SCHEDULE D

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

This is Schedule D of the Corporation of the Village of Lytton Subdivision and Development Servicing Bylaw No. 483, 1998.

Clerk

SCHEDULE D

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

D - 1.0 GENERAL

D - 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.

D - 1.02 Approval of Engineering Drawings Required prior to Construction

Prior to construction, engineering drawings prepared in accordance with the Village's specifications for drawings in Schedule J showing detailed design of the necessary works shall be submitted to the Approving Officer for approval. No construction of the works shall commence until the design drawings have been approved by the Approving Officer and the Owner advised accordingly in writing.

D - 1.03 Curb, Gutter and Sidewalk Requirements

Complete curb, gutter and sidewalk shall be provided as follows:

Highway Classification	**Curb Type Required**	**Minimum Sidewalk Widths (measured from back of curb)**
Downtown Commercial	Non-mountable concrete	1.5 m plus a 0.6 m paving stone strip
Industrial	mountable concrete	N/A
Local	mountable concrete	1.4 m

D - 2.0 DESIGN CRITERIA

D - 2.01 Design Gradient

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

D - 2.02 Curb Return

The minimum curb return radius shall be as set out in Section 2.20 of Schedule C 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.

D - 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%.

D - 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 C.11 of Schedule C.

D - 2.05 Sidewalks Cross Section

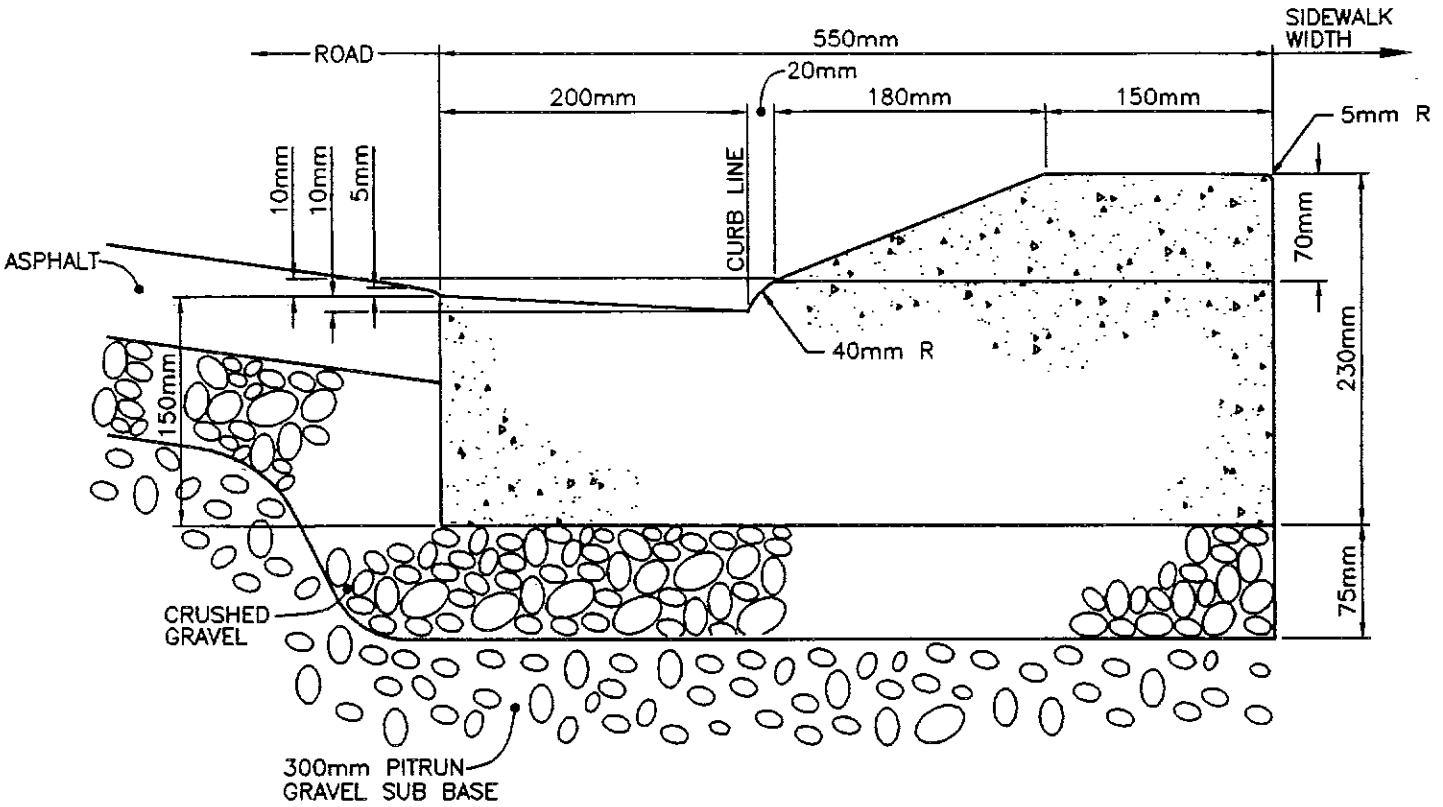
Concrete sidewalks shall have a thickness not less than 100 mm and shall be constructed consistent with the applicable Standard Drawings. The sidewalk shall be graded to drain to the curb at a slope of 2%.

D - 2.06 Driveway Access Across Boulevards

Maximum driveway access for all Village boulevards shall be 3%. Where non-mountable curb is required under this Bylaw, only one access per parcel shall be permitted.

D - 2.07 Curb and Gutter Cross Section

Curbs and gutters shall be constructed in accordance with the applicable Standard Drawings.



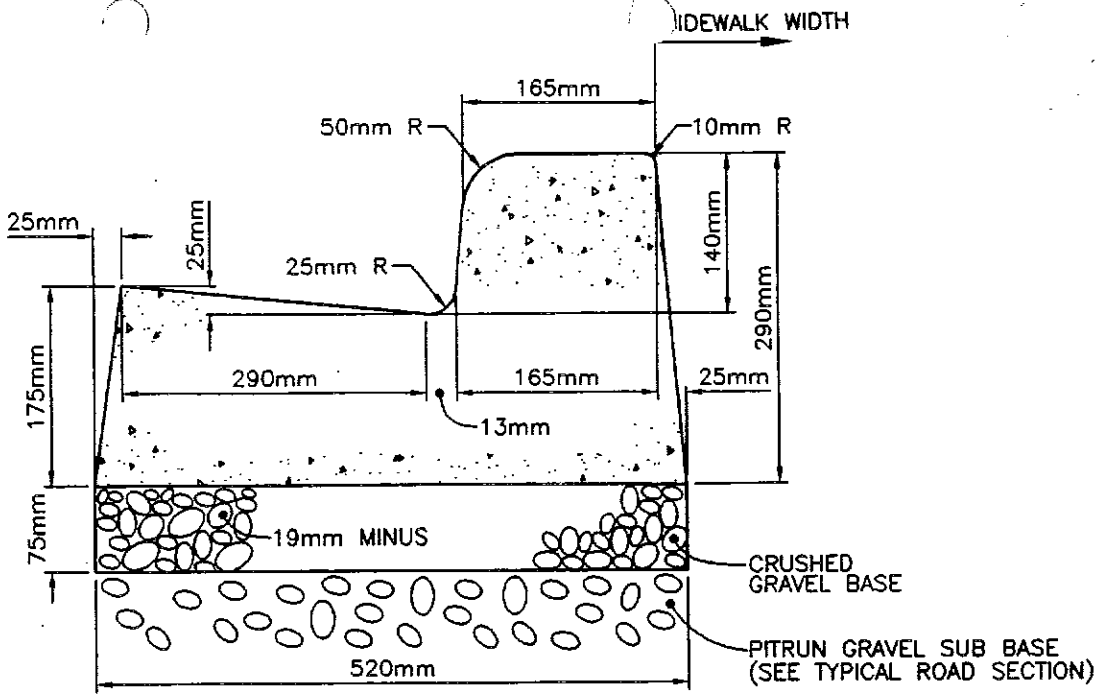
NOTE:

1. GRAVEL BASE & SUB-BASE AS FOR ROAD & COMPACTED TO 100% STANDARD PROCTOR DENSITY.
2. CURB & GUTTER SHALL BE EXTRUDED OR FORMED.
3. CONCRETE SHALL CONFORM TO C.S.A. A23:1-94 EXPOSURE CLASS C-2, 14-20mm SIZE AGGREGATE (32MPa @ 28 DAYS)
4. ALIGNMENT TOLERANCES: 3mm IN ANY 3.0m SECTION.
5. TRANSVERSE CONTRACTION JOINTS SHALL BE AT MAX. 3.0m INTERVALS & SHALL BE STRAIGHT & PERPENDICULAR TO THE ALIGNMENT OR RADIAL TO THE RADIUS POINT ON CURVES.
6. FINISH SHALL BE BRUSHED CONCRETE AS FOLLOWS:
   -CURB & GUTTER - LONGITUDINALLY WITH ALIGNMENT

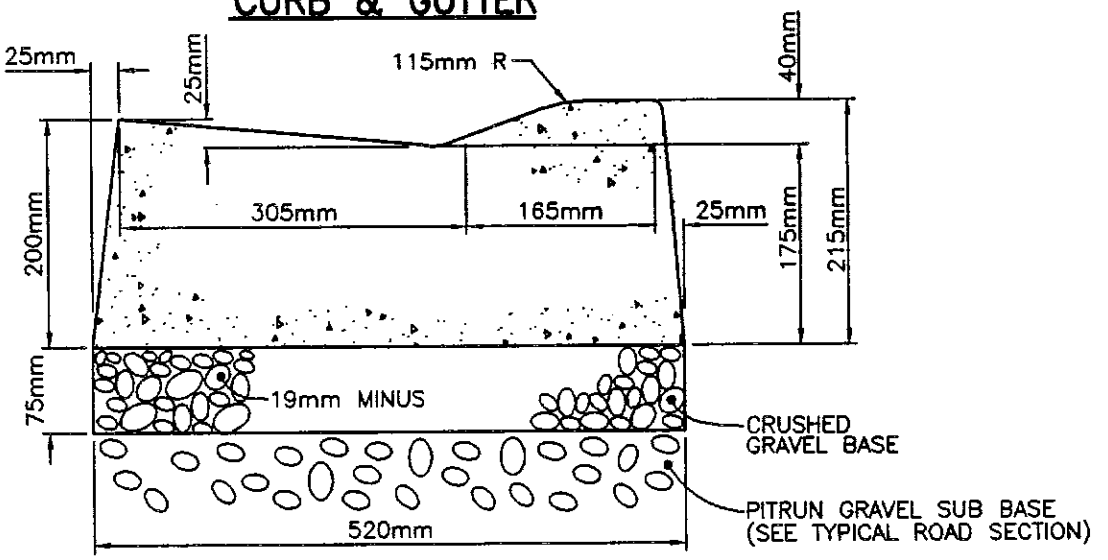
PLOT DATE: 98/04/30 9:25am RH

PROJ. CAD FILE No.: J:\STDDET\LYTSTD\D-1.DWG

VILLAGE OF LYTTON	SCALE: NOT TO SCALE	TITLE: MOUNTABLE CURB & GUTTER	
	DATE DRAWN: MAR. 1998 / LATEST REVISION DATE: MAR. 1998		
	APPROVED BY:	SECTION: SCHEDULE D CURB,GUTTER & SIDEWALK	REVISION No. 0 / DWG No. D-1



CURB & GUTTER



CURB & GUTTER CROSSING

NOTE:

1. GRAVEL BASE & SUB-BASE AS FOR ROAD & COMPACTED TO 100% STANDARD PROCTOR DENSITY.
2. CURB & GUTTER SHALL BE EXTRUDED OR FORMED.
3. CONCRETE SHALL CONFORM TO C.S.A. A23:1-94 EXPOSURE CLASS C-2, 14-20mm SIZE AGGREGATE (32MPa @ 28 DAYS)
4. ALIGNMENT TOLERANCES: 3mm IN ANY 3.0m SECTION.
5. TRANSVERSE CONTRACTION JOINTS SHALL BE AT MAX. 3.0m INTERVALS & SHALL BE STRAIGHT & PERPENDICULAR TO THE ALIGNMENT OR RADIAL TO THE RADIUS POINT ON CURVES.
6. FINISH SHALL BE BRUSHED CONCRETE AS FOLLOWS:
   -CURB & GUTTER - LONGITUDINALLY WITH ALIGNMENT

PLOT DATE: 98/04/30 9:25am RH

PROJ. CAD FILE No.: J:\STDDET\LYTSTD\D-2.DWG

VILLAGE OF LYTTON

SCALE: NOT TO SCALE

DATE DRAWN: MAR. 1998

LATEST REVISION DATE: MAR. 1998

APPROVED BY:

TITLE: NON-MOUNTABLE CURB AND GUTTER

SECTION: SCHEDULE D CURB,GUTTER & SIDEWALK

REVISION No. 0

DWG No. D-2

D - 2.08 Commercial Driveway Crossings

Commercial driveway crossings shall be a maximum 8.0 m wide and shall be provided at all access locations for usages other than residential. Commercial driveway crossings shall be constructed consistent with the applicable Standard Drawings.

D - 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 applicable Standard Drawings.

D - 3.0 MATERIALS

D - 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 C, Article 3.03.

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

D - 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%.

D - 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 Approving Officer for review and approval.

D - 3.04 Curing Compound

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

D - 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.

D - 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.

D - 4.0 WORKMANSHIP

D - 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.

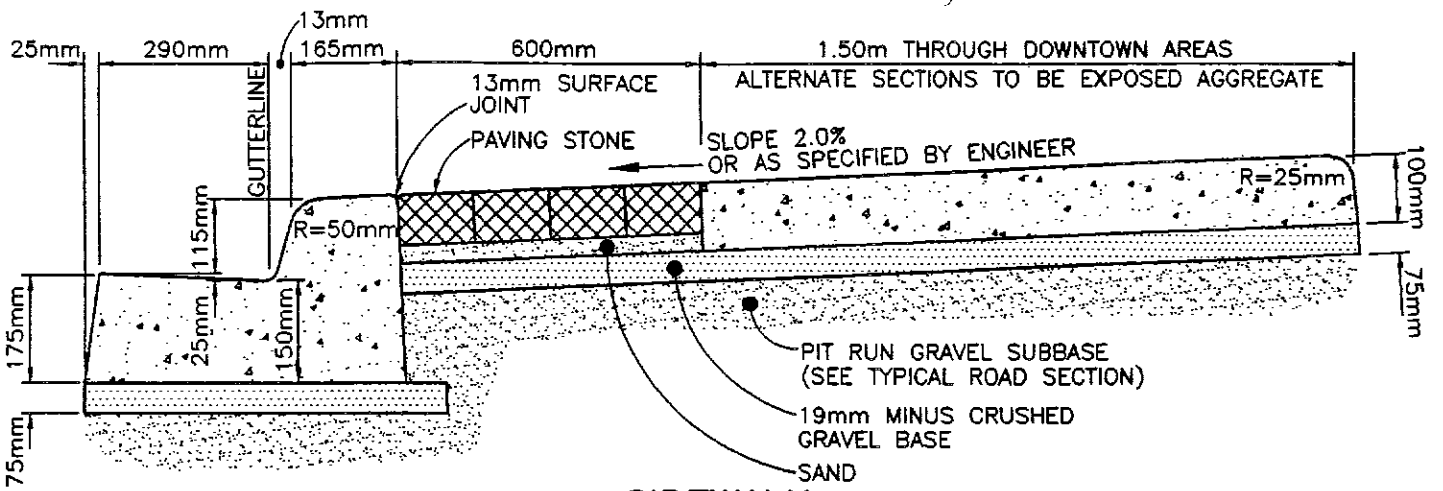
The granular base aggregate shall be moistened immediately prior to placing concrete.

D - 4.02 Commercial and Industrial Driveway Crossings

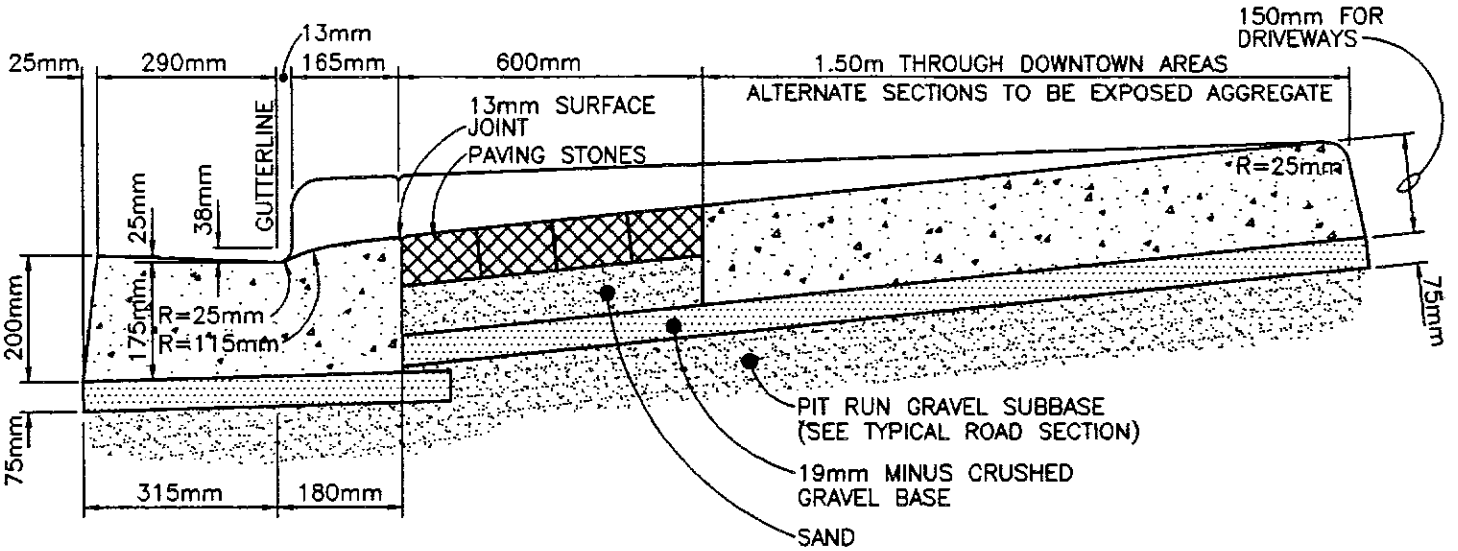
Commercial and industrial driveway crossings shall be built on a base with the same construction as the roadway they border. Commercial and industrial driveway crossings shall have a minimum concrete thickness of 150 mm. Expansion joints shall be made at the sides of the crossover.

D - 4.03 Placing and Finishing Concrete

The Approving Officer shall be notified forty-eight hours in advance of any concrete pour for curb and gutter or sidewalks. Concrete shall be prepared, delivered, and placed in conformance with CSA CAN3-A23.1-M (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.



SIDEWALK



SIDEWALK CROSSING

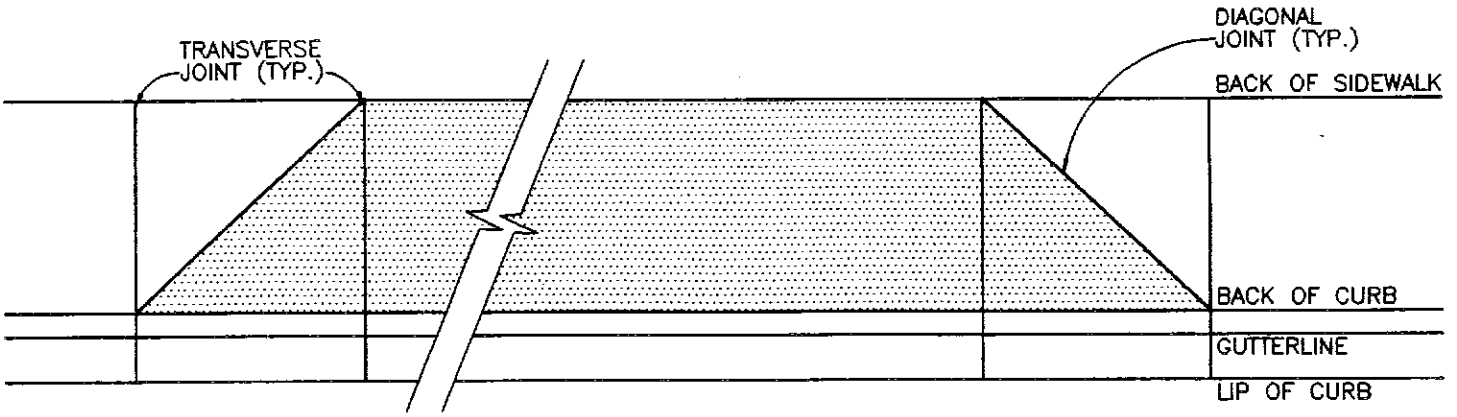
NOTE:

1. GRAVEL BASE & SUB-BASE AS FOR ROAD & COMPACTED TO 100% STANDARD PROCTOR DENSITY.
2. CURB & GUTTER SHALL BE EXTRUDED OR FORMED.
3. CONCRETE SHALL CONFORM TO C.S.A. A23:1-94 EXPOSURE CLASS C-2, 14-20mm SIZE AGGREGATE (32MPa @ 28 DAYS)
4. ALIGNMENT TOLERANCES: 3mm IN ANY 3.0m SECTION.
5. TRANSVERSE CONTRACTION JOINTS SHALL BE AT MAX. 3.0m INTERVALS & SHALL BE STRAIGHT & PERPENDICULAR TO THE ALIGNMENT OR RADIAL TO THE RADIUS POINT ON CURVES.
6. ROAD WIDTH IS MEASURED FROM GUTTERLINE TO GUTTERLINE.
7. FINISH SHALL BE BRUSHED CONCRETE AS FOLLOWS:
   - CURB & GUTTER - LONGITUDINALLY WITH ALIGNMENT
   - SIDEWALK - PERPENDICULAR TO ALIGNMENT OR RADIALLY TO THE RADIUS POINT OF CURVES.

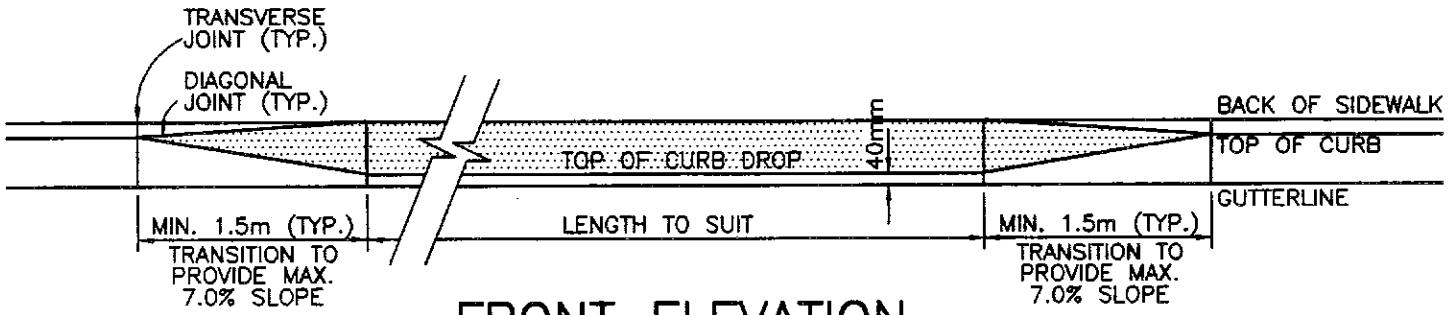
PLOT DATE: 98/04/30 9:30am RH

PROJ. CAD FILE No.: J:\STDDET\LYTSTD\D-3.DWG

VILLAGE OF LYTTON	SCALE: NOT TO SCALE	TITLE: NON-MOUNTABLE CURB, GUTTER & SIDEWALK THROUGH DOWNTOWN AREAS
	DATE DRAWN: MAR. 1998 / LATEST REVISION DATE: MAR. 1998	
	APPROVED BY:	SECTION: SCHEDULE D CURB,GUTTER & SIDEWALK / REVISION No. 0 / DWG No. D-3



PLAN



FRONT ELEVATION

NOTE:

1. SEE STANDARD DRAWING No. D-2 & D-3 FOR TYPICAL CURB, GUTTER & SIDEWALK SECTIONS.
2. TRANSVERSE JOINTS SHALL BE AT MAX. 3.0m INTERVALS. NO EXPANSION JOINTS IN DRIVEWAY CROSSING. TRANSVERSE JOINTS SHALL BE STRAIGHT, PERPENDICULAR TO THE CURB, GUTTER & SIDEWALK ALIGNMENT OR RADIAL TO THE RADIUS POINT OF CURVE.
3. CONCRETE SHALL CONFORM TO CSA A23.1 EXPOSURE CLASS A(5-7% ENTRAINED AIR & w/c = 0.45) 32MPa AT 28 DAYS.
4. FINISHES SHALL BE BRUSHED CONCRETE AS FOLLOWS:
   -CURB & GUTTER - LONGITUDINALLY WITH ALIGNMENT
   -SIDEWALK - PERPENDICULAR TO ALIGNMENT OR RADIALLY TO THE RADIUS POINT OF CURVES.

PLOT DATE: 98/04/30 9:30am RH

PROJ. CAD FILE No.: J:\STDDET\LYTSTD\D-4.DWG

VILLAGE OF LYTTON	SCALE: NOT TO SCALE	TITLE: DRIVEWAY CROSSING OVER NON-MOUNTABLE CURBS & SIDEWALK	
	DATE DRAWN: MAR. 1998 / LATEST REVISION DATE: MAR. 1998		
	APPROVED BY:	SECTION: SCHEDULE D CURB,GUTTER & SIDEWALK	REVISION No. 0 / DWG.No. D-4

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-M are met.

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

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.

D - 4.04 Curing Concrete

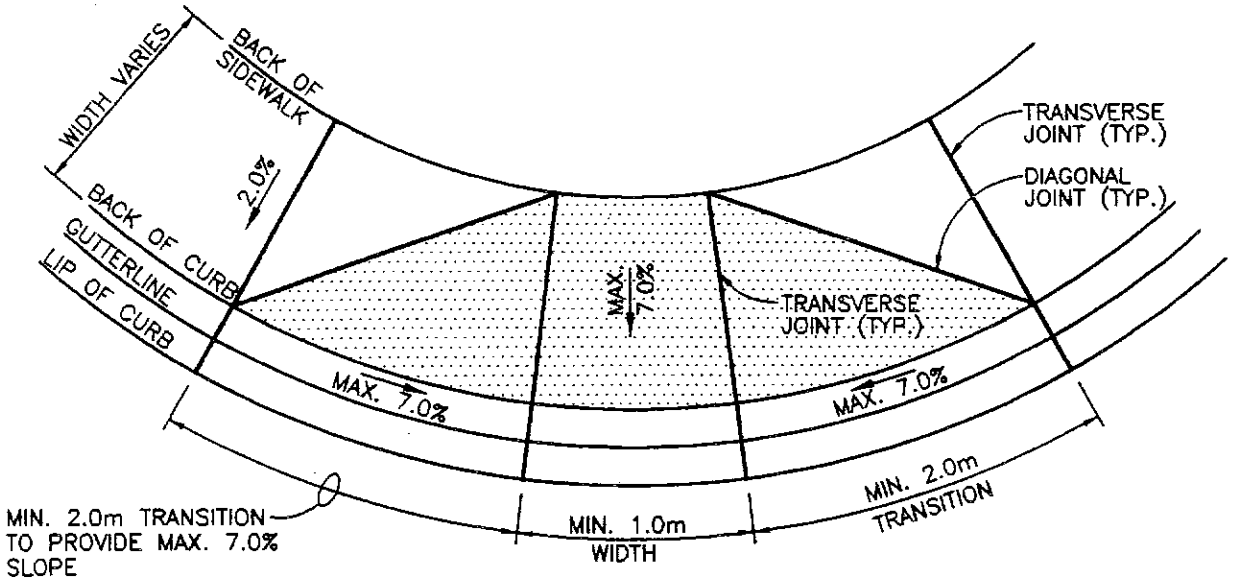
Between April 1 and October 1, concrete shall be sprayed with two coats of an approved membrane curing compound as soon as the concrete has obtained its initial set. Prior to April 1, or after October 1, alternate methods of curing concrete must be used and the method approved by the Approving Officer.

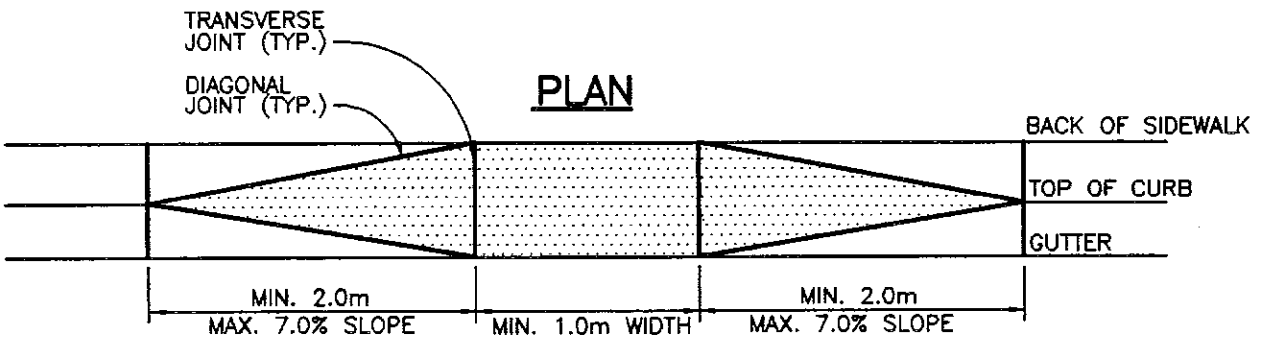
D - 4.05 Boulevards Driveway Approaches

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

D - 4.06 Construction Record Drawings

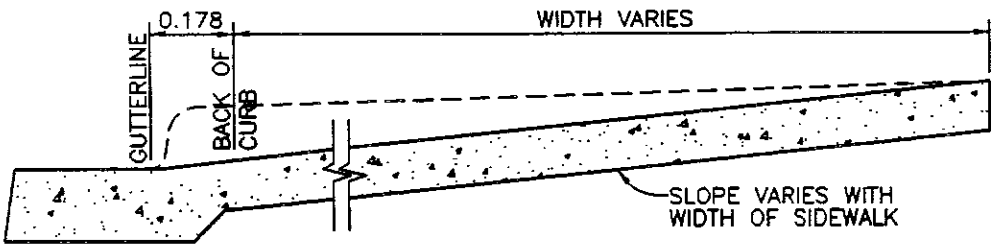
Prior to Construction Completion, the Owner shall deposit with the Village a computer diskette (3½") in AutoCAD (latest release) format showing all the information requested by this schedule conforming to the criteria set out in Schedule J.





PLAN

FRONT ELEVATION

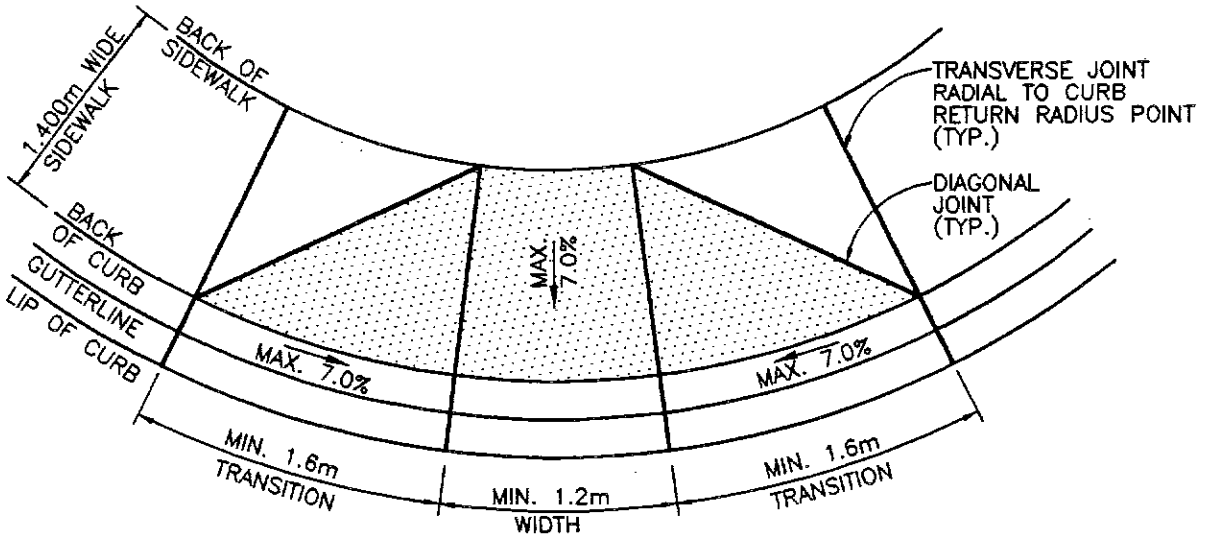


SECTION

PLOT DATE: 98/04/30 9:30am RH

PROJ. CAD FILE No.: J:\STDDET\LYTSTD\D-5.DWG

VILLAGE OF LYTTON	SCALE: NOT TO SCALE	TITLE: STANDARD WHEELCHAIR RAMP FOR NON-MOUNTABLE CURB, GUTTER & SIDEWALK	
	DATE DRAWN: MAR. 1998 / LATEST REVISION DATE: MAR. 1998		
	APPROVED BY:	SECTION: SCHEDULE D CURB, GUTTER & SIDEWALK	REVISION No. 0 / DWG No. D-5



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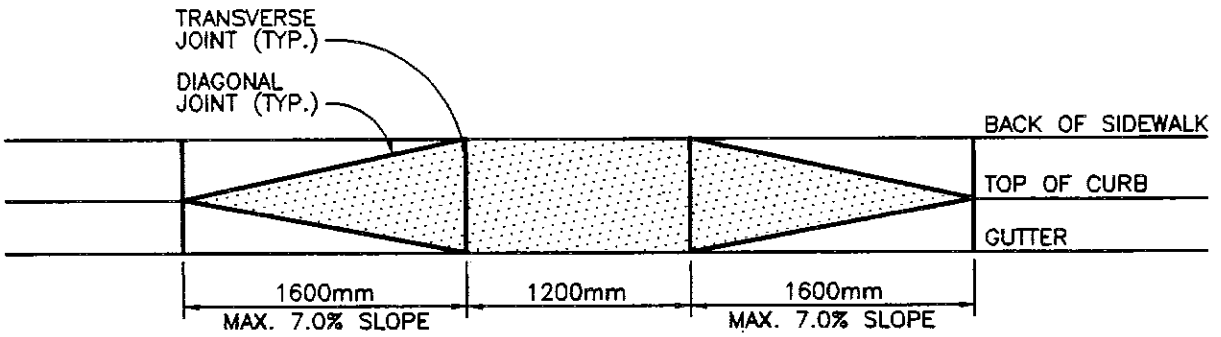
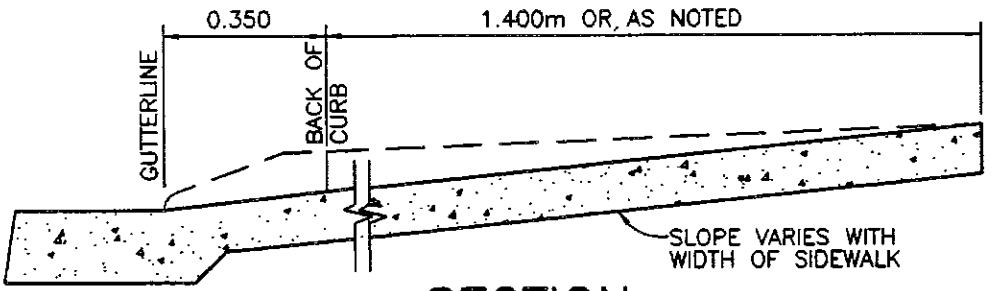


FRONT ELEVATION



SECTION

PLOT DATE: 98/04/30 9:30am RH

PROJ. CAD FILE No.: J:\STDDET\LYTTSTD\D-6.DWG

VILLAGE OF LYTTON	SCALE: NOT TO SCALE	TITLE: STANDARD WHEELCHAIR RAMP FOR MOUNTABLE CURB, GUTTER & SIDEWALK	
	DATE DRAWN: MAR. 1998 / LATEST REVISION DATE: MAR. 1998		
	APPROVED BY:	SECTION: SCHEDULE D CURB, GUTTER & SIDEWALK	REVISION No. 0 / DWG No. D-6

SCHEDULE E

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

This is Schedule E of the Corporation of the of Village of Lytton Subdivision and Development Servicing Bylaw No. 483, 1998.

Madigan

Clerk

SCHEDULE E

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

E - 1.0 GENERAL

E - 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 Approving Officer.

E - 1.02 Approval of Engineering Drawings Required prior to Construction

Engineering drawings showing detailed design of the necessary works together with technical specifications shall be submitted to the Approving Officer prepared in accordance with the Village's specification for drawings contained in Schedule J for approval. No construction shall commence until the engineering drawings have been approved in writing by the Approving Officer. 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. Through areas where connection to the existing community water system is not possible as determined by the Village Approving Officer the Owner shall construct a new water supply, distribution and storage system in accordance with this bylaw to service his development.

E - 2.0 DESIGN CRITERIA

E - 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.

E - 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:

Average day: 950 litres/day/capita
Maximum Day: 2850 litres/day/capita
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 Approving Officer.

E - 2.03 Fire Flow Requirements

Water distribution systems shall also be designed to ensure that fire flows as required by the Fire Underwriters Survey are available for required durations. Fire flows shall not be less than 4540 litres per minute. The amount and duration of design fire flows shall be provided to the Approving Officer for his approval prior to final design of the water distribution system.

E - 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.

E - 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.

E - 2.06 Location and Grade of Water Mains

Water mains shall be located in the road right-of-way as shown on the applicable Standard Drawings unless otherwise approved by the Approving Officer. Where the location of the watermain is not practical due to topography or other factors, the

PLOT DATE: 98/04/30 9:40am RH

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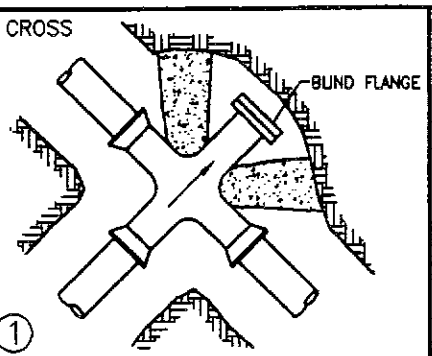
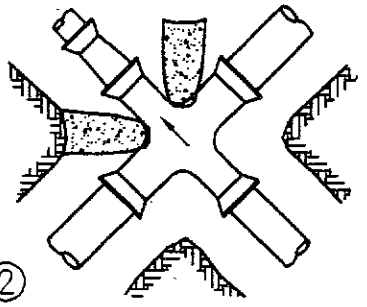
CROSS



1

REDUCER

TABLE VALUES BASED ON REDUCTION TO 150mm



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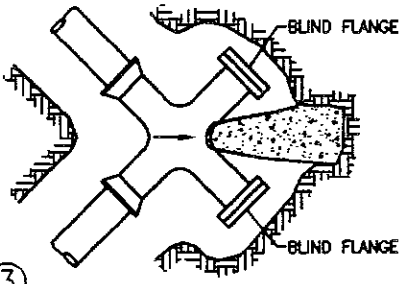

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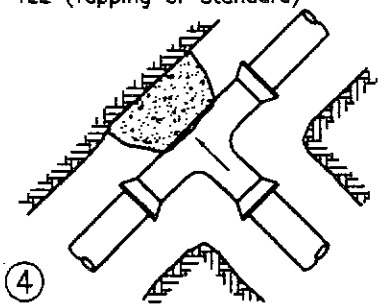

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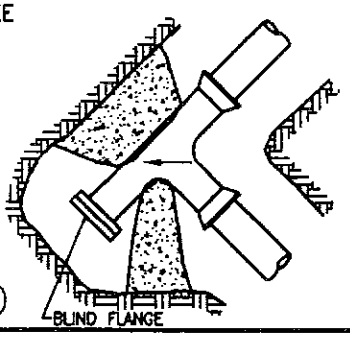

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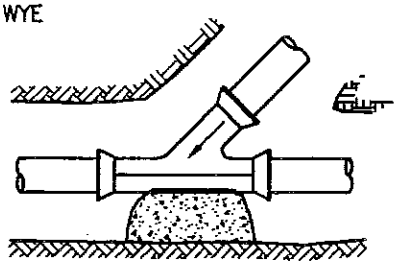
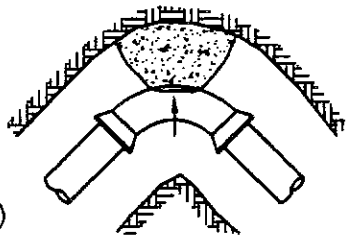


6

90° BEND



7

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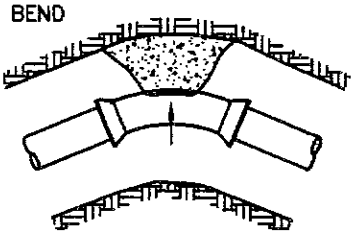
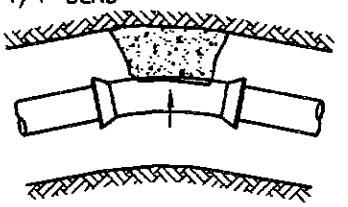


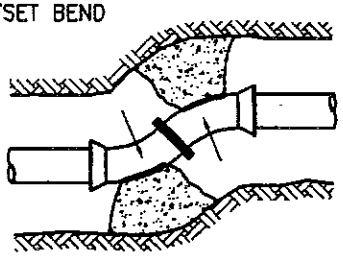
8

22-1/2° BEND AND
11-1/4° BEND



9

OFFSET BEND



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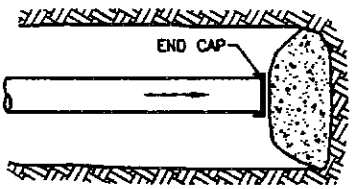
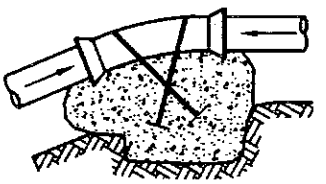


11

VERTICAL BEND



VERTICAL REACTION BLOCK SHALL BE DESIGNED BY A STRUCTURAL ENGINEER.

12

BEARING AREA OF BLOCKS

CONCRETE AREAS IN M²

TYPE / PIPE SIZE	100	150	200	250	300	400
1, 4, 11	0.2	0.4	0.7	1.0	1.45	1.9
3, 5, 7	0.3	0.55	0.9	1.45	2.05	2.7
2			0.25	0.5	0.75	1.65
6, 8	0.15	0.3	0.5	0.6	1.2	1.45
9	0.1	0.15	0.3	0.45	0.6	0.75
10	0.3	0.6	1.0	1.2	2.2	2.9

DESIGN ASSUMPTIONS

- HYDRAULIC HEAD = 1.38 MPa.
- SOIL BEARING VALUE = 0.096 MPa. (MEDIUM SOFT CLAY)
- THRUST BLOCKS FOR MAINS LARGER THAN 300mmø SHALL BE DESIGNED BY A PROFESSIONAL ENGINEER AND SHOWN ON THE ENGINEERED DRAWINGS

NOTE: CONCRETE THRUST BLOCKS MAY NOT BE REQUIRED AS APPROVED BY BY THE APPROVING OFFICER WHERE APPROVED THRUST RESTRAINING DEVICES ARE INSTALLED

VILLAGE OF LYTTON

SCALE: NOT TO SCALE

DATE DRAWN: MAR. 1998

LATEST REVISION DATE: MAR. 1998

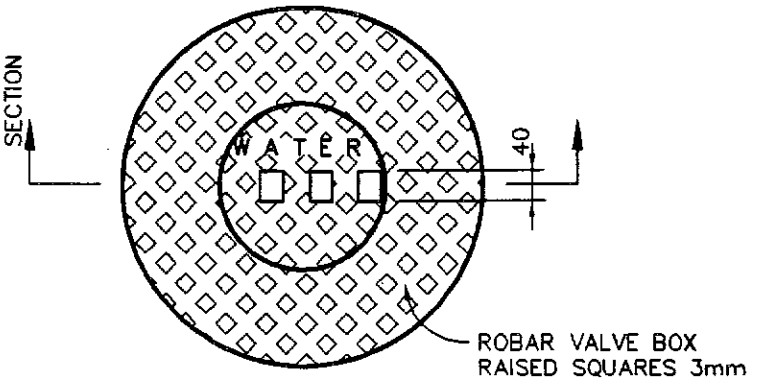
APPROVED BY:

TITLE: PRESSURE MAIN THRUST BLOCK

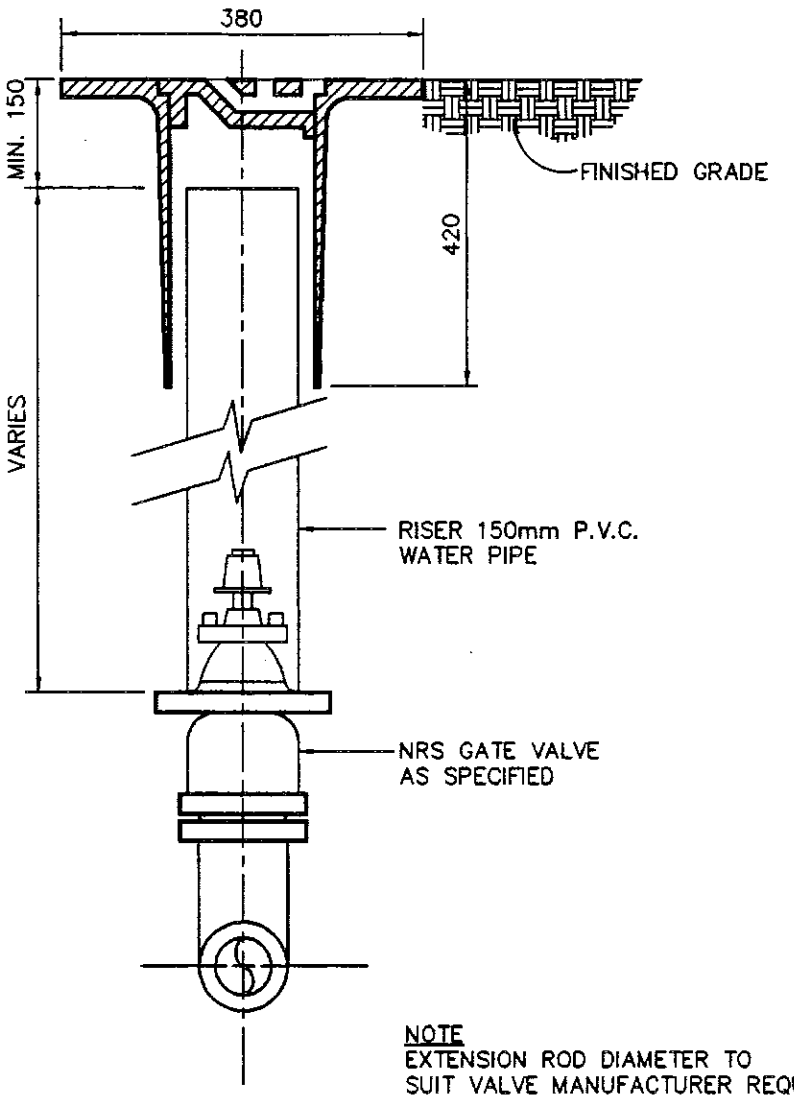
SECTION: SCHEDULE E WATER SYSTEMS

REVISION No. 0

DWG.No. E-1



PLAN



NOTE
EXTENSION ROD DIAMETER TO
SUIT VALVE MANUFACTURER REQUIREMENTS

SECTION

PLOT DATE: 98/04/30 9:45am RH

PROJ. CAD FILE No.: J:\STDDET\LYTSTD\E-2.DWG

VILLAGE OF LYTTON	SCALE: NOT TO SCALE	TITLE: ROBAR VALVE BOX & RISER	
	DATE DRAWN: MAR. 1998 / LATEST REVISION DATE: MAR. 1998		
	APPROVED BY:	SECTION: SCHEDULE E WATER SYSTEMS	REVISION No. 0 / DWG.No. E-2

watermain shall be located in a utility right-of-way registered in favour of the Corporation of the Village of Lytton and having a width of not less than 6.0 metres.

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 the centerline of the watermain and the centerline of the 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 Approving Officer, 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 normally be 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 twice the minimum radius of curvature recommended by the pipe manufacturer. The design drawings shall indicate where short lengths or pipe bends 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 Approving Officer and may necessitate the provision of rights-of-way in favour of the Corporation of the Village of Lytton.

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.

E - 2.07 Spacing of Fire Hydrants

Fire hydrants shall be located, in general, at highway intersections and at maximum spacing of 75 metres. Additional hydrants may be required by the Approving Officer at schools, major multiple family developments, commercial buildings or other major developments consistent with the current fire flow requirements of the Fire Underwriters' Survey.

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, but shall be located within 0.5 m of the back of sidewalk or 1.0 m from the gutterline on road sections where there is no sidewalk.

E - 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.

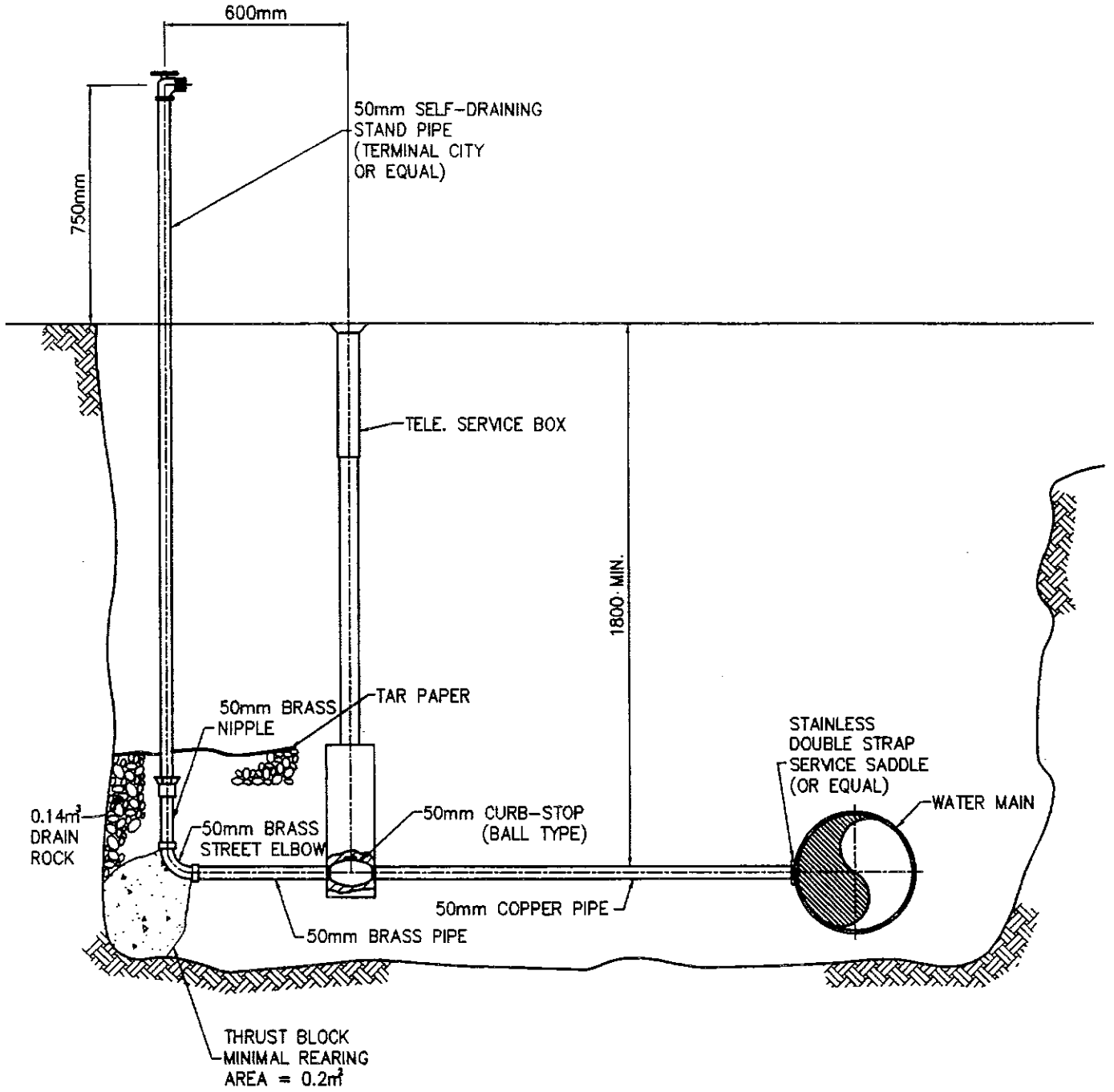
Each tee shall have two line valves; each cross shall have three line valves. Each line valve shall be the same diameter as the pipe on each downstream branch of the tee or cross. At the discretion of the Approving Officer, line valves may be required on all branches of a wye or tee.

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

E - 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.

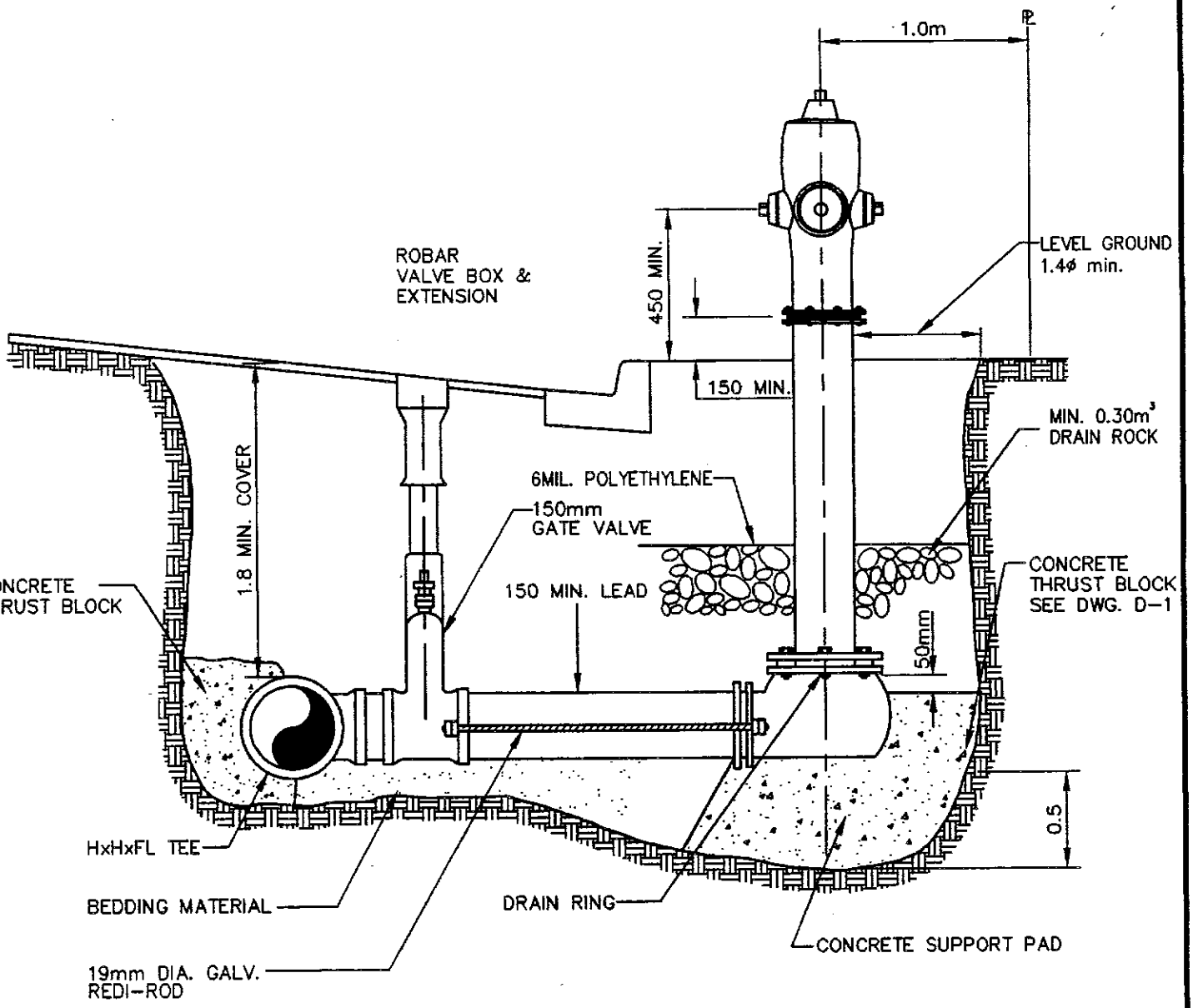
Temporary blow offs (usually a corporation stop) may be installed to facilitate chlorination and flushing of any part of the system. After flushing, the temporary blow off shall be removed as directed by the Approving Officer.



PLOT DATE: 98/04/30 9:45am RH

PROJ. CAD FILE No.: J:\STDDET\LYTSTD\E-3.DWG

VILLAGE OF LYTTON	SCALE: NOT TO SCALE	TITLE: TYPICAL SELF-DRAINING STANDPIPE	
	DATE DRAWN: MAR. 1998 / LATEST REVISION DATE: MAR. 1998		
	APPROVED BY:	SECTION: SCHEDULE E WATER SYSTEMS	REVISION No. 0 / DWG.No. E-3



NOTES:

1. HYDRANTS – CLOW (HERITAGE STYLE) COMPRESSION TYPE
2. HYDRANTS SHALL HAVE 2 – 65mm OUTLETS B.C. STANDARD THREAD
   1 – 100mm PUMPER OUTLET, 4 THREADS/INCH 4.938 O.D.,
   c/w CHAINS
3. PUMPER OUTLET MUST FACE CURB
4. HYDRANT BOOT SIZED FOR 150mm PIPE
5. HYDRANT BODY COLOUR – RED, WITH WHITE
   CAPS AND TOP

VILLAGE OF LYTTON

SCALE: NOT TO SCALE	TITLE: FIRE HYDRANT INSTALLATION DETAIL
DATE DRAWN: MAR. 1998	LATEST REVISION DATE: MAR. 1998
APPROVED BY:	SECTION: SCHEDULE E WATER SYSTEMS
REVISION No. 0	DWG No. E-4

PLOT DATE: 98/04/30 9:45am RH

PROJ. CAD FILE No.: J:\STDDET\LYTTSTD\E-4.DWG

E - 2.10 Air Relief Valves

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

E - 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.

E - 2.12 Service Connections

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

Water services shall be installed in an individual trench to the center of each lot in accordance with the applicable Standard Drawings. Through areas of steep topography and roads the service location may be moved to 6.0 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 1200 mm apart.

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

The curb stop at the end of each service pipe shall be located 0.3 m in front of the street/property boundary line. Where such location will conflict with other services, the location may be revised with the approval of the Approving Officer.

E - 2.13 Depth of Cover

The depth of the water main shall be sufficient to provide all services with a minimum cover of 1.8 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 1.8 m, and through areas where watermains are deeper, valve operating extensions complete with rock guards shall be installed at all deep mainline valves and service valves.

E - 2.14 Tie-ins to Existing Water Mains

Connections 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.

E - 2.15 Reservoirs

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

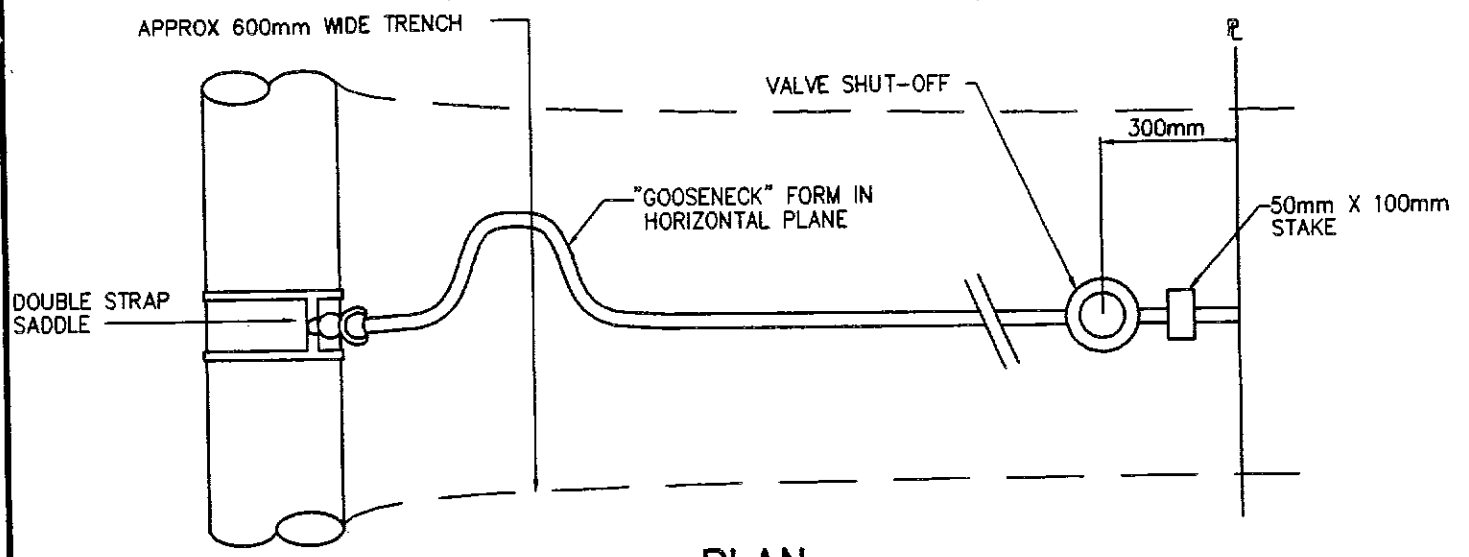
Total Storage Requirement = A + B + C

where

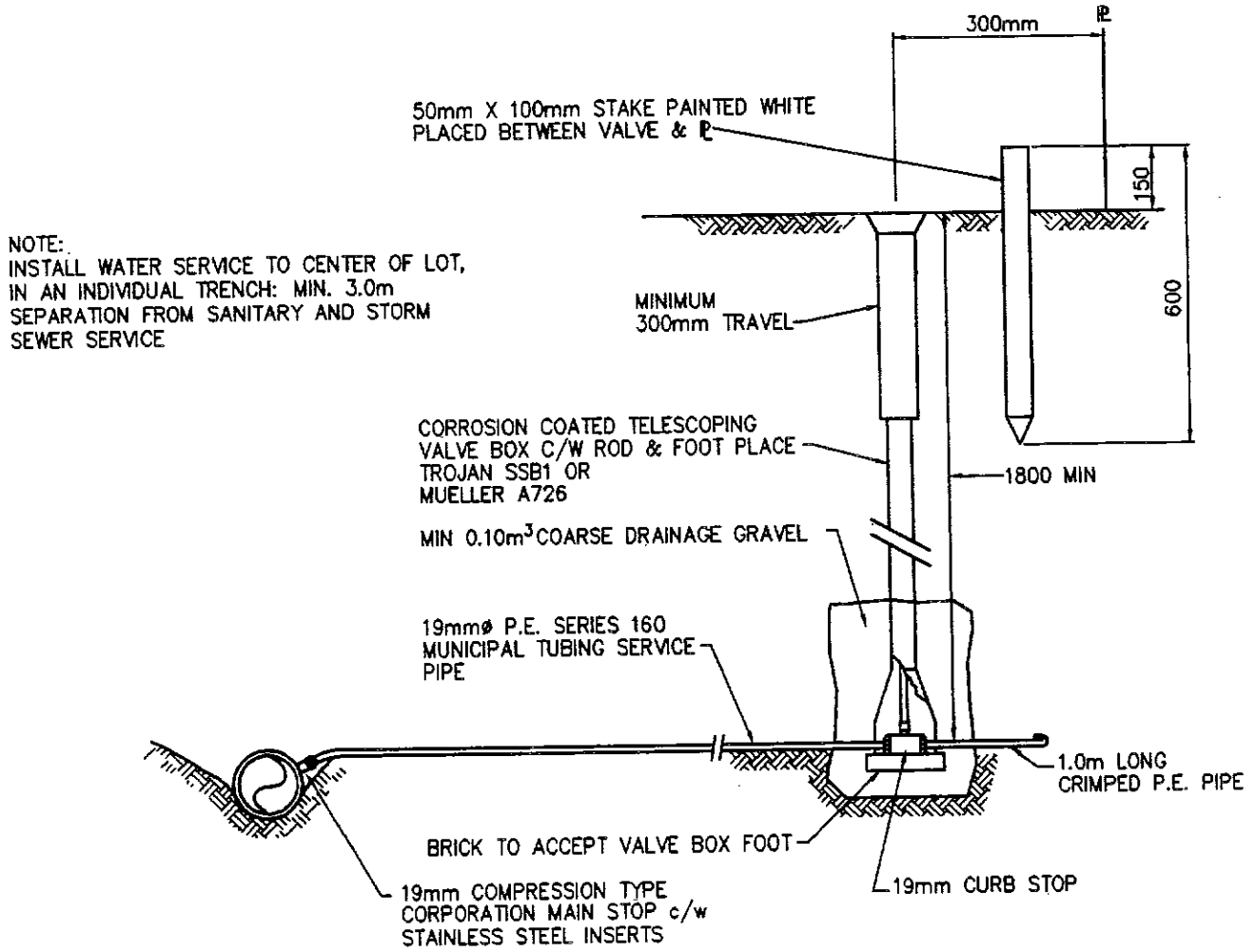
A = Fire Storage, based on minimum 3640 litres per minute fire flow
B = Equalization Storage (25% of maximum day demand)
C = Emergency Storage (25% of A + B)

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;



PLAN

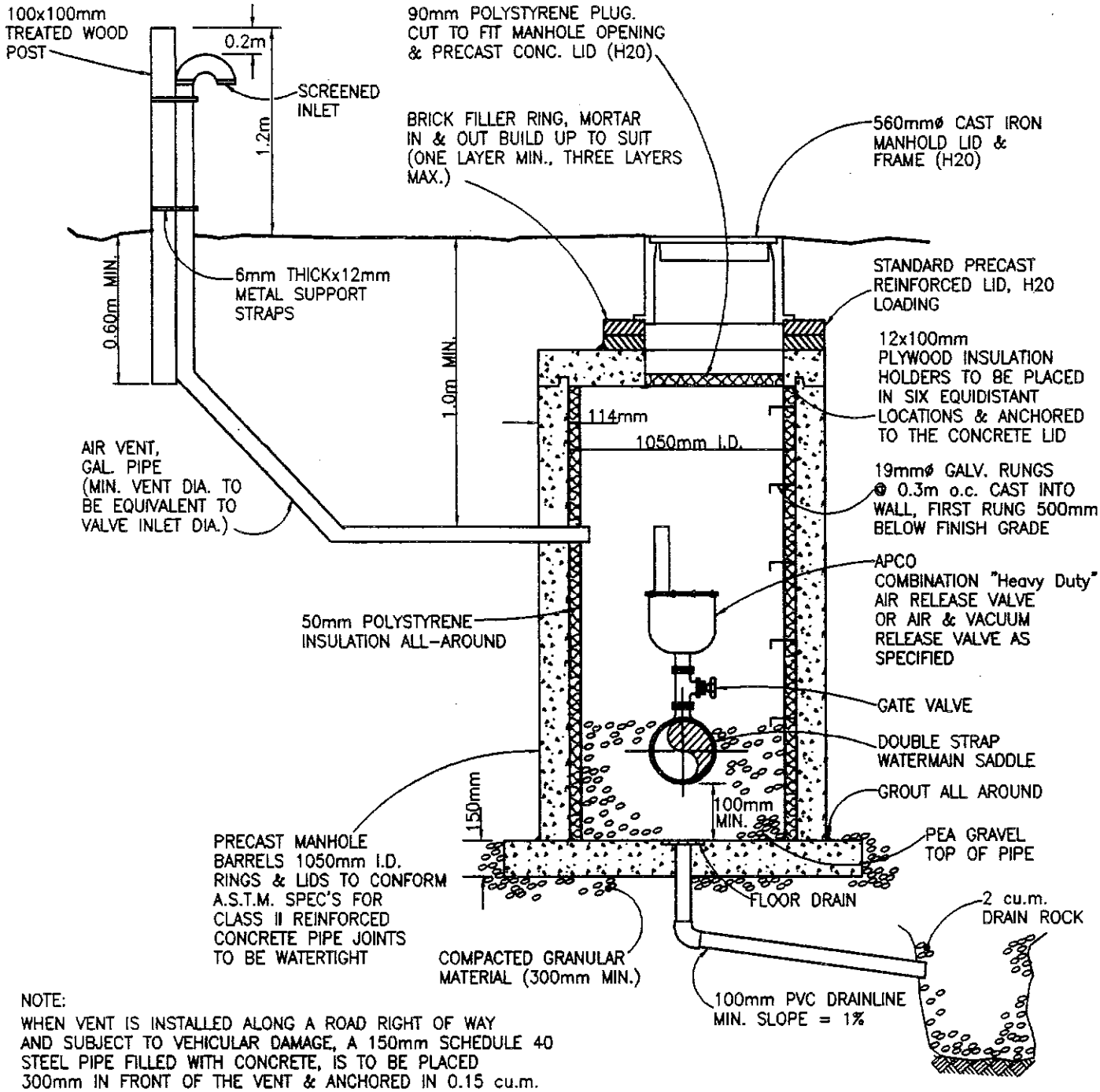


ELEVATION

PLOT DATE: 98/04/30 9:45am RH

PROJ. CAD FILE No.: J:\STDDET\LYTSTD\E-5.DWG

VILLAGE OF LYTTON	SCALE: NOT TO SCALE	TITLE: TYPICAL 19mm WATER SERVICE CONNECTION	
	DATE DRAWN: MAR. 1998 / LATEST REVISION DATE: MAR. 1998		
	APPROVED BY: Madrigal	SECTION: SCHEDULE E WATER SYSTEMS	REVISION No. 0 / DWG No. E-5



NOTE:
WHEN VENT IS INSTALLED ALONG A ROAD RIGHT OF WAY AND SUBJECT TO VEHICULAR DAMAGE, A 150mm SCHEDULE 40 STEEL PIPE FILLED WITH CONCRETE, IS TO BE PLACED 300mm IN FRONT OF THE VENT & ANCHORED IN 0.15 cu.m. OF CONCRETE THE PIPE SHOULD PROJECT 1.2m ABOVE THE GROUND & IS TO BE PAINTED YELLOW.

PLOT DATE: 98/04/30 9:50am RH

PROJ. CAD FILE No.: J:\STDDET\LYTSTD\E-6.DWG

VILLAGE OF LYTTON	SCALE: NOT TO SCALE	TITLE: COMBINATION AIR RELEASE VALVE OR AIR & VACUUM RELEASE VALVE	
	DATE DRAWN: MAR. 1998 / LATEST REVISION DATE: MAR. 1998		
	APPROVED BY:	SECTION: SCHEDULE E WATER SYSTEMS	REVISION No. 0 / DWG.No. E-6

.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;
.12 access roads;
.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.

E - 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 or soft start / soft stop meter controls as approved by the Approving Officer, 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;
.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 reviewed.
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 Approving Officer. 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.
.10 Emergency operating procedures.

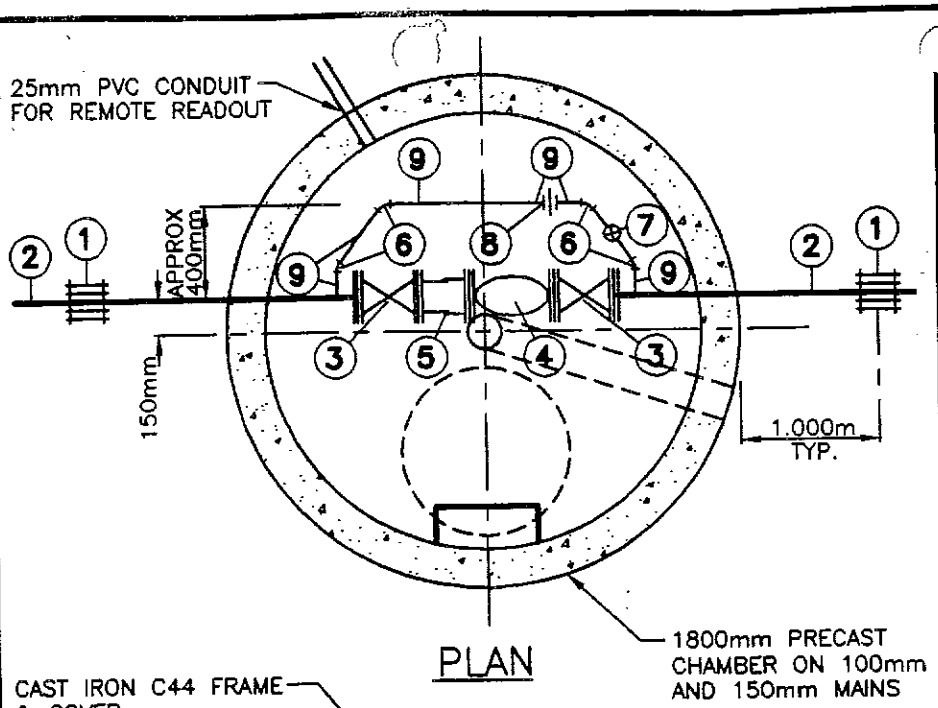
The maintenance manuals shall be hardbacked bound documents with the name of the facility embossed on the cover. Each section of the manual shall be identified by plastic covered tabbed dividers, with the section name identified on the tab.

E - 2.17 Pressure Reducing Stations

Pressure reducing stations, were 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:

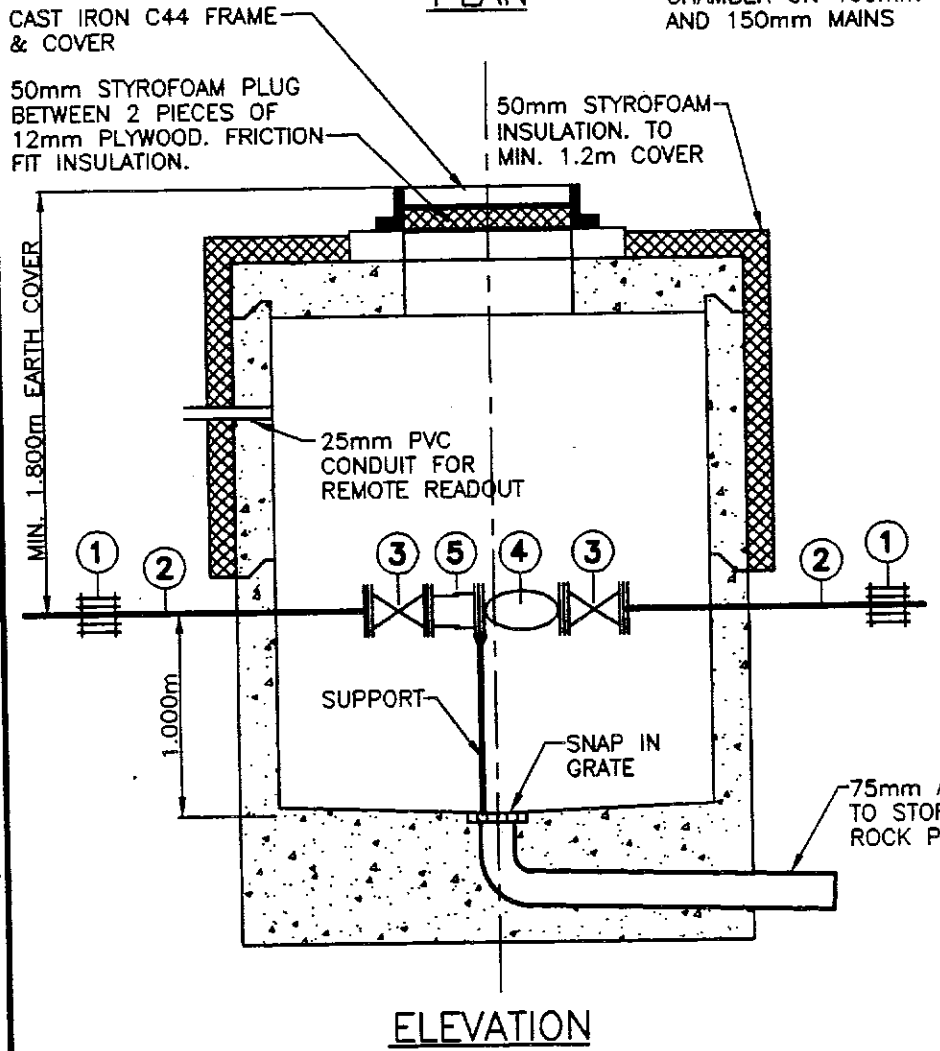
.1 access road to chamber;



PLAN

SCHEDULE OF QUANTITIES

ITEM	DESCRIPTION
1	PVCxSTL TRANSITION COUPLING
2	PExF SCH40 STEEL SPOOL c/w WELD-O-LET FOR BYPASS PIPE
3	FxF OS&Y GATE VALVE
4	NEPTUNE TRU/FLO COMPOUND WATER METER c/w REMOTE READOUT
5	VIKING JOHNSON DISMANTLING JOINT
6	BRASS 45° ELBOWS
7	BRASS BALL VALVE (WATTS SERIES B OR EQUAL)
8	UNION
9	BRASS NIPPLES-LENGTHS TO SUIT



ELEVATION

NOTE:

- ALL INTERIOR & EXTERIOR PIPING SURFACES SHALL BE PAINTED WITH 2 COATS OF COAL TAR EPOXY.
- BYPASS PIPING SIZE MAY VARY TO MEET FLOW REQUIRMENT OF THE DEVELOPMENT BEING SERVICED.
- PROVIDE REMOTE READOUT TERMINAL WITHIN 10m OF CHAMBER
- A ONE SIZE SMALLER DIAMETER WATERMETER MAY BE INSTALLED IN THE CHAMBER
- A LARGER CHAMBER WILL BE REQUIRED FOR 200mm AND LARGER MAINS, HOWEVER, THE PIPING/FITTING CONFIGURATION WILL REMAIN THE SAME

PLOT DATE: 98/04/30 9:50am RH

PROJ. CAD FILE No.: J:\STDDET\LYTTSTD\E-7.DWG

VILLAGE OF LYTTON

SCALE: NOT TO SCALE

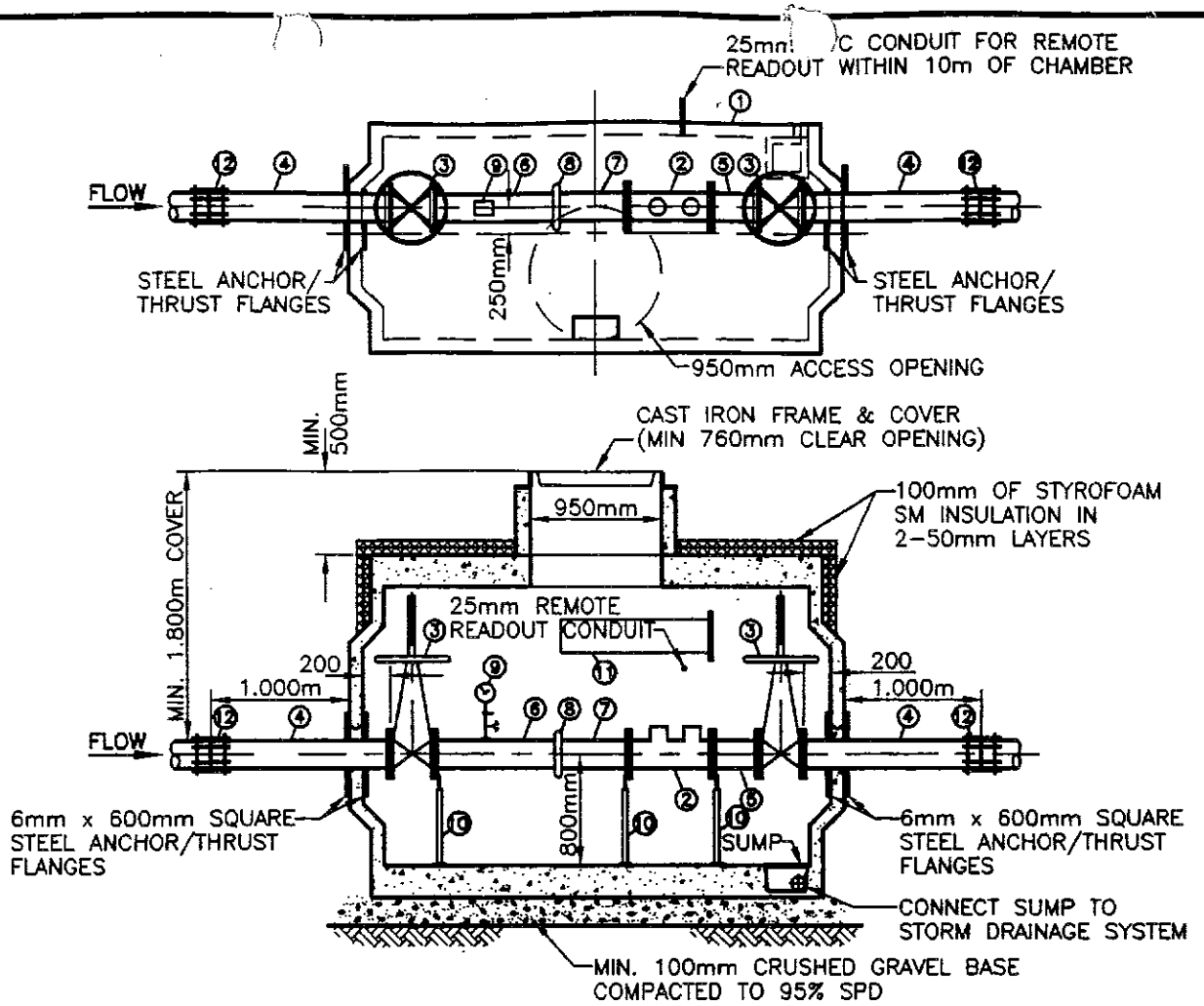
DATE DRAWN: MAR. 1998

LATEST REVISION DATE: MAR. 1998

APPROVED BY:

TITLE: TYPICAL METER CHAMBER FOR INDUSTRIAL APPLICATIONS FOR UP TO 100mm MAINS

SECTION: SCHEDULE E WATER SYSTEMS | REVISION No. 0 | DWG No. E-7



SCHEDULE OF MATERIALS

ITEM No.	QUANTITY	DESCRIPTION	SPECIFICATION
1	1	3.56 x 2.46 x 2.44m PRECAST CONCRETE CHAMBER c/w INSULATION, ENTRANCE RISER, CAST IRON FRAME & COVER, DRAINAGE SUMP, & LADDER	•H-20 LOADING & ACCESS TO WCB REQUIREMENTS •CONNECT DRAINAGE SUMP TO STORM SEWER, ROCK PIT OR DAYLIGHT AS DIRECTED BY VILLAGE ENGINEER
2	1	NEPTUNE HP PROTECTUS III WATERMETER FOR 150mm & 200mm WATERMAINS	•FLANGED, CALIBRATED IN CUBIC METERS •REMOTE READOUT SYSTEM
3	2	OS&Y F x F RESILIENT SEAT GATE VALVE	•125# FLANGES
4	2	1.3m LONG F x PE SPOOL PIECE	•SCH 40 STEEL c/w 125# FLANGES & 6mm x 600mm SQUARE STEEL ANCHOR/THRUST FLANGES
5	1	F x F SPOOL PIECE	•SCH 40 STEEL c/w 125# FLANGES
6	1	F x VICTALIC SPOOL PIECE	•SCH 40 STEEL c/w 125# FLANGES & 12mm WELD-O-LET
7	1	F x VICTALIC SPOOL PIECE	•SCH 40 STEEL c/w 125# FLANGES
8	1	VICTALIC COUPLING	•STYLE 07 ZERO FLEX
9	1	PRESSURE GUAGE AND HOSE BIB ASSEMBLY	•100mm LIQUID FILLED 0-1380kPa (0-200Psi) PRESSURE GUAGE, BALL TYPE VALVES & SCH 40 GI PIPING
10	3	PIPING SUPPORT PEDESTALS	•STANDON MODEL S-89
11	1	F x VICTALIC SPOOL PIECE FOR TEMPORARY REPLACEMENT OF WATERMETER	•SCH 40 STEEL c/w 125# FLANGES & FABRICATE BRACKETS TO HANG ON WALL
12	2	PVC x STEEL TRANSITION COUPLING	•ROBAR OR EQUAL

NOTES:
1. ALL SCHEDULE 40 STEEL PIPING COMPONENTS SHALL HAVE TWO (2) INTERIOR COATS OF COAL TAR EPOXY. EXTERIOR SURFACES SHALL BE PAINTED WITH TWO (2) COATS OF TREMCLAD BLUE PAINT.
2. CORROSION PROTECTION MEASURES SHALL BE INSTALLED THROUGH CORROSIVE SOIL AREAS.
3. BACKFILL AROUND CHAMBER WITH IMPORTED GRANULAR SOILS COMPACTED TO 95% SPD.

VILLAGE OF LYTTON

SCALE: NOT TO SCALE

DATE DRAWN: MAR. 1998

LATEST REVISION DATE: MAR. 1998

APPROVED BY:

TITLE: **WATERMETER CHAMBER FOR 150mm & 200mm WATERMETERS**

SECTION: SCHEDULE E WATER SYSTEMS | REVISION No. 0 | DWG No. E-8

PLOT DATE: 98/04/30 9:50am RH

PROJ. CAD FILE No.: J:\STDDET\LYTTSTD\E-8.DWG

.2 precast or cast in place buried concrete chamber suitable for H20 Highway loading;
.3 lockable access hatch (914mm x 914mm minimum);
.4 Aluminium ladder;
.5 sump with sump pump assembly, and/or connection to storm sewer system;
.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 20mm hose bib connection;
.13 pipe stands
.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.

E - 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 sub-grade;
.3 300 mm pitrun gravel sub-base; and
.4 50 mm crushed gravel base.

E - 3.0 MATERIALS

E - 3.01 Pipe

Pipe for water mains shall be polyvinyl chloride (PVC) conforming to AWWA C-900 and CSA CAN3-B137.3 for mains 100 - 300 mm dia. and with AWWA C-905 and CSA CAN3-B137.3 for mains 350 mm to 600 mm dia. Joints shall be wall thickened and sleeve reinforced bell and spigot ends with formed groove for elastomeric gasket seal conforming to ASTM D2122.

E - 3.02 Fittings

Fittings shall be PVC conforming to AWWA C907, CSA B 137.2 and B 137.3 or 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 Approving Officer.

E - 3.03 Buried Gate Valves

Buried gate valves shall conform to:

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

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.

E - 3.04 Valve Boxes

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

E - 3.05 Hydrants

All hydrants shall be Clow, heritage style, compression type complete with 2 – 63 mm ports and 114 mm pumper port. Threads shall conform to the British Columbia Fire Hose Thread specifications. Drain outlets shall be provided. Depth of bury shall be a minimum of 1.8 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 are required. Hydrant colour shall be red with white top and caps.

Hydrant lead pipe shall be a minimum of 150 mm diameter. At the discretion of the Approving Officer, 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.

E - 3.06 Service Connection Pipe, Saddles, and Joints

All pipe for underground services 50 mm diameter and smaller shall be Polyethylene Municipal grade series 160 service pipe (PE tubing) 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.

E - 3.07 Corporation Stops

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

E - 3.08 Curb Stop and Boxes

Curb stops shall be Mueller or Ford compression type; stop and drain for 20 mm diameter through 50 mm diameter. Service boxes shall be trojan, or approved equal.

E - 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 Approving Officer.

E - 3.10 Stops and Drains For Blow Offs

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

E - 3.11 Meters

Metering is required at the owners expense on all developments at a location approved by the Approving Officer. All meters and remote readout devices shall be easily accessible to the Village. Meter chambers or enclosures shall be constructed in accordance with the applicable Standard Drawing, as follows:

.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 2.5 m
.6 piping primed and painted with a rust-inhibiting paint
.7 remote readout device
.8 meter bypass
.9 meter for domestic, irrigation and fire flows

E - 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 Approving Officer or dictated otherwise by soil conditions.

Admixtures shall not be included in the concrete mix without the approval of the Approving Officer.

E - 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 the following table:

TABLE E-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 drain rock shall be installed to bed the pipe.

E - 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 3.13 above.

E - 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 that 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 sill not provide an adequate subgrade base for the proper placement of road sub-base, base and asphalt. 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 C.

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.

E - 3.16 Encasement Pipe Filler Sand

To be well graded, clean sand, free from organic materials and conforming to the following to gradation limits;

TABLE E-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

E - 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 1.8 depth of earth cover.

E - 3.18 Bolts and Nuts

Bolts and nuts to be Type 314 stainless steel.

E - 4.0 WORKMANSHIP

E - 4.01 Trench Excavation

Trenches shall be excavated in accordance with Workers' Compensation Board requirements 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 Approving Officer. When trenches through existing pavement areas are permitted, the pavement shall be saw-cut in straight continuous lines parallel to the trench centreline prior to commencement of trenching operations. Cages shall be used where practical to reduce the width of trench excavation and provide safety for workers.

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.

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 owner of such facility sufficiently in advance that the owner 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 Approving Officer.

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

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 backfilled with a competent soil to the correct shape, grade and elevation as directed by the Design Engineer.

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.

E - 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.

E - 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 1.8 m measured from the top of the installed pipe to the finished grade elevation over the pipe.

E - 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 or the entrance of dirt and debris. The pipe shall be jointed in strict accordance with the manufacturer's recommended practice.

Thrust restraint devices shall be installed on pipes installed on grades in excess of 20%

E - 4.05 Service Connections

Service connections shall be connected to the Corporation stop and a gooseneck formed as shown on 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 using a tool as recommended by the pipe manufacturer 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 1200 mm. A marker stake shall be set with bottom flush with the end of the service and the top projecting a minimum 1000mm 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 0.5 m length of copper pipe 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.

E - 4.06 Thrust Blocking

Concrete thrust blocking shall be provided at fittings and on hydrants as shown on the applicable Standard Drawings. 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. Uni-flange joint restrainers shall be used through unstable soils and on steep vertical slopes.

E - 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 Approving Officer 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.

E - 4.08 Blow-Offs

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

E - 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.

E - 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.

E - 4.11 Pipe Casings

Pipe casings shall be installed as shown on the applicable 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.

E - 4.12 Asphalt Restoration

If the edges of the cut asphalt become ragged as a result of construction operations, the asphalt shall be saw-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.

E - 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 Approving Officer with 24 hour notice provided to the Village in advance of the test. A leakage test. However, the owner shall pretest the watermain section before hand to generally ensure that the Approving Officer only witnesses actual pressure/leakage tests. 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 lead valves shall be open to ensure 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:

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

in which

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.
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.

E - 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.

E - 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. 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 Approving Officer. On completion of chlorination, the entire piping system shall be thoroughly flushed, filled with water and left in a condition ready for use.

E - 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.

E - 4.17 Construction Record Drawings

Prior to Construction Completion, the Owner shall deposit with the Village one computer diskette (3½") in AutoCAD (latest version) format and one set of original construction record mylar drawings showing all the information requested by this schedule and conforming to the criteria set out in Schedule J.