grantor as may reasonably be required for the purpose of ingress to and egress from the Perpetual Right-of-Way;

1.4 Grant, convey, confirm and transfer unto the Grantee for itself and its servants, agents, workmen, contractors and all other licensees of the Grantee, together with machinery, vehicles, equipment and materials for a period of _____ days only from the date of this Agreement, the full, free and uninterrupted right, licence, liberty, privilege, permission and right-of-way to enter upon, pass and repass, clear, labour, and use for the purpose of ingress to and egress from the Perpetual Right-of-Way and for the purpose of storing machinery, equipment, material or supplies used or to be used in connection with the construction of the Works herein described, and for the purpose of placing or storing the surface or subsurface material to be excavated from the Perpetual Right-of-Way upon and over, but not under that part or parts of the Lands of the Grantor, shown outlined in green on Right-of-Way Plan Number:

(hereinafter called the "Working Right-of-Way")

Provided always, and it is hereby agreed that nothing herein contained shall permit the Grantee to dig, trench or otherwise disturb the sub-surface of the Working Right-of-Way,

and the Grantee shall only clear such trees and growth and interfere and disturb the surface of the Working Right-of-Way in a manner that is reasonably necessary in the conduct of its operations thereon;

2.0 THE GRANTOR HEREBY COVENANTS TO AND AGREES WITH THE GRANTEE, as follows:

2.1 That the Grantor will not, nor permit any other person, to erect, place, install or maintain any building, structure, mobile home, concrete driveway or patio, pipe, wire or other conduit on, over or under any portion of the Perpetual Right-of-Way so that it in any way interferes with or damages or prevents access to, or is likely to cause harm to Works authorized hereby to be installed in or upon the Perpetual Right-of-Way;

2.2 That the Grantor will not do nor knowingly permit to be done any act or thing which will interfere with or injure the said Works, and in particular, will not carry out any blasting on or adjacent to the Perpetual Right-of-Way without the consent in writing of the Grantee, provided that such consent shall not be unreasonably withheld;

2.3 That the Grantor will not substantially diminish the soil cover over any of the Works installed in the Perpetual Right-of-Way, and in particular, without in any way limiting the generality of the foregoing, will not construct open drains or ditches along or across any Works installed in the Perpetual Right-of-Way;

2.4 That the Grantor will from time to time and at all times upon every reasonable request, and at the cost of the Grantee do and execute or cause to be made, done or executed all such further and other lawful acts, deeds, things, devices, conveyances and assurances in law whatsoever for the better, assuring unto the Grantee of the rights hereby granted;

3.0 THE GRANTEE HEREBY COVENANTS TO AND AGREES WITH THE GRANTOR, as follows:

3.1 That the Grantee will not bury any debris or rubbish of any kind in excavations or backfill, and will remove shoring and like temporary structures as backfilling proceeds;

3.2 That the Grantee will thoroughly clean all lands to which it has had access hereunder of all rubbish and construction debris created or placed thereon by the Grantee, and will leave such lands in a neat and clean condition;

3.3 That the Grantee will, as soon as weather and soil conditions permit, and so often as it may exercise its right of entry hereunder to any of the lands of the Grantor, replace the surface soil as nearly as may be reasonably possible to the same condition as it was prior to such entry, in order to restore the natural drainage to such lands;
PROVIDED, HOWEVER, that nothing herein contained shall require the Grantee to restore any trees or other surface growth, but the Grantee shall leave such lands in a condition which will not inhibit natural regeneration of such growth;

3.4 That the Grantee will, as far as reasonably possible, carry out all work in a proper and workmanlike manner so as to do as little injury to the Lands of the Grantor as possible;

3.5 That the Grantee will make good at its own expense all damage or disturbance which may be caused to the surface soil of the Lands of the Grantor in the exercise of its rights hereunder;

3.6 That the Grantee will, as far as reasonably possible, restore any fences, lawns, flower beds, at its costs as nearly as may be reasonably possible to the same condition that they were in prior to any entry by the Grantee upon the Lands.

4.0 THE PARTIES HERETO EACH HEREBY COVENANT TO AND AGREE WITH THE OTHER, as follows:

4.1 The said Works referred to above, together with all pipes, manholes, valves, conduits, wires, casings, fittings, lines, meters, appliances, facilities, attachments or devices used in connection therewith shall constitute the Works;

4.2 Notwithstanding any rule of law or equity to the contrary, the Works brought on to, set, constructed, laid, erected in, upon or under the Perpetual Right-of-Way by the Grantee shall at all times remain the property of the Grantee, notwithstanding that the same may be annexed or affixed to the freehold and shall at any time and from time to time be removable in whole or in part by the Grantee;

4.3 In the event that the Grantee abandons the Works or any part thereof the Grantee may, if it so elects, leave the whole or any part thereof in place;

4.4 That no part of the title in fee simple to the soil shall pass to or be vested in the Grantee under or by virtue of these presents and the Grantor may fully use and enjoy all of the Lands of the Grantor subject only to the rights and restrictions herein contained;

4.5 That the covenants herein contained shall be covenants running with the land and that none of the covenants herein contained shall be personal or binding upon the parties hereto, save and except during the Grantor's seisin or ownership of any interest in the Lands of the Grantor, and with respect only to that portion of the Lands of the Grantor of which the Grantor shall be seised or in which he shall have an interest, but that the Lands of the Grantor, nevertheless, be and remain at all times charged therewith;

4.6 If at the date hereof the Grantor is not the sole registered owner of the Lands of the Grantor, this agreement shall nevertheless bind the Grantor to the full extent of his interest therein, and if he shall acquire a greater or the entire interest in fee simple this Agreement shall likewise extend to such after-acquired interests;

4.7 Where the expression "Grantor" includes more than one person, all covenants herein on the part of the Grantor shall be construed as being several as well as joint;

4.8 This agreement shall endure to the benefit of and be binding upon the parties hereto and their respective heirs, administrators, executors, successors and assigns, as the case may be; and wherever the singular or masculine is sued, it shall be construed as if the plural or the feminine or neuter, as the case may be, had been used; where the parties or the context hereto so require and the rest of the sentence shall be construed as if the grammatical and terminological changes thereby rendered necessary had been made.

IN WITNESS WHEREOF the parties hereto have executed these presents in the manner and on the date hereinafter appearing.

THE COMMON SEAL OF THE GRANTOR)
was hereto affixed this ___ day of)
19__ in the presence of:)
)
)
_____) C/S
Signature of Witness)
_____)
Address:)
_____)
)
_____)
Occupation:)
(as to all signatures of the Grantor))

THE CORPORATE SEAL OF
THE VILLAGE OF VALEMOUNT)
was hereunto affixed this ____ day of)
_____, 19__ in the presence)
of:) C/S
)
_____)
Mayor:)
)
)
_____)
Village Clerk:)

CONSENT TO GRANT OF RIGHT-OF-WAY

KNOW ALL MEN BY THESE PRESENTS THAT _____ is the registered holder of a charge by way of _____ against the within-described property, which said charge is registered in the Land Title Office, City of Kamloops, under Numbers _____, for and in consideration of the sum of One dollar ($1.00) paid by the Corporation of the Village of Valemount to the said chargeholder (the receipt whereof is hereby acknowledged), agrees with the Corporation of the Village of Valemount, its successors and assigns, that the within Right-of-Way shall be an encumbrance upon the within-described property in priority to the said charge in the same manner and to the same effect as if it had been dated and registered prior to the said charge.

IN WITNESS WHEREOF the parties hereto have caused these presents to be signed, sealed and delivered in the presence of its duly-authorized officers this __ day of _____, 19__.

SIGNED, SEALED AND DELIVERED by the)
Grantor this ___ day of _____)
19 __ in the presence of:)
)
)
)
_____)
Signature of Witness:)
)
)
_____)
Address:)
)
_____)
)
)
_____)
Occupation:)

THE CORPORATE SEAL OF THE GRANTOR was)
hereunto affixed this ____ day of)
_____, 19 __ in the)
presence of:) C/S
)
)
_____)
)
)
_____)

LAND TITLE ACT

FORM 6

(Section 46)

PROOF OF EXECUTION BY CORPORATION

I CERTIFY that on the _____ day of _____, 19 ___ at _____ in British Columbia, _____, personally known to me, appeared before me and acknowledged to me that he/she is the authorized signatory of _____ and that he is the person who subscribed his/her name and affixed the Seal of the Corporation to the instrument, that he/she was authorized to subscribed his/her name and affix the Seal to it, and that the Corporation existed at the date the instrument was executed by the Corporation.

IN TESTIMONY of which I set my hand at _____, British Columbia, this _____ day of _____, 19 __.

_____
A Commissioner for Taking Affidavits
for British Columbia

SAMPLE AGREEMENT C

CONFIRMATION OF COMMITMENT BY OWNER

CONFIRMATION OF
PROFESSIONAL ASSURANCE

CONFIRMATION OF "COMMITMENT BY OWNER"
RE: DESIGN AND FIELD REVIEW OF CONSTRUCTION
BY A REGISTERED PROFESSIONAL

The Corporation of the Village of Valemount
P.O Box 168
99 Gorse Street
Valemount, B.C.
V0K 2Z0

Attention: Village Engineer

Dear Sir:

Re: _____
(Description and Address) of Subdivision or Development

The undersigned has retained as my/our Professional Engineer, _____ _____ (the "Design Engineer"), to undertake and/or co-ordinate and review all associated design criteria and "field reviews" required for this Project. It is understood that he/she will take all such steps as regulated under the Provincial Statute for his/her profession and by the definition of "field reviews" hereinafter set forth, to ascertain that the design will comply and construction of the project will substantially conform in all material respects with the provisions of The Village of Valemount Subdivision and Development Servicing Bylaw No. _____, 19____, and other applicable Permits, Bylaws, Acts and Regulations which apply to the Project. This representative will ascertain that only qualified personnel are retained to carry out tests, inspect or carry out design work, detailing or "field reviews."

> As used herein, "field reviews" shall mean such reviews of the work at the project site and at fabrication locations, where applicable, as the "Consultant", in his/her professional discretion, considers to be necessary in order to ascertain that the work substantially conforms in all material respects to the plans and supporting documents "accepted" by the Village of Valemount. This will include keeping records of all site visits and any corrective actions taken as a result thereof.

CONFIRMATION OF "COMMITMENT BY OWNER" (Cont'd)

The undersigned has given a contractual mandate to the "Design Engineer" to review reports of other testing and inspection agencies and disciplines where necessary, comment on their acceptability, determine the corrective action to take if unacceptable, and maintain a detailed record of every such report and comments. The "Design Engineer" will automatically submit a monthly summary progress report to the Village Engineer including all field reports and change orders.

NOTE: The Owner will notify the Village Engineer in writing 30 days prior to any intended termination of or by the "Design Engineer". It is understood that work on the above project will cease as of the effective date of such termination, until such time as a new appointment is made, and a "Stop Work Order" shall be posted upon the said project by the Village.

_____ _____

Witness Name (Print) Owner's Name (Print)

_____ By: _____

Witness Signature (Owner or Owner's Appointed Agent) Signature

_____ Date: _____

Address (Print)

_____ _____

Occupation Title of Agent (if applicable)

_____

Address (Print)

The Corporate Seal of _____

was hereunto affixed in the presence of:

_____

_____

The above must be signed by the Owner or his/her appointed Agent. The signature must be witnessed. If the Owner is a company, the corporate seal of the company must be affixed to the document in the presence of its duly authorized officers. The officers must also sign, setting forth their positions in the company.

This "Design Engineer" acknowledges that he/she has been retained to ascertain that the design will comply and construction of the project will substantially conform in all material respects with Bylaws as set out above and will submit letters of Confirmation of Professional Design Assurance from others, as needed, for the approval of the subdivision. Furthermore, the "Design Engineer" hereby covenants that he/she or his/her firm presently carries liability insurance in the amount of _____.

_____ _____

Name of Professional (Print) Signature of Professional (Design Engineer)

Date: _____

_____

Mailing Address (Print)

Phone: _____

Professional Seal

SAMPLE AGREEMENT D

CONFIRMATION OF PROFESSIONAL ASSURANCE

CONFIRMATION OF
PROFESSIONAL ASSURANCE

The Corporation of the Village of Valemount
P.O. Box 168
99 Gorse Street
Valemount, B.C.
V0E 2Z0

Attention: Village Engineer

Dear Sir:

Re: _____
(Description and Address of Project)

This is to advise that I am a Professional Engineer licensed to practice in the Province of British Columbia and was retained by the Owner to undertake and coordinate all field reviews and inspections required with respect to this project and took all steps as regulated under The Engineering Act of British Columbia and required by good practices and by the definition of "field reviews" hereinafter set forth in order to issue the following certification.

> As used herein, "field reviews" shall mean such reviews of the work at the project site and at fabrication locations where applicable as the Professional Engineer, in his professional discretion, considered to be necessary in order to ascertain that the work substantially conformed in all material aspects to the plans and drawings accepted by the Village of Valemount.

The following aspects have been reviewed by me or under by direction and have been found to comply with the engineering drawings and plans submitted and accepted by the Village Engineer.

1.0 Storm Drainage System including, but not restricted to, the following:

.1 the location, alignment, size and grade of all pipes and culverts;
.2 the spacing of manholes and catch basins;
.3 the construction of drywells;
.4 materials used for pipes, culverts, manholes, catch basins, pipe and fitting joints, service connections, inlet and outlet structures;
.5 materials used for pipe bedding and backfilling of trenches; and
.6 workmanship in the construction and installation of all materials.

2.0 Sanitary Sewer System including, but not restricted to, the following:

.1 location, alignment, size and grade of all pipes;
.2 spacing of manholes and catch basins;
.3 materials used for pipes, manholes, pipe and fitting joints, service connections;
.4 materials used for pipe bedding and backfilling of trenches; and
.5 workmanship in the construction and installation of all materials.

3.0 Water Distribution System including, but not restricted to, the following:

.1 location, alignment, size and grade of all pipes;
.2 spacing of hydrants and valves;
.3 construction of pumping stations and reservoirs;
.4 materials used for pipes, fittings, fate valves, valve boxes, hydrants, service connections, corporation stops, curb stop and boxes, air valves, stops and drains.
.5 materials used for pipe bedding and backfill of trenches; and
.6 workmanship in the construction and installation of all materials.

4.0 Roads including, but not restricted to, the following:

.1 alignment, width and grade of all roads;
.2 materials used for preparation or road bases and road surfaces; and
.3 workmanship in the installation of materials.

5.0 Curb and Gutter, Sidewalks, and Boulevards including, but not restricted to, the following:

.1 width and grade of sidewalks and boulevards;
.2 alignment and grade of curbs and gutters;
.3 materials used for preparation of subgrades and surfaces; and
.4 workmanship in the installation of materials.

6.0 Street Lighting, Electrical and Communications Wiring and Gas Installations including, but not restricted to, the following

.1 number and spacing of street light poles and luminaires;
.2 materials used for street lighting, electrical and communications wiring and gas installations;
.3 materials used for backfilling of trenches; and
.4 workmanship in the installation of materials.

I certify that the foregoing areas substantially comply in all material respects with the plans and supporting documents, including all amendments thereto, which supported the application for subdivision approval File No. _____ which were "accepted" by the Village of Valemount.

In addition, significant revisions to the accepted plans and supporting documents have been submitted to the Village in order to depict, as nearly as possible, given my "field reviews" as defined herein, the services as finally designed and built.

_____
Name of Professional Engineer (Print)

(PROFESSIONAL SEAL)

_____
Signed

_____
Date

_____
Address (Print)

_____
Phone

*Attached hereto you will find the appropriate "**field review**" assurance from each of the associated Professional consultants, who are registered in the Province of British Columbia as members in good standing of the Association of Professional Engineers.*

ASSURANCE OF "ENGINEERING" FIELD REVIEW

Re: _____
(Project Address)

This is to assure that I/We provided "field reviews" as defined herein of all engineering work including checklist items 1.0 to 6.0 inclusive except as specifically noted below.

EXCEPTIONS –

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Name (Print) _____

(PROFESSIONAL SEAL) Signed _____

Date: _____

Address (Print) _____

Representing _____

APPENDIX 1

Standard Drawing Index

STANDARD DRAWING INDEX

Drawing No.	**Drawing Description**
B-1	Service Level 1 - Downtown Commercial
B-2	Service Level 2 - Frontage Commercial
B-3	Service Level 2 – Highway Standards
B-4	Service Level 2 – Typical Cul-de-Sac Bulb Layout
C-1	Mountable Curb and Gutter
C-2	Non-mountable Curb and Gutter
C-3	Non-mountable Monolithic Curb, Gutter and Sidewalk
C-4	Driveway Crossing over Non-mountable Curbs & Sidewalks
C-5	Standard Wheelchair Ramp for Non-mountable Curb, Gutter and Sidewalk
C-6	Standard Wheelchair Ramp for Mountable Curb, Gutter and Sidewalk
D-1	Pressure Main Thrust Block
D-2	Nelson Type Lockable Valve Box and Riser
D-3	Typical 19 mm Water Service Connection
D-4	Watermain Realignment
D-5	Standard Hydrant Detail
D-6	Typical Self-Draining Stand Pipe
D-7	Combination Air Release Valve or Air and Vacuum Release Valve
D-8	Typical Meter Chamber
E-1	Typical Manhole and Base Details for Sewer up to 400 mm diameter
E-2	Exterior Drop Manhole
E-3	Manhole Benching and Channelling
E-4	Manhole for Large Diameter Sewers
E-5	Sewer Cleanout for 150 mm and 200 mm Sanitary Sewer Terminals
E-6	Typical Sewer Service Connection
E-7	Sanitary Sewer Peaking Factor Determination Graph

STANDARD DRAWING INDEX(Cont'd)

Drawing No.	**Drawing Description**
F-1	Standard Catch Basin Detail
F-2	Catch Basin Placed in an Open Ditch
F-3	Typical Catch Basin Frame and Grate Installation in Gutter
F-4	Storm Sewer Side Inlet Frame
F-5	Standard Catch Basin Detail (Type II)
F-6	Drainage Drywell
F-7	Drainage Drywell Installation Requirements
F-8	Concrete Outlet and Inlet Structure
F-9	Sandbag Bulkheads for Culvert Inlets and Outlets
F-10	Typical Perforated Drain Installation
F-11	Fire Hydrant Access Across Ditch
G-1	Typical Commercial Street Lighting Type “A” and Type “B”
G-2	Typical Street Light Anchor Base Type “A”
G-3	Typical Street Light Anchor Base Type “B”
G-4	Street Light Underground Conduit Installation and Hydro Connection
I-1	Underground Utility Locations
I-2	Standard Classes of Pipe Bedding and Backfill Within the Pipe Zone
I-3	Trench Detail
I-4	Typical Pavement Patching for Utility Trench Crossing
I-5	Carrier Pipe Detail for CMP Encasement Pipe
I-6	Large Diameter Sewer & Water Services
I-7	Typical Parking Space Layout
I-8	Range Fence
I-9	Chain Link Fence Detail