

VILLAGE OF GRANISLE

BY-LAW NO. 148

A By-Law to regulate the subdivision of land

WHEREAS pursuant to Section 729 of the Municipal Act Council is authorized to regulate the subdivision of land;

NOW THEREFORE, the Municipal Council of the Village of Granisle, in open meeting assembled, enacts as follows;

1. This By-Law may be cited for all purposes as "Granisle Subdivision By-Law No. 148

2. In this By-Law, unless the context otherwise requires;

- (a) "Approving Officer" means the Approving Officer of the Village of Granisle appointed pursuant to the provisions of the Land Title Act;
- "Arterial Highway" means a major highway serving as a major traffic route between areas of the municipality;
- "Boulevard" means that portion of a highway allowance lying between a curb or road shoulder and the adjacent property line;
- "Collector Highway" means a highway serving several local highways and may serve as a connector between neighbourhoods;
- "Cul-de-sac" means a highway having access to another highway at one end only;
- "Village" means Village of Granisle;
- "Highway" means and shall include a public street, road, trail, lane, thoroughfare, walkway, bridge and any other public way;
- "Lane" means a highway ten (10) metres or less in width;
- "Municipal Engineer" means the person appointed by the Council of the Village of Granisle in that capacity;
- "Municipality" means the Village of Granisle;
- "Owner" means any person registered in the Land Title Office as owner of land or of any charge by way of right-to-purchase on land, whether entitled thereto in his own right or in a representative capacity or otherwise;
- "Parcel" means any lot, block or other area in which land is held or into which land is subdivided, but does not include a highway or portion thereof;
- "Residential Highway" means a highway serving a residential neighbourhood not intended to carry traffic from one neighbourhood to another;

- "Rural Highway" means a highway serving rural parcels of land not being an arterial highway;
- "Subdivision" means the division of land or redivision of land into two or more parcels whether by plan or by metes and bounds description;
- "Trunk Sewer" means any sanitary sewer main of twenty-five (25) centimeters diameter or greater;
- "Trunk Water Main" means any water supply main of twenty-five (25) centimeters diameter or greater;
- "Works" means the highways, drainage, water and sewer systems, the sidewalks, boulevards, street lighting and underground wiring to be provided for in a subdivision of land under this by-law;
- "Zone" means a zone created by Village of Granisle Zoning By-Law in force at the date applicable.

(b) Unless otherwise defined herein all other words or expressions used in this By-Law shall have the same meaning as like words or expressions in the "Land Title Act".

SUBDIVISION 3.  
APPLICATION

- (a) An applicant for subdivision shall, before causing a plan to be prepared of the subdivision, file with the Approving Officer a sketch plan drawn to a convenient scale showing the proposed subdivision.
- (b) The Approving Officer shall examine the preliminary application and shall advise the applicant in writing, within 30 days from receipt by him of such application, either that the subdivision proposal could be approved, or that it could not be approved. In the latter case, the reasons for so deciding shall be stated.
- (c) Preliminary approval of any proposed subdivision shall not be construed as final approval of such subdivision for land registration purposes and such preliminary approval is revocable by the Approving Officer at any time.
- (d) The application for subdivision approval shall be made by the Owner or his duly authorized agent. The Approving Officer, before dealing with an application for subdivision approval, made by a person other than the Owner, may require such other person to produce satisfactory evidence he is duly authorized by the Owner to make such application.
- (e) If the subdivision is rejected, the applicant for approval shall be so advised in writing by the Approving Officer, and the reasons for rejecting the subdivision shall be given.
- (f) Where the Approving Officer is of the opinion that the lands of any adjoining or neighbouring owner are, or might be, detrimentally affected by the subdivision under application for approval, he may require the applicant to furnish sufficient evidence to satisfy him that notice of intention to subdivide, and of the scheme of subdivision and of the application pending has been served on such adjoining or adjacent Owners in such forms as the Approving Officer may direct. Satisfactory evidence of service of such notice shall be the production of a statement in writing from each such Owner indicating that he is aware of the intended scheme of subdivision and either consents to it or gives reasons for objecting to it, provided that any other proof of such service may be accepted by the Approving Officer if deemed by him satisfactory.

- (g) The Approving Officer himself may serve notice in writing of the proposed subdivision on any Owner or other person whose land or interest therein, in his opinion, might be detrimentally affected by it, and may make such further enquiry into the effect of the proposed subdivision upon adjoining or neighbouring lands as will establish to his satisfaction the desirability or otherwise of the proposed subdivision.
- (h) If in the opinion of the Approving Officer the application for subdivision indicates that there is reason to anticipate a further resubdivision of the relevant lands, the person tendering the subdivision for approval, at the request of the Approving Officer, shall furnish a sketch plan showing the ultimate method of subdivision and showing how the present intermediate stop fits into such ultimate subdivision.
- (i) Every applicant for a subdivision approval shall submit with his application a fee equal to \$25.00 for the first parcel to be created by the proposed subdivision and a fee of \$10.00 for each additional parcel to be created by the proposed subdivision. The fee shall be submitted at the same time as the application for final subdivision approval and shall not be refundable.

OFFICIAL  
COMMUNITY  
PLAN

4. The Approving Officer shall give due regard to and take cognizance of the Official Community Plan when dealing with applicants for the approval of any plan of subdivision.

COST

5. The Approving Officer may refuse to approve a subdivision plan if he is of the opinion that the cost to the municipality of providing public utilities or other municipal works or services would be excessive.

OPEN SPACE

- 6. (a) The Owner of land being subdivided shall provide, without compensation, land for public open space in the locations and to the extent required by the Approving Officer for the purpose of providing sufficient open space within the proposed subdivision for park and public use.
- (b) Where land being subdivided adjoins a lake, river, stream, or other body of water, the Approving Officer may, as a condition of approving the subdivision, require the dedication, without compensation of a strip of land not exceeding 7 m in width along the bank or shore for the purpose of providing public access, if, in his opinion, it is in the public interest to do so.
- (c) The amount of land required to be provided or dedicated under this section shall not exceed 5% of the land being developed.

CONFIGURATION  
OF LAND

7. Notwithstanding the provisions of this By-Law, no parcels shall be subdivided unless the proposed subdivision is suited to the configuration of the land being subdivided.

USE

8. Notwithstanding the provisions of this By-Law, no parcel shall be subdivided unless the parcels created by the subdivision are suited to the use to which they are intended and the owner of the land being subdivided shall state in writing such intended use when application is made for approval of the proposed subdivision.

FUTURE  
SUBDIVISION

9. No parcel of land shall be subdivided in such a manner as to make impractical the future subdivision of the parcels of land within the subdivision or of any adjacent land.

CONFORMITY

10. No subdivision shall be created or developed except in conformity with the provisions of this By-Law.

AREA, SHAPE & DIMENSIONS OF PARCELS

- 11. (a) The minimum area of a parcel, created by subdivision in a particular zone, shall be as stated in the Village of Granisle Zoning By-Law.
- (b) No parcel created by subdivision shall have less than one-tenth (1/10) of its perimeter fronting on a highway. Provided exemption may be granted pursuant to the provisions of the Municipal Act.
- (c) For the purpose of this section, the fronting width of a parcel shall be the measurement along a line running parallel to and distant seven and one-half (7.5) metres from the lateral boundary of the highway upon which the said parcel fronts and where the parcel fronts on more than one highway, the distance shall be measured from the highway, other than a lane, having the shortest frontage.
- (d) Notwithstanding the preceeding regulations the minimum area of parcels shall be increased:
  - (i) as necessary to suit the topography and to ensure that the gradient on access driveways to service the proposed lots or parcels shall not exceed fifteen percent (15%);
  - (ii) where a lot in a zone other than RR-2 is traversed by a natural water course by an amount that allows for the minimum lot size plus the water course plus space for an easement for maintenance purposes of the water course of at least six (6) metres on each bank of the water course;
  - (iii) where a lot is traversed by a right-of-way for hydro, gas, sewer, water or drainage purposes the minimum lot size shall be increased by an amount equal to the area of the right-of-way.

WORKS REQUIRED & CONSTRUCTION STANDARDS

HIGHWAYS

- 12. All subdivisions shall conform to the relevant requirements set out hereunder as a condition precedent to the approval of the same.
  - (a) All new highways within the subdivision, including widening strips of existing highways, cul-de-sacs or lanes, if any, shall be cleared to their full width and shall be graded, drained and surfaced in different zones, and all construction shall be carried out in accordance with the standards prescribed and set out in Schedule "A" hereto which Schedule is made a part of this By-Law.

General Requirements

	Right-of-Way Width	Surface & Drainage of Highways
R-1 Low Density Residential		11.0 metres asphaltic pavement and ditches
R-2 High Density Residential		
R-3 Mobile Home	20 m	
C-1 Commercial		
C-2 Service and Commercial		
I-1 Industrial	20 m	11.0 metres gravel surface and ditches
RR-1 Rural Residential District		
RR-2 Rural Reserve District		

Where lanes are provided they shall be ten (10) metres in width and shall be surfaced with not less than three (3) metres of asphaltic pavement. Where walkways are provided they shall be not less than six (6) metres in width and shall be surfaced with not less than one and one-half (1.5) metres of asphaltic pavement.

SEWAGE  
COLLECTION

- (b) (i) Where any parcel in a zone other than I-1, RR-1, and RR-2 is to be subdivided, a sewage collection system shall be provided in accordance with the standards set out in Schedule "B" hereof which Schedule is made a part of this By-Law. The sewage collection system shall be connected to the existing sewage disposal system of the Municipality according to the terms and conditions set out in the then current Sewer Rates and Regulations By-Law. The lands included in the subdivision served by such sewage collection system, shall be exempt from, but only from, the charges imposed in the Village of Granisle for works of a like nature for a period of time calculated to be sufficient to amortize the actual cost of the collection system computed at an interest rate not exceeding the prime rate of interest per annum. Provided, however, if the Engineer of the Village of Granisle requires that any main of such collection system be of a diameter in excess of that required to service the subdivision, the Village of Granisle shall assume and pay the cost of providing the excess capacity over twenty centimeters in diameter.
- (ii) In I-1, if the parcel being created by subdivision is less than two (2) hectares in area, the provisions of subsection (b) and (d) of this section shall apply unless that parcel meets the requirements set forth in Schedule "B" annexed to and forming part of this By-Law.

WATER  
SUPPLY

- (c) Where any parcel in a zone other than I-1, RR-1, or RR-2 is to be subdivided, a water distribution system shall be provided in accordance with the standards set out in Schedule "C" hereto which Schedule is made a part of this By-Law. The water distribution system shall be connected to the existing water supply system of the Municipality according to the terms and conditions set out in the existing and current Waterworks By-Law of the Village of Granisle. The lands included in the subdivision served by such water distribution system shall be exempt from, but only from, the charges imposed in the Village of Granisle for works of a like nature for a period of time calculated to be sufficient to amortize the actual cost of the distribution system computed at an interest rate not exceeding the prime rate of interest per annum. Provided, however, if the Engineer of the Village of Granisle requires that any main of such distribution system be of a diameter in excess of that required to service the subdivision the Village of Granisle shall assume and pay the cost of providing the excess capacity over twenty (20) centimeters in diameter.

600' METRE  
RULE

- (d) Notwithstanding the preceding sections of this By-Law where the nearest boundary of any parcel of land in a zone other than I-1, RR-1, or RR-2 proposed to be subdivided, is six hundred (600) metres or more in distance from an established trunk water main or trunk sanitary sewer or both, provision shall be made by the owner of the land proposed to be subdivided, for the installation of water mains and sanitary sewers, including trunk water mains and trunk sanitary sewers in and to the proposed subdivision. The said trunk water mains shall be not less than twenty (20) centimeters in diameter and the trunk sanitary sewers shall not be less than twenty (20) centimeters in diameter. The said water mains within the subdivision shall not be less than twenty (20) centimeters in diameter. All trunk water mains and sanitary sewers shall be constructed according to the standards prescribed in Schedule "B" and "C" of this By-Law.

- BOULEVARDS (f) Where any parcel in a zone other than I-1, RR-1, or RR-2 is to be subdivided and new highways are created, boulevards shall be provided in accordance with the standards set out in Schedule "A" to this By-Law.
- STREET LIGHTING (g) Where any parcel in a zone other than I-1, RR-1, or RR-2 is to be subdivided and new highways are created, street lighting shall be located and constructed in accordance with the standards set out in Schedule "A" to this By-Law.
- STORM DRAINS (h) Where any parcel is to be subdivided ditches shall be provided where required in accordance with the standards set out in Schedule "A" to this By-Law.
- SECURITY IN LIEU OF CONSTRUCTION 13. (a) All works required to be done pursuant to the provisions of this By-Law in connection with the subdivision of any lands shall be carried out at the sole expense of the owner of such land by such owner or his contractor, or at the option of the Village of Granisle, by the Village of Granisle, at the sole cost of such owner to the standards prescribed in this By-Law before approval of such subdivision may be granted by the Approving Officer.
- PROVISO Provided, however, a plan of subdivision may be approved prior to completion of the required works providing the owner of such land being subdivided:
- (i) deposits with the Village of Granisle, cash or an irrevocable letter of credit from a chartered bank, trust company or credit union in the amount of money estimated by the Municipal Engineer to be the cost of installing and paying for all work and services required to be done pursuant to the provisions of this By-Law to service the proposed subdivision prior to the approval of the subdivision plan and;
  - (ii) enters into a contract with the Village of Granisle to construct and install the prescribed works and services that are required but have not yet been constructed or installed and on failure of the owner to have the same constructed or installed, the money shall be forfeited to the Village of Granisle who shall then construct or install such services.
- PERIMETER ROADS (b) Provided, however, should the works required to be constructed pursuant to the terms of this By-Law be upon perimeter roads, or be of such a nature or in such a location that their construction or installation should be delayed pending completion of other works on lands other than those owned by the applicant for subdivision, then, and in that event, the owner may, in lieu of construction of the works prior to subdivision approval, pay to the Village of Granisle an amount calculated by the Municipal Engineer to be the cost of construction and installation of such works and authorize the Village of Granisle to construct and install such works at the appropriate time according to the standards set out in this By-Law.

CONNECTION

14. Where an owner of land proposed to be subdivided constructs and installs the works necessary to serve the proposed subdivision without entering into an agreement with the Village of Granisle as referred to in the immediately preceding section hereof, the owner shall not connect such works to any of the sewer, drainage, electrical or water works of the Village of Granisle and the Village of Granisle shall not accept the works constructed and installed by the owner or any part thereof, until:

- (a) The Municipal Engineer has recommended acceptance of the works.
- (b) The layout of the proposed subdivision has been approved by the Approving Officer.
- (c) The owner has deposited with the Municipal Engineer "as built" drawings of such works prepared by a professional engineer.
- (d) The owner has caused to be registered in the Land Title Office in Prince Rupert and has deposited with the Municipal Engineer a copy of all rights-of-way required where such works cross private property, such rights-of-way to be in the form annexed hereto as Schedule "D".

SCHEDULES

15. Schedules "A" through "C" inclusive form part of this By-Law as if embodied herein.

OFFENCE

- 16. (a) Every person who violates any of the provisions of this By-Law or suffers or permits any act or thing to be done in contravention of this By-Law, or who neglects to do or refrains from doing any act or thing required to be done by this By-Law shall be deemed to be liable to the penalties hereby imposed.
- (b) Any person who violates any of the provisions of this By-Law shall, upon summary conviction thereof, be liable to a penalty of not more than \$500.00 plus the cost of the prosecution.

READ A FIRST TIME THIS 4th DAY OF October A.D., 19 82

READ A SECOND TIME THIS 4th DAY OF October A.D., 19 82

READ A THIRD TIME THIS 4th DAY OF October A.D., 19 82

RECONSIDERED AND FINALLY ADOPTED, SIGNED BY THE MAYOR AND CLERK AND SEALED WITH THE CORPORATE SEAL ON THE 21st DAY OF February, 1983

*W.S. Brown*  
Mayor

*[Signature]*  
Clerk

I HEREBY CERTIFY THE ABOVE TO BE A TRUE COPY OF BY-LAW NO. 148

A true copy of By-Law No. 148 registered in the office of the Inspector of Municipalities this 24th day of March, 1983.

*[Signature]*  
Deputy Inspector of Municipalities

*[Signature]*  
Clerk

GENERAL PROVISIONS - SCHEDULES "A", "B", AND "C"

DEFINITIONS

1. In these Schedules unless the context otherwise requires:

"Engineer" means except in reference to the Municipal Engineer, a professional engineer licensed to practice in the Province of British Columbia.

"Engineering Drawings, Standards & Requirements" means drawings and specifications prepared and given under the hand and seal of a professional engineer.

CONSTRUCTION OF HIGHWAYS

2. The Village shall permit the subdivider to lay out, construct and erect works and co-ordinate the installation of the private utility works in the highways to be dedicated by the subdivision plan, but subject to the terms and conditions hereinafter provided in Schedules "A", "B" and "C" and subject to the By-Laws of the Village governing the use of highways and subject to all Provincial and Federal statutes and regulations governing construction and the use of highways.

SUBDIVISION PLAN

3. The Subdivider shall be solely responsible for the preparation of subdivision plans and for the registration of the approved subdivision plans in the Land Registry Office at Prince Rupert. In no case shall a single phase of development be approved unless the tentative subdivision plan for the entire development has been submitted to the Municipal Engineer and approved by him.

ENGINEERING DRAWINGS

4. Prior to commencing any works the subdivider shall produce engineering drawings satisfactory to the Municipal Engineer for the installation of the underground, surface and overhead works connected with the servicing of the subdivision including the works to be supplied and installed by the private utility companies. The Village may require the subdivider to engage the services of a qualified consulting engineering firm or qualified engineer acceptable to the Village to prepare the engineering drawings, contract documents, reports, studies and any other engineering information which may be required by the Village relevant to the development of the subdivision. Engineering drawings prepared and signed by private utility companies in support of their works will be acceptable.

Engineering drawings shall consist of the following:

- (a) Key plan at a scale of 1:2,500 showing work to be constructed, contours at 1 m. or another appropriate interval for the area considered, and an inset site location plan;
- (b) A drainage plan showing drainage pattern of each parcel within the subdivision and the tributary area upstream of the subdivision;
- (c) Plan and profile drawings of roads, water, sewerage and drainage systems at a scale of 1:500 horizontally and 1:50 vertically. Profiles shall be drawn on the upper half of the sheet, all elevations shall be referred to Geodetic Survey of Canada datum, with the location and value of the bench mark used in the drawings.
- (d) The drawings shall include:
  - (i) the size, class, type and grade of all pipes;
  - (ii) anticipated design flows and pipeline capacities;
  - (iii) the finished elevations on top of the centre line of the roads and at the property line;
  - (iv) the location, type and size of all hydrants, valves and water fittings;

- (v) any special instructions or installations such as pumping stations;
- (vi) additional information as specified in the Schedules attached hereto;
- (vii) plan drawings of electrical, telephone and gas distribution systems and ornamental roadway lighting;
- (viii) drawings showing boulevard elevations.

The engineering drawings shall be submitted to and shall receive the approval of the Municipal Engineer prior to commencement of construction. Approval shall be construed only to mean that the drawings meet the general intent of the By-Law and the Schedules attached hereto and shall not derogate from the right of the Municipal Engineer to require such changes, the necessity for which becomes apparent from time to time, in order that the requirements of this By-Law shall be met.

- (e) The engineering drawings shall show the layout of the roads, drainage, sewerage and water facilities and their appurtenances. The layout of all Works shall be referred to legal survey markers. The drawing numbers and the symbols used on the drawings shall conform to Municipal requirements. Drawings shall be drawn so that they are legible if reduced to half size.
- (f) The location of the proposed building areas, the proposed finished grades at property lines and at the building line shall be shown.

INSPECTION

- 5. The subdivider's consulting engineer, at the subdivider's expense, shall provide full layout and inspection services for all Works installed by the subdivider or his contractors and shall ensure that all Works are constructed and installed in accordance with the standards and specifications contained in this By-Law. The consulting engineer shall file all his inspection reports with the Municipal Engineer, who may refuse to accept such report if there is reason to doubt the adequacy of such inspection. Provided, however, should such inspection in the opinion of the Municipal Engineer be unsatisfactory the Village may carry out the inspections at the cost of the subdivider.

MATERIALS

- 6. The subdivider shall submit to the Municipal Engineer prior to commencing construction on any phase of the subdivision, a complete list of the type of materials to be incorporated in the subdivision Works along with the time schedule of construction. The materials list shall set out the type of materials to be incorporated in the Works, the name of the manufacturer, a description of the material, its composition, the class or grade, the A.S.T.M. or A.W.W.A. specification number and trade name for the materials. All materials used in the Works must conform to the Village's standards as set out in this By-Law. Any materials not meeting the Village's standards or the approval of the Municipal Engineer shall not be incorporated in the Works.

CERTIFICATE OF ACCEPTANCE

- 7. (a) Upon completion of any phase of subdivision the subdivider shall supply the Village with a notification of completion of the Works under the hand and seal of the consulting engineer of the subdivider. If the work is acceptable to the Municipal Engineer a Certificate of Completion shall be issued. Such certificate may be issued separately for that portion of the Works being the water distribution system, sanitary sewer, collection system and appurtenant structures, service connections, storm drains, street lights and controls and all private utility facilities necessary to service a phase of the subdivision for use. Subject to the correction of deficiencies as hereinafter provided the Village shall, on issuance of the Certificate of Acceptance, be responsible for the maintenance and operation of the Works covered thereby.

- (b) A second Certificate of Completion may be issued for any phase of subdivision at the completion of the surface works including the installation of street paving, final boulevard grading and clean-up.
- (c) On receipt of the subdivider's Notification of Completion the Municipal Engineer shall inspect the Works and upon being satisfied that the Works are completed according to the approved plans and specifications he may issue his Certificate of Acceptance to the subdivider. This certificate may be in two parts for any phase of subdivision as described above. No phase of subdivision Works shall be accepted until they are ready to operate and this shall include connection to Village services or appropriate outfalls or other services provided by the subdivider and approved by the Municipal Engineer.
- (d) If upon application for Certificate of Acceptance the Municipal Engineer refused to accept the Works the subdivider shall repair the works installed and correct deficiencies in the Works not resulting from normal wear and tear and acts of God and not resulting from action of the Village.

TRANSFER AND  
RIGHTS-OF-WAY

- 8. (a) Upon acceptance of the work by the Municipal Engineer the subdivider shall execute such documents as shall be produced by the Village conveying to the Village all right, title and interest of the subdivider in the Works.
- (b) The subdivider shall grant to the Village all rights-of-way as shall be required by the Village for the purpose of servicing the Works installed where the Works are installed on property other than highways. The subdivider shall execute such right-of-way agreements as the Village may produce to the subdivider for this purpose prior to the Certificate of Acceptance being issued by the Municipal Engineer.

LEGAL  
SURVEY

- 9. The subdivider shall be responsible for all the legal surveys in connection with the subdivision and shall prepare all the documents necessary for registration of the subdivision. The subdivider shall at his sole expense, maintain sufficient legal survey control to the satisfaction of the Municipal Engineer throughout the construction program and shall, upon completion of the construction of highways and boulevards, cause each legal lot corner to be posted by a qualified land surveyor at the subdivider's sole cost.

BARRICADES  
AND DETOURS

- 10. (a) The subdivider shall provide all such barricades, lighting and signs as shall be required to protect the public while the Works are being installed. In order to maintain traffic movement with the least possible inconvenience, the subdivider shall construct, where necessary in the opinion of the Municipal Engineer, such detours, temporary bridges and barriers as may be required to allow the public to drive around the Works being installed.
- (b) Prior to commencing excavation on or in the vicinity of highways, the subdivider shall contact the owners of all the utilities that may be affected by his work and request from them instructions for the emergency action to be taken in the event of damage to a utility or service connection.

WAIVER

- 11. Where because of the size, location or service requirements of any subdivision the services of a professional engineer is not required in the opinion of the Municipal Engineer the provision set out above dealing with the engineering drawings, construction and inspection of Works not applicable may be waived by the Municipal Engineer.

SCHEDULE "A"

HIGHWAYS, SIDEWALKS, BOULEVARDS, STREET LIGHTING,

UNDERGROUND WIRING AND DRAINAGE

I HIGHWAYS

1. General Requirements:

(a) Design

Roads shall be arranged to minimize traffic hazards, to provide adequate access to all parcels within the subdivision and to adjacent land or as are necessary to implement any applicable Municipal traffic plans and due regard shall be given to provide efficient gravity drainage.

Cul-de-sacs in areas with single family dwellings shall conform to drawing number 1. The dimensions shall be increased to meet traffic and vehicular requirements in areas with other zoning, or where the turn-around is skewed. No cul-de-sac shall exceed 120 m in length and the turn-around shall be visible from its entrance. If necessary to ensure through pedestrian traffic to schools, parks and other facilities, a walkway shall be provided from the turn-around to an adjacent street.

(b) Alignment

- (1) Roads shall as far as possible be arranged without jogs or sharp changes in alignment and centre lines of intersecting streets shall meet at a single point. Whenever possible, roads shall intersect at right angles, but in no case at an angle less than 70 degrees, which angle shall be maintained for a distance of at least 40 m measured from the centre point of the intersection.
- (2) The horizontal alignment of the road shall be on the centreline of the road allowance, taking into consideration the location of all present and foreseeable future services to be installed within the road allowance.
- (3) Centreline chainage stations shall be referenced and dimensioned from legal survey markers. The degree of curvature shall be relative to the classification of the road and its designed speed. The minimum radius of curve and maximum superelevations shall conform to the following table, A-1.

TABLE A-1

<u>Design Speed</u>	<u>Minimum Centreline Radius</u>	<u>Maximum Superelevation</u>
50 km/h	30 m	8%
65 km/h	155 m	8%

Horizontal curves shall be fully described showing their internal angle, radius, tangent length and arc.

(4) Vertical Alignment

Maximum and minimum gradients on all roads shall conform to the following table, A-2.

TABLE A-2

ROADWAY GRADIENTS

	<u>Gradient Percent</u>			
	<u>Desirable</u>		<u>Absolute</u>	
	<u>Max.</u>	<u>Min.</u>	<u>Max.</u>	<u>Min.</u>
Residential	12	0.5	15	0.3
Collector	8	0.5	12	0.3
Arterial	8	0.5	12	0.3
Turn-around	7	0.5	10	0.5
Intersection approach	3	0.5	5	0.3
Curb returns	3	1.0	5	0.5

In the case of residential subdivisions the vertical alignment of roads shall be set to serve adjacent properties with access driveways at a grade not steeper than fifteen percent (15%) as measured from the property side of the curb, to the proposed building area.

The length of vertical curves shall be calculated using the equation  $L = K_A$ , using K values as in Table A-3

Where L = length of vertical curve  
 K = a constant  
 A = the algebraic difference of tangent grades

TABLE A-3

<u>LENGTH OF VERTICAL CURVES</u>					
<u>Speed km/hr</u>	<u>K</u>	<u>Minimum Sight Distance</u>	<u>Speed km/hr</u>	<u>K</u>	<u>Minimum Sight Distance</u>
30	25	38 m	30	10	38 m
50	35	60 m	50	28	60 m
65	50	85 m	65	50	85 m

(5) Superelevation

Horizontal curves on residential roads shall not be superelevated without the consent in writing of the Municipal Engineer. Collector and arterial roads shall be superelevated if required by the criteria for centreline radius and design speed.

The length of a transition from a normal cross-sectioned road to a section of road where there is superelevation shall in no case be less than 30 m for a 50 km/hr designed road or 38 m for a 65 km/hr designed road. In selecting the length of the transition, care and consideration shall be given to drain all of the pavement.

(6) Intersections

Breaks in grade may be required on all roads at an intersection. Within 30 m radius of the centre point of an intersection the maximum grade shall not exceed five percent (5%).

(7) Pavement Structure

All roads within the subdivision shall be paved unless otherwise provided by this By-Law. Roads in residential zones shall have a two inch compacted thickness of asphaltic plant-mix concrete laid on a compacted gravel base. Roads in commercial and industrial zones shall have a minimum of 8 cm compacted thickness of asphaltic plant-mix concrete laid on a compacted gravel base.

The minimum pavement structure shall be as shown on the drawings for the various classification of road:

<u>Class of Highway</u>	<u>Drawing</u>
Residential Highway	2
Arterial Highway	3
Collector Highway	3
Rural Highway	4

Additional depths of subbase or alternative construction details shall be required when the nature of the ground so requires.

(8) Appurtenances

The drawings shall detail the design of, and show location of, all appurtenances, including proposed traffic islands, retaining walls,

guard rails and, in a location where an acceptable turn-around is not to be constructed, barricades. These structures shall be designed in keeping with good engineering practices.

(9) Side Slopes

Constructed side slopes shall be not greater than as shown on the drawings or greater than the angle of repose of the material in question; they shall be protected against erosion. Alternatively, retaining walls may be required. Drawings shall show the structural detail and surface finish of the walls.

(10) Utility Poles and Existing Underground Services

Drawings shall show all existing utility poles and underground services; those utilities shall be indicated which have to be relocated prior to road construction; the owner shall confirm with the utility the feasibility of their relocation prior to design completion.

(11) Lanes and Pedestrian Walkways

Where service lanes for vehicular traffic are included in a subdivision they shall be a minimum of 10 m in width and the requirements for subgrade preparation and surfacing shall be as for street surfacing.

2. Materials

(a) Subgrade Material

Material for subgrade fill shall be free of rock larger than 20 cm in diameter and free of organic or any other deleterious matter; it shall be capable of being compacted as specified.

(b) Granular Aggregates

(1) Sub-base Gravel

Sub-base gravel shall be well graded granular material within the following gradation limits when tested in accordance with ASTM C136.

<u>USBS Sieve Size</u>	<u>Percent by Weight Passing</u>
10.2 cm (4 inch)	100
2.5 cm (1 inch)	50-90
#100	0-16
#200	0-8

(2) Base Course Gravel

Base course gravel shall be material composed of inert, durable aggregate, reasonably uniform in quality and free from soft or disintegrated pieces. The aggregate shall fall within the following limits when tested in accordance with ASTM C136.

<u>USBS Sieve Size</u>	<u>Percent by Weight Passing</u>
1.9 cm (¾ inch)	100
.95 cm (3/8 inch)	60-90
#4	40-75
#8	30-60
#16	20-40
#50	8-20
#200	2-9

A minimum 50 percent of the material retained on a #4 sieve shall have at least one fractured face as determined by particle count.

(3) Crushed Granular Aggregate for Asphaltic Concrete

Aggregate for asphaltic concrete shall be composed of hard, durable, crushed gravel conforming to the following gradation:

<u>USBS Sieve Size</u>	<u>Percent by Weight Passing</u>	
	<u>Lower Course</u>	<u>Surface Course</u>
1.9 cm ( $\frac{3}{4}$ inch)	100	100
1.3 cm ( $\frac{1}{2}$ inch)	70-100	100
.95 cm ( $\frac{3}{8}$ inch)	55-90	80-100
#4	35-70	45-80
#8	25-57	32-64
#16	18-45	24-51
#30	13-34	17-40
#50	8-26	13-29
#100	5-17	7-18
#200	2-8	3-10

A minimum 50 percent of the material retained on a #4 sieve shall have at least 2 fractured faces. Percentages shall be determined by particle count.

Aggregate shall be free from shale, clay, silt balls, loose coatings and other deleterious materials.

Aggregate short of material passing the #200 sieve shall have approved mineral filler added. Mineral filler shall be material passing the #200 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 percent by weight.

(c) Primer

Bituminous primer shall be MC-0 liquid asphaltic, or as approved.

(d) Tack Coat

Bituminous tack coat shall be SS-1 or SS-1h asphalt emulsion or as approved.

(e) Asphalt Cement

Asphalt cement shall conform to the following specifications:

Penetration @ 25 <sup>o</sup> C 100 gm, 5 seconds	85-100 AC-6
Viscosity @ 60 <sup>o</sup> C (poises) @ 135 <sup>o</sup> C (centistokes)	60-90 Pa.s (600-900) $1.7 \times 10^{-4} \text{ m}^2/\text{s}$
Ductility @ 25 <sup>o</sup> C (cms)	100+
Solubility in CC14 (percent)	99.5+
Flash point COC <sup>o</sup> C	232.2+
Loss on heating (percent)	max. 1.0
Penetration @ 25 <sup>o</sup> C loss on heating 100 gm, 5 seconds, percent of original	70+

Asphalt shall be uniform in character and shall not foam when heated to 176.7<sup>o</sup>C.

(f) Asphaltic Concrete

Asphaltic concrete shall conform to the following specifications as based on the Marshall method of design:

Number of blows each face of test specimen	75
Percent voids in mineral aggregate	min 14
Percent air voids in compacted mixture, surface and lower course	3 - 5

Minimum modified Marshall load, kg @ 60°C	340.2 kg
Flow index, units of cm	.2 - .46
Minimum index of retained stability after immersion in water @ 60°C for 24 hours	75 percent

(g) Testing

The Municipality may retain an independent materials testing firm to carry out the following tests:

1. Density tests on subgrade, sub-base and base course.
2. Bankman Beam testing as may be required prior to paving.
3. Asphalt cores for density analysis.
4. Such other testing as may be requested by the Owner's Engineer.

The Owner shall provide the Municipal Engineer with a mix design showing the items listed in Clause 2 (f) above. The materials testing firm shall be requested by the Municipality to submit one set of test results direct to the Owner's Engineer.

3. Construction

(a) Clearing

The street 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 right-of-way, and for such additional width as may be required to contain cut and fill slopes. In addition, buildings, fences, superfluous culverts or other structures within the right-of-way shall also be removed. All clearings shall be disposed of on the site by burning or as otherwise directed.

(b) Subgrade Preparation

Prior to placing of any granular aggregate on the road all existing topsoil or other deleterious matter shall be removed from the street right-of-way and the road surface graded to the desired cross-section. Any fill required to build the road up to subgrade level shall be compacted to a minimum of 90 percent (90%) of modified Proctor Density. The upper 15 cm of the subgrade shall be compacted to ninety-five percent (95%) of modified Proctor Density.

Should any soft spots develop during the process of compaction, such areas shall be excavated and backfilled with acceptable material. Particular attention shall be paid to utility trenches to ensure that they are well consolidated.

(c) Spreading and Compaction of Granular Aggregate

Granular aggregate shall be placed in maximum 15 cm 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 ninety-five percent (95%) of modified Proctor Density. The finished surfaces shall be within 1.5 cm of the design grade and cross-section.

(d) Base Inspection

Before commencement of paving the granular base shall be inspected by the Municipal Engineer. The Municipal Engineer shall be notified 24 hours in advance when the Owner wishes to proceed with paving. The Owner may be required to provide a single axle dump truck fully loaded with gravel for the purpose of proof rolling the base. If the Municipal Engineer has doubts as to the acceptability of the base, he may order that paving not

proceed until after the base has been tested with a Bankelman Beam. If such is the case, the Owner shall provide a loaded single axle truck with a rear axle load of 8,165 kg to be used in conducting the tests.

Any area found to be soft or wet shall be excavated and backfilled with select granular sub-base and resurfaced with crushed granular base course.

(e) Gravel Surface

Where gravel roads are specified in the By-Law such roads are to be constructed to Department of Highways specifications, in force during the year of construction, for roads carrying similar traffic in unorganized areas in the Burns Lake Highway District.

(f) Primer

Primer shall be applied on the granular base when the surface is dry or slightly damp, and the air temperature above 10°C. Primer shall be uniformly applied with an approved pressure distributor at a rate of 1.6 l/m<sup>2</sup> to 2.17 l/m<sup>2</sup> and the temperature of the material shall be such that the kinematic viscosity will be between 5 x 10<sup>-5</sup> to 1.5 x 10<sup>-4</sup> m<sup>2</sup>/s (50 to 150 centistokes). Traffic shall be kept off primed areas until primer has been absorbed. Additional primer shall be applied to areas requiring priming to fill voids, to coat and bond particles, or as directed by the Municipal Engineer. If the primed surface is loose, the Municipal Engineer may require rolling of the surface with a pneumatic-tired roller. The requirement for priming may be waived by the Municipal Engineer in the early spring or late fall. In such cases the Owner will be required to increase the pavement thickness by .6 cm.

(g) Tack Coat

Tack coat shall be applied to all existing asphaltic concrete to be overlain. Tack coat shall be uniformly applied with an approved pressure distributor at a rate of .36 l/m<sup>2</sup>. The temperature of the material shall be maintained between 32°C and 38°C. Traffic shall, where possible, be kept off tack coat areas until overlain by asphalt. Where not possible, the areas shall be thoroughly cleaned by use of a power driven sweeper immediately prior to laying asphaltic concrete.

(h) General Paving Requirements

Paving shall not be undertaken during snow, heavy rain, freezing or other unsuitable conditions. Asphaltic concrete shall not be placed on a frozen, wet, muddy or rutted base. Prior to paving all manhole frames and covers, valve boxes and all other appurtenances shall be set accurately to grade to conform to the required finished grades.

The minimum compacted thickness of asphaltic concrete pavement for new construction shall be 5 cm for collector and local residential streets and 8 cm for arterial or industrial streets.

(i) Placing and Compacting Asphaltic Concrete

(1) Lay Down Temperature

The temperature of the asphaltic concrete shall be between 116 °C and 163 °C at the time of lay down as measured in the truck box immediately prior to laying.

(2) Rolling

Rolling shall commence immediately after the bearing capacity of the course is adequate to support the compaction equipment and shall be carried out as specified in the Asphalt Paving Manual published by the Asphalt Institute.

(j) Density of Completed Asphaltic Concrete Pavement

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

If the field density does not fully meet this requirement the Municipal Engineer may require that the area exhibiting lesser densities be sealed with a fog coat. The fog coat shall be of the same material and applied in the same manner as tack coat.

(k) 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 pavement faces and other abutting structures shall be painted with liquid asphalt and heated to 66 °C.

(l) Restoration of Improvements

Driveways, retaining walls, vegetation and other private or Municipal improvements on private or Municipal roadways or rights-of-way affected by the road construction shall be restored as closely as possible to the condition existing prior to construction, to the satisfaction of the Municipal Engineer.

(m) Boulevard Grading

Boulevards shall be graded to the finished cross section, being surfaced with 10 cm of topsoil stockpiled during stripping, cleared of debris and raked clean of all rock exceeding 2 cm in largest dimension.

(n) Clean-up

Immediately prior to the Owner's request to the Municipal Engineer for an inspection all installation shall be cleaned of all debris, rocks, gravel or other materials. Manholes and the sewerage and drainage system shall be similarly rechecked and cleaned and flushed if required by the Engineer.

II BOULEVARDS

1. General

Boulevards shall be provided in all subdivisions where new highways are created except in I-1, RR-1, or RR-2 zones.

2. Requirements

Boulevard areas lying between the curb and property lines of road allowances shall be graded and top soiled as follows:

- (a) Unless otherwise approved, boulevards shall be graded to drain to the curb at a minimum slope of 2.8 cm/m.
- (b) The boulevard area shall be finished by excavation or filling as required to grade from the top elevation of curb to the property line. Fill sections shall be consolidated by rolling.
- (c) The top 10 cm of soil shall be good quality topsoil raked free of all roots and other organic material and debris which is not conducive to the growing of grass, and shall contain no rock greater than 2 cm in maximum dimension.

III STREET LIGHTING AND UNDERGROUND WIRING

1. General

The Owner shall cause the British Columbia Hydro and Power Authority (BCH &PA) to install electrical distribution systems to service all

parcels in his subdivision, such systems to the standards required by the BCH & PA; the Owner shall also install roadway lighting as required by this By-Law.

This requirement to install electrical distribution systems shall apply to all subdivisions that are eligible for service under the current BCH & PA extension policies.

2. Electrical Distribution Systems

The electrical distribution system shall be underground whenever new streets are being created except in I-1, RR-1, or RR-2 zones.

3. Gas Distribution System

Where applicable, the Owner shall cause the Pacific Northern Gas to install the gas mains on both sides of the roadway to prevent the cutting of newly paved surfaces in order to install service connections to individual lots.

4. Telephone Distribution System

Where applicable the Owner shall cause the British Columbia Telephone Company to install its distribution lines underground, wherever new streets are being created except in I-1, RR-1, or RR-2 zones.

5. Street Lighting

(a) General

The Owner shall cause to be installed a complete ornamental roadway lighting system in every subdivision except in I-1, RR-1, or RR-2 zones. The installation shall include:

- (1) Services, service equipment and control equipment in kiosks.
- (2) Concrete foundations and anchor bolts for roadway light poles as shown on standard drawing no. 5.
- (3) Roadway lighting poles, luminaires, lamps, photo cells and photo cell brackets.
- (4) Painting of roadway light poles.
- (5) Everything necessary to provide a complete operating system.

Roadway light poles shall be provided at a maximum interval of 75 m, staggered on both sides of the roadway.

(b) Rules and Regulations

Equipment supply and 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 Department of Public Works, Province of British Columbia and all bulletins issued thereto. Work shall also be in accordance with all applicable Municipal codes and regulations, Provincial by-laws or statutes in effect at the time, and the Fire Marshall and Workmen's Compensation Act, hereinafter collectively 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 conflict between the rules and regulations and the drawings and specifications, the rules and regulations shall prevail.

(c) Materials

(1) General

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

(2) Conductors

Conductors shall be copper and if larger than 10 AWG shall be stranded. Conductor gauges shall be as shown on the drawings. Conductors run in rigid conduits or in the interior of roadway light poles shall have type TW insulation. Conductors run in polyethylene tubing shall have type TWU insulation.

(3) Conduit

Poly Vinyl Chloride (PVC) conduit shall be Scepter Manufacturing Co. Ltd., or as approved, rigid unplasticized polyvinyl chloride sizes as shown on the drawings. Couplings, adaptors and bends shall be of PVC, as manufactured by Scepter Manufacturing Co. Ltd., or as approved.

(4) Connectors

Insulated connectors shall be Scotchlok as manufactured by the Minnesota Mining and Manufacturing Co. Ltd., or as approved. For conductor combinations too large to use Scotchlok connectors, a solderless line connector shall be used, such as connector CL 2, manufactured by Thomas and Betts Ltd., or as approved. Bare copper lugs used for connecting ground conductors to ground studs in lighting pole hand holes shall be Thomas and Betts 54106 full compression lug or as approved. The connector serving a ground rod shall be a Burndy type GAR, or as approved.

(5) Roadway Lighting Poles

Poles shall be NAPCO Davit lighting poles #29180-110-00, single 3 m arm, 5° rise, with slip fitter tenon to suit mercury luminaire. Each pole shall be supplied with a handhole with cover plate and a .6 cm x 5 cm ground stud, complete with 2 nuts and 2 washers. Three shims shall be supplied with each lighting pole. One template shall be provided to permit accurate spacing of anchor bolts.

(6) Luminaires

Luminaires shall be 250 watt mercury vapour integral regulated output type dual primary (120/240 volt) thermally protected ballast. Luminaires shall be complete with 250 watt, colour corrected, mercury vapour lamps, ASA H37-5KC/C. Where specified on the drawings, luminaires shall be supplied with twist-lock receptacles to accept photo-electric control units.

(7) Photo-cell Units

Photo-cell units shall be cadmium sulphide type having externally adjustable sensitivity, and shall be provided with a twist-lock base to match the receptacle provided in the luminaire. Operating voltage shall be 120 volts, and an integrally contained control relay shall be capable to switching at least 1000 voltamperes. The action of the unit shall be such that in daylight the relay is energized, holding open its normally closed contacts. The unit shall have a built-in surge protector and a lightning arrester.

(8) Service Panels

Service panels shall be of the pole-mounting or kiosk type as shown on the drawings, and shall be constructed to the details shown on drawing no. 5.

(9) Ground Rods

Ground Rods shall be 2 cm diameter steel with hot forged point. Top ends shall be galvanized for a minimum distance of 25 cm for 2 m rods and 45 cm for 3 m rods.

(d) Construction

(1) Conductors

The conduit system shall be thoroughly cleaned to remove all foreign materials before conductors are drawn in. No conductor shall be drawn in any duct or raceway until all work of any nature that may cause injury to the conductor or its insulation has been completed. Care shall be exercised during the pull-in of conductors, and a competent mechanic shall be stationed at the feed end of any wire pulling operation to feed in the conductors. Conductors shall be guided to prevent twisting, kinking, or looping. Talc or a CSA approved lubricant only may be used to assist in the pulling operation. A minimum of 45 cm of conductor shall be left projecting above each concrete pole base.

(2) Splices and Terminations

Splices in the poles shall be made with connectors specified and approved for the combination of conductors being connected. Splices made with uninsulated connectors shall be insulated by serving the splice with half-lapped servings of electrical tape providing at least 6 layers of tape in all corners and projections of the connector. Neutral splices shall remain uninsulated.

Bonding conductors shall be connected to the ground stud provided with each pole, using the connectors specified. Conductors terminating at devices supplied with binding head screws shall be served with an insulated compression type solderless lug. Compression fittings shall be made only with the tool approved for use with the type and size of compression lug used. Splices and taps made at the pole base shall be pushed up inside the pole in such a manner that any moisture on the conductors will run away from the connections. Where possible the hole for the base shall be dug without disturbing the surrounding soil. If the soil remains firm and hole dimensions conform to those specified, no formwork need be used except for the top 20 cm of the base (40 cm at road side of base to provide for curb construction). Where formwork is required, a 60 cm tubular form of .3 cm thick hardboard may be employed as an alternative to wood. An accurate template shall be used to locate conduits and anchor bolts. The top of the base shall be trowelled smooth and level, and the edges shall be bevelled. Concrete shall have a compression strength of  $1.17 \times 10^6$  kg.mm<sup>2</sup> (4000 psi) after 28 days. Poles shall not be mounted until 7 days after pouring the bases. Before mounting poles, all formwork except the hardboard form shall be removed and backfill dug from the hole placed around the base and compacted with a mechanical tamper. After poles are raised, the shafts shall be plumbed, with devits at right angles to centreline of road. Poles shall be numbered as shown on the drawing on the side face of the pole to be viewed by a moving vehicle.

Shims shall be used where required, and bases then neatly grouted ensuring that drain holes are not plugged.

(3) Roadway Light Poles

Poles shall be erected plumb, using the shims supplied if required. Plumbing shall be done with a .6 m spirit attached to a proper size wedge to allow for taper of the pole. No more than 6 shims shall be used for any one pole. Threads of each anchor rod shall be liberally coated with Dearborn Chemical Co. No-Oxide grease, type G special, before pole erection. After the pole has been erected and plumbed and anchor nuts tightened to approximately 203.3 N.m torque, rods and nuts shall be completely covered with the grease. Arrangements shall be made by the Owner to de-energize high potential conductors that are too

close to roadway lighting poles during erection. The Owner shall be responsible for the care of other utilities, and in the event such utilities must be permanently removed, raised or lowered to avoid conflict with the roadway lighting poles, he shall make the necessary arrangements with the utility concerned. The cost of such removal, raising or lowering shall be at the expense of the Owner.

If temporary protection is required for erection of works where overhead conductors of 600 volts or less or telephone cables are in contact with or in danger of contacting roadway lighting poles or luminaires during erection, the Owner shall supply, install and securely fasten in place adequate polyethylene conduit sleeves.

(4) Luminaires and Lamps

Luminaires shall be securely fastened to the lighting poles and oriented to produce the required light distribution. The contractor shall estimate the month of turn-on of the roadway lighting system, and using a sharp file, shall mark the appropriate month coding on those lamps which are supplied with a date coding on the brass base.

(5) Grounding

A neutral block shall be supplied in each wire service breaker compartment to accept neutral wire of incoming service, wire connecting to utility system ground, and neutral wire of control circuit. The contractor shall install one or more ground rods at the two poles specified in subsection (6) (i) securing grounding wires to rods with connectors specified in subsection (c) (4).

(6) Painting

The contractor shall paint all poles with one coat of green finish paint specified by the Municipal Engineer and shall paint the control cabinet with two coats of the same paint. No painting shall be done unless surfaces are free of moisture (rain, dew, frost, or fog) or when the meteorological department predicts frost within 24 hours of the proposed painting. After the poles have been erected and plumbed and the control cabinet installed, the contractor shall wire-brush and touch up marks, scratches, and abrasions found in the prime coat, using primer paint as specified by the Municipal Engineer.

The contractor shall not apply the finish coat prior to the Municipal Engineer's approval of the prime coat.

(7) Tests

After conductors have been pulled in conduits and raceways, but before conductors are connected or spliced, they shall be checked for continuity and freedom from short circuits or ground faults. After completion of connections and splices, the conductors shall again be checked for continuity and freedom from ground faults. After energization of the lighting system, branch circuit currents shall be measured at branch circuit service point. The Municipal Engineer shall be notified if measured currents exceed calculated currents by 10 percent.

(8) Connection to BCH & PA Distribution System

After the roadway lighting has received the approval of the Electrical Inspector and the Municipal Engineer, the Municipality shall apply for service for said roadway lighting system. The Owner shall be charged by the Municipality for all connection and installation fees required by BCH & PA.

IV DRAINAGE

1. General

The drainage system shall be designed to serve the whole subdivision, including land, roads, and buildings, together with all drainage from the surrounding tributary area. Where the owner elects to enclose storm drainage the following is applicable including the pipe references.

Generally, all natural watercourses shall be maintained open; open ditches shall be installed to connect to such watercourses.

The drainage system shall be designed on the basis of the rational formula.

$Q = A \times I \times R$  where:

Q = amount of runoff in cubic metres per second

A = drainage area in hectares

I = intensity of rain fall expressed in centimetres per hour

R = runoff coefficient

Times of concentration of local rainfall intensity factors shall be based on 10 year rainfall curve as shown in drawing no. 10. In certain cases pipe sizes may already be established as part of an overall drainage system. Such sizes shall be obtained from the Municipal Engineer.

The runoff coefficient shall be 0.84 in urban areas and in rural areas as follows in Table C 1.

TABLE C 1 - RUNOFF COEFFICIENT

<u>Type of Surface</u>	<u>Coefficient</u>
Concrete or sheet asphalt pavement	0.8 - 0.9
Asphalt macadam pavement	0.6 - 0.8
Gravel roadway or shoulders	0.4 - 0.6
Bare earth	0.2 - 0.9
Steep grassed areas	0.5 - 0.7
Turf meadows	0.2 - 0.6
Forested areas	0.1 - 0.3
Cultivated fields	0.2 - 0.4

For flat slopes or permeable soil the lower value may be used. For steep slopes or impermeable soil the higher values shall be used.

(a) Pipes

Pipes shall be sized based on a roughness coefficient of Manning-n=0.013 to achieve velocities between .9 mps to 4.6 mps. The minimum pipe size shall be 25 cm on mains, 20 cm for catchbasin leads and 10 cm on service connections. The preferred minimum grade for service connections shall be 2 percent, but with the approval of the Municipal Engineer, minimum grades of 1.25 percent may be used, for particular circumstances.

(b) Manholes

Manholes shall be constructed to the same requirements as sanitary sewer manholes excepting that they shall not be water tight unless particularly required by the Municipal Engineer. They shall be spaced not more than 120 m apart and for pipes up to 45 cm in diameter, the manholes riser shall be not less than 30 cm greater than the outside diameter of the largest pipe at the manhole. Outside drop inlets shall be installed when the drop exceeds .6 m.

Drops shall be allowed in each manhole of not less than 3 cm for deflections in alignment of 90 degrees or less, and 6 cm for deflections over 90 degrees, or such greater amount as may be necessary to allow for all losses at the manhole.

(c) Service Connections

Service connections shall be provided for all lots or parcels and ends shall be capped.

(d) Minimum Cover

The minimum cover over the pipes shall be 2 m or such greater depth as may be necessary to adequately service the adjacent lots.

(e) Ditches

- (1) Where no enclosed drainage system is required, drainage shall be by means of open ditches located in the boulevard as shown on the drawing included in Schedule "A". Ditches in all cases shall be lower than the subgrade level, and shall be constructed as part of the subgrade preparation.
- (2) Where the drainage system is required to cross a highway or right-of-way, the ditch shall be enclosed by means of a culvert, the size, line or grade of which shall be shown on the drawings.
- (3) At the ends of each culvert, headwalls shall be constructed, together with aprons where the culvert exceeds 30 cm in size or where the grade exceeds 3 percent.
- (4) Ditches shall be provided on both sides of the roadway, a minimum ditch width at the bottom of 1 m. Ditch side slopes shall be at a two horizontal to one vertical slope.
- (5) Ditches shall drain to natural or created low points to provide surface drainage.
- (6) Drainage crossings of the roadway shall be made with galvanized corrugated iron pipe of sufficient size as approved by the Municipal Engineer to carry the drainage water and of a gauge to withstand highway loadings.
- (7) All road and drainage construction shall be the responsibility of the subdivider including the procurement of necessary permits, barricading and traffic control and all other things necessary during the period of construction.
- (8) Culverts may be either concrete or galvanized corrugated metal pipe designed to carry H.20 loading in accordance with ASSHO. Drainage design shall be for 30 year flood frequency in all the zones except I-1, RR-1, and RR-2 zones and shall be 10 year flood frequency in I-1, RR-1, and RR-2 zones. All culverts will be a minimum pipe size of 45 cm diameter, except where the Municipal Engineer is satisfied that a 30 cm diameter culvert will adequately carry the drainage waters.

2. Materials

(a) Pipes

Pipes shall be of concrete, conforming to American Society of Testing Materials (ASTM) designation C14 for extra strength concrete pipe in sizes 20 cm to 38 cm diameter. Pipes 45 cm in diameter and larger shall be reinforced concrete pipe manufactured by spinning process, conforming to ASTM designation C76, class 3, excepting that pipes for culverts in rural areas may be corrugated metal pipe, hot dipped galvanized.

(b) Bedding gravel

The bedding gravel shall be clean pit run or crushed gravel conforming to the grain size curve as shown on drawing no. 8.

(c) Manholes

Manhole risers shall conform to the requirements specified in Schedule "B", excepting that for pipes larger than 45 cm the diameter of the precast risers shall be increased to a minimum of the outside diameter of the sewer pipe plus 30 cm.

(d) Catchbasins

Catchbasins shall be of precast concrete with a minimum diameter of 60 cm and a depth sufficient to allow for a .3 m sump below the invert of the pipe. The minimum wall thickness shall be 7 cm and the precast lid shall be suitable for an H-20 highway loading with an opening to suit the frame and cover.

Precast spacers for use between the precast package basins and the bottom extruded curb and cast iron frame shall be precast, 5 cm thick.

Catchbasin frames and covers shall be cast iron as manufactured by Dobney Foundry, No. B-23, type D.

3. Construction

(a) Clearing and Grubbing

Clearing and grubbing shall conform to the requirements of clearing and grubbing as specified in Schedule "B".

(b) Protective Shoring

Protective shoring shall conform to the requirements for protective shoring as specified in Schedule "B".

(c) Excavation

Excavation shall conform to the requirements for excavation as specified in Schedule "B".

(d) Pipelaying

Pipelaying shall conform to the requirements for pipelaying as specified in Schedule "B".

(e) Service Connections

Wyes for service connections shall be located as shown on drawing no. 6 and arranged as shown on drawing no. 13 except markers shall be painted green. Excavation, bedding, pipelaying and backfilling shall be done as specified for the pipe mains.

(f) Manholes

Manholes shall be constructed as required for sanitary sewers, specified in Schedule "B" excepting that they are not required to be watertight.

(g) Catchbasins

The excavation for catchbasins shall be made sufficiently large to permit the placing of the precast basin sections. The bottom of the excavation shall be cleared of all loose and soft material before placing the precast sections.

(h) Backfilling

Backfilling shall conform to the requirements for backfilling as specified in Schedule "B" for sanitary sewer system.

(i) Clean-up

All surplus material, equipment, tools, coverings, lumber, waste concrete, excess excavated material, rocks or boulders and all other rubbish resulting from the construction shall be removed from the site immediately after completion.

4. Testing

Piped drainage systems shall be checked by lamping, but not for exfiltration or infiltration.

Storm drains shall be cleaned by flushing to remove all sand, dirt and foreign materials from the manholes and catchbasins.

5. Connections to Existing Systems

Connections to any existing system shall not be made until they have been flushed to the satisfaction of the Municipal Engineer in order to prevent dirt and foreign materials being carried into the Municipal system already in service.

B

SCHEDULE "B"

SANITARY SEWERAGE SYSTEM

1. Design Criteria

(a) Design Flows

Average design flows for single family residential areas shall be computed using a density of 40 persons per hectare and 455 litres per capita per day. A peaking factor based on the Greater Vancouver Sewerage and District of Surrey Sewerage Survey peaking factor curve as shown on drawing no. 7 shall be used. For other zonings the densities to be used shall be as required by the Municipal Engineer.

(b) Pipe Sizing

Pipes shall have a minimum size of 20 cm diameter.

Pipes shall be sized based on a roughness co-efficient of Manning-n= 0.013 to achieve velocities of not less than .6 m per second nor more than 3.7 m per second at full bore. The minimum grade for service connections shall be 2 percent excepting that in special circumstances a grade of 1.25 percent will be acceptable. The design of service connections for use other than single family dwellings shall be submitted to the Municipal Engineer for approval.

(c) Manholes

Manholes shall be placed at all changes in grade and alignment and at a maximum interval of 120 m. Outside drop manholes shall be provided when the drop exceeds .3 m. For drops lesser than .3 m a ramped, benched inlet is acceptable. Manholes shall be constructed at the upper end of all lines.

(d) Minimum Cover

The minimum cover shall be 2 m to permit service connections to cross over them or at such greater depth as may be necessary to afford adequate depth for servicing the adjacent lots.

(e) Manhole Drops

At all manholes, drops shall be provided across the benching; such drops shall be not less than 3 cm for deflections in alignment of 90° or less and 6 cm for deflections greater than 90°.

(f) Service Connections

A sanitary sewer service connection shall be installed to each property at an elevation that will provide drainage at basement floor level. Minimum size of a service shall be 10 cm. Minimum installed grade on service pipe shall be 2 cm per metre.

2. Materials

(a) Pipes

(1) Pipe and Fittings

Sewer pipe and fittings employed on mains shall be either asbestos cement pipe, vitrified clay pipe, plastic pipe, or concrete pipe as described below.

Asbestos cement pipe shall be Class 2400, Type 11, non-pressure sewer pipe in accordance with ASTM Designations C 428-65 and D 1869-63T.

Plastic pipe shall be Blue Brute, SDR-35 Type.

Clay pipe shall be extra strength in accordance with ASTM Designations C 200-65T and C 425-64. Clay pipe shall be ceramic glazed.

Concrete pipe shall be in accordance with ASTM Designations C 14-65 and C 443-65.

Pipe shall, in addition to the above, be specified to meet the actual installed loading conditions. Concrete pipe larger than 45 cm diameter shall be reinforced.

10 cm and 15 cm diameter service connection pipe shall be either asbestos cement or vitrified clay or plastic to the same specifications as sewer pipe above.

(b) Bedding Gravel

The bedding material shall be clean pit run or crushed gravel conforming to the grain size curve drawing no. 8.

(c) Manholes

Manholes shall conform to the typical details shown in drawings no. 9, 10, and 11. Manholes shall, unless otherwise specified, be of preformed 107 cm inside diameter reinforced concrete, conforming to ASTM specification C 67 and having a minimum 11.4 cm wall thickness, complete with 2 cm galvanized steps at 30.5 cm centres. Concrete lids shall be designed to withstand H-20 highway loading conditions. Alternatively, a tapered pipe section shall be used if requested by the Municipal Engineer. Base shall be  $5.85 \times 10^3 \text{ kg.mm}^2$  (2000 psi) concrete with minimum thickness of 15 cm. Brickwork shall be one to three courses of bricks used to support the cast iron frame and cover. Manhole frames and covers shall be of cast iron, conforming to ASTM 448, as manufactured by Mainland Foundry to pattern 3R-13 and 12A. Bearing surfaces between the frame and cover shall be machined. The clear opening in frames shall not be less than 50 cm. Covers shall be embossed, in letters 5 cm high by .6 cm deep, the word SEWER. The surface of the lettering shall be flush with the remainder of the pattern embossed on the lids. Two pick-holes 2.2 cm in diameter shall be cored in each cover.

3. Construction

(a) Clearing and Grubbing

All sewer alignments shall be cleared and grubbed to a sufficient width to allow for proper installation of the system components. Where sewer alignments traverse virgin areas, care shall be taken to ensure that the cleared strip is only wide enough to permit proper excavation and temporary storage of excavated material. All necessary precautions shall be taken to preserve the indigenous aesthetic values of the location. Waste material shall be disposed of in a manner approved by the Municipal Engineer.

(b) Protective Shoring

Where required, protective shoring shall be used in accordance with the regulations of the Workmen's Compensation Act.

(c) Excavation

Trenches shall be excavated to a true line and to a depth at least 7 cm below the bottom of the pipe. All loosened material shall be removed from the trench. If, in the opinion of the Municipal Engineer, the subgrade is soft and inadequate to support the pipe, the Owner may be instructed to overexcavate and backfill the overexcavated portion with compacted bedding gravel or to use concrete cradling. The trench bottom width shall be not less than the pipe outside diameter plus 60 cm. See drawing no. 12. Excavated material shall not be side cast unless such approval is given by the Municipal Engineer.

(d) Bedding and Pipelaying

All pipe shall be handled in a manner to avoid damage; damaged pipe shall not be used. All pipelaying shall commence at the low end of the section and proceed toward the higher end. A minimum of 7 cm of bedding gravel shall be compacted in place along the full width of the trench bottom (unless the Engineer has elected concrete cradling). Bell holes shall be dug, if required, such that the full length of the pipe barrel is evenly supported on the bedding gravel. The pipe shall be laid to line and grade by use of sight rails erected over the trench at intervals no more than 15 m. A minimum of 3 sight rails shall be in place at all times. The line and grade shall be checked after placing each pipe. After the pipe is laid to line and grade, gravel bedding shall be hand placed and compacted in maximum 15 cm lifts to the springline of the pipe.

(e) Backfilling

Selected material containing no stones larger than 5 cm shall be hand placed and compacted in maximum 15 cm lifts to a point 30 cm maximum above the top of the pipe. The remainder may be backfilled by machine, but no stones larger than 15 cm diameter, nor any organic matter may be permitted in the backfill. Under travelled portions of roads, lanes, etc., the machine backfill must be done with selected material in maximum 30 cm lifts, compacted to 95 percent Proctor with a powered vibratory compactor to the subgrade elevation. In the case of existing roads, the balance of the trench shall then be restored to at least the equivalent of the original condition. If, in the opinion of the Municipal Engineer, the native backfill material is not suitable, the Owner may be directed to import suitable backfill material. All asphalt pavement cuts or breaks shall be widened or trimmed to a straight uniform edge prior to patching. The initial asphalt patch may be "Hot Mix", or "Cold Mix", but final patching shall be done with "Hot Mix" after the final trench settlement has taken place. In areas where trench settlement is not of prime importance, i.e., easements, boulevards, etc., or any other areas so designated by the Municipal Engineer, the backfill may be mounded over top of the trench in anticipation of future subsidence, provided that prior to acceptance of the work, all excess material shall be removed.

(f) Service Connections

All main pipe and service pipe shall be installed on granular bedding material.

Service junctions to the main shall be made using wyes. (No pipe shall be tapped for the connection of service pipe at the main).

Service connections shall be capped at property line with a waterproof cap until such time as the service is continued from the property line to the building.

Service terminus at property line shall be marked with a 5 x 10 cm stake extending vertically from the pipe invert to .3 m above ground surface. The depth from the top of stake to the pipe invert is to be marked on the stake above ground level.

Wyes for house connections shall be placed as shown on attached drawing no. 13. Excavation, bedding, pipelaying and backfilling of sewer main to the property line shall be done in the same manner specified for sewer mains in this Schedule. Include a Wye and capped standpipe .3 m outside the property line for a cleanout to service each house connection.

(g) Manholes

The excavation for manholes shall be made sufficiently large to permit

the proper forming and pouring of base slab. The bottom of the trench shall be cleaned of all loose and soft material before pouring the base. The sewer pipes shall be laid continuously through the manhole and set to elevation and line by using concrete bricks for support. A square concrete base shall then be poured to a depth at least 15 cm below the bottom of the pipe and to the springline of the pipe. When placing the initial course of the precast risers, care shall be taken to ensure that the weight of the riser does not bear on the pipe. The pipe shall then be cut along the springline for the full inside width of the manhole and the top section of the pipe removed. Benching and finishing of the manhole shall be done in accordance with drawing no. 9, 10, and 11, and particular care shall be taken to ensure that the manhole is water tight.

(h) Construction Tolerances

- |                  |           |   |
|------------------|-----------|---|
| (1) Sewer Pipes: | Elevation | 1.3 cm.   |
|                  | Alignment | 1/10 of pipe diameter<br>but shall not exceed<br>5 cm |
| (2) Manholes:    | Alignment | 5 cm  |
- Manhole frames shall be set as part of road construction to conform to the road grade and crowning.

4. Testing

(a) General

The owner shall test the sewers during the progress of the work, and prior to acceptance of the work. He shall provide all materials, water, plant and equipment necessary to conduct the test. The length of untested gravity sewers shall not exceed 60 m at any time, unless otherwise approved by the Municipal Engineer. All water shall be disposed of in a manner that will not cause nuisance, injury, loss or damage.

(b) Gravity Sewers

(1) Initial Test

Prior to backfilling, all pipe, including service connections, shall be pressurized with air to 10 cm of water column, when the leakage rate shall not exceed 2.5 cm of water column in 5 minutes.

(2) Testing

On completion of backfilling, manhole construction and service connection installation between consecutive manholes, sewer pipe shall be cleaned by flushing or the use of mechanical equipment as necessary to remove all foreign material from the pipe and manholes.

All sanitary sewers, other than service connections, shall be lamped from manhole to manhole to check alignment and grade of the main sewer pipe.

Lamping shall be carried out by employing lights or mirrors or, if necessary, by pulling a suitable light through the sewer pipe from manhole to manhole.

Variation in line or grade or pipe, and any jointing, pipe cleaning or other deficiencies discovered during the inspection shall be rectified by the Owner.

During this test, manhole construction in general and invert elevations shall be checked and any variations from the established elevations, drawing, or specifications shall be rectified by the Owner.

Leakage tests shall be carried out on all installed sewers.

Tests for leakage shall be either infiltration or exfiltration tests. Where the surface level of existing groundwater in the backfilled trench is 1 metre or more above the top of the pipe over the entire test section, an infiltration test may be used to determine leakage to the pipe. Where the groundwater surface level is less than 1 m above the top of the pipe, or where groundwater at time of testing is not apparent, exfiltration tests shall be employed.

Main sanitary sewers and service connections, manholes and appurtenant structures thereon shall be constructed such that the leakage as evidenced by exfiltration or infiltration tests is less than that calculated using the following formula.

$$\text{Allowable leakage in imperial gallons} = \frac{HDL}{500}$$

Where H = duration of tests in hours  
D = inside diameter of pipe  
L = length of pipe in test section

The above leakage limit shall constitute the total maximum allowable leakage of any test section of sanitary sewer. Where service connections exist along the test section, the allowable leakage from the service pipe calculated by use of the above formula shall be added to that of the main sewer to arrive at the total allowable leakage. No additional leakage allowance shall be made for manholes existing along the test section.

(c) Manholes

Manholes shall be tested by filling them with water to grade or to a maximum of 2.4 m above invert when there shall be no measurable leakage.

5. Connections to Existing Sewers

The Owner shall clean all sewers by flushing or other means to remove all sand, dirt or foreign materials from the sewer pipe or manholes. Connections to the existing system shall not be made until all sewers have been tested and flushed to the satisfaction of the Municipal Engineer. If requested by the Municipal Engineer, plugs shall be installed until road construction is completed to prevent the eroding of material into the downstream system.

6. Clean-up

Clean-up shall conform to the requirements of Schedule "A".

SCHEDULE "B1"

SERVICES IN I-1 ZONES

1. Requirements

In I-1 zone, where the parcel being created is less than 2 hectares in area, the owner shall measure the percolation rate, the ground slope and the depth of porous soil above the water table. These measurements shall be compared with the appropriate table hereunder and the parcel shall be sized accordingly. The tests shall be taken and measurements made by an Officer of the Department of Health, a land surveyor or an Engineer, and copies of the results of the test shall contain the signature, occupation and address of the person undertaking the test and shall accompany the plans of the proposed subdivision when it is submitted for approval to the Clerk of the Municipality.

Provided, however, if the subdivider of the land connects the subdivided parcel to an existing sanitary sewer, any parcel exceeding 930 m<sup>2</sup> may be created.

APPENDIX

1. The area of soil required for sewage disposal shall not be smaller than the following according to the percolation rate for that area of soil:

Percolation Rate Min/2.54 cm (inch)	Less than 5	under 5 - 10	under 10 - 15	under 15 - 20	under 20 - 25	under 25 - 30
Area of Soil m <sup>2</sup> (sq. ft.)	92.9 (1000)	139.4 (1500)	185.8 (2000)	232.3 (2500)	278.7 (3000)	325.2 (3500)

When the percolation rate is 30 minutes, 2 hectares is required.

2. Depending on the slope measured from the uppermost point of the area of soil meeting the requirement of item 1 of this Appendix to the lowest point of that area of soil that area shall be increased in size in a location downhill from that area of soil according to the following.

Steepest Slope in Degrees	Less than 10	For each 5 degrees or part thereof for 10 degrees and over
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Area of soil to be added in m <sup>2</sup>	0	46.5 m <sup>2</sup>
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3. Yet a further increase in the size of the area of soil meeting the requirements of item 1 of this Appendix that is required to be made to the total area required in items 1 and 2 of this Appendix depending on the depth of porous top soil above the water table is as follows:

Depth of porous soil above the water table	More than 1.2 m	under 1.1 m - 1.2 m	under .9 - 1.1 m	under .8 - .9 m
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Area of soil to be added m <sup>2</sup>	0	46.5	92.9	139.4
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When the depth of porous top soil above the water table is .8 m or less, 2 hectares are required.

4. The area of soil required for sewage disposal shall be capable of meeting the siting requirements for absorption fields in the "Regulations Governing Sewage Disposal".

SCHEDULE "C"

WATER SYSTEM

1. Design Criteria

A system of water distribution piping shall be provided complete with valves, hydrants, service connections and appurtenant structures.

In general, the complete distribution design and construction shall conform to the following minimum requirements. Actual design, materials, and construction specifications shall be to the approval of the Municipal Engineer.

The water distribution system shall be designed according to the following minimum standards:

Average daily per capita consumption	455 litres
Minimum daily per capita demand	1,137 litres
Maximum peak per capita	1,818 litres
Fire demand	In accordance with the standard Municipal Fire Protection as published by the Canadian Underwriters Association

Design shall be based on the assumption that the fire demand can be coincidental with maximum daily demand.

Minimum and maximum pressures throughout the subdivision shall be to the approval of the Municipal Engineer. If required within the subdivision, the Applicant shall install pressure reducers and/or booster pump station.

Water mains shall be installed in trenches separate from sanitary sewer mains.

Fire hydrants shall be located in general such that all buildings in a residential area can be reached with a hose length of 90 m or less, and a hose length of 76 m or less in a commercial zone. Hydrants shall, where possible, be located at road intersections.

A service connection shall be provided for each property. The minimum size of service shall be 2 cm diameter. Water service connections may be installed in the same trench with the sewer service connections but must conform with any requirements imposed by the Department of Health.

Minimum cover on water service connection from the main to the property line shall be 2 m.

Services shall be provided with approved corporation valves at the main and curb stop and drain with service box at the property line.

The water main sizes shall be 20 cm diameter, excepting that, in short cul-de-sacs where there is no fire hydrant required and which are dead-ended, then the size may be reduced to 20 cm diameter. If a larger pipe size than 25 cm is required, then the Municipality shall pay the additional cost for such larger pipe.

The water system shall be designed as a loop system and the maximum length of dead-end main shall be 152 m. All mains shall be continued to the extremity of the subdivision to facilitate future extensions where such are anticipated.

Isolating gate valves shall be installed, either so that the distance between them shall be not greater than 24 m or provide service for not more than 20 residential lots between valves; generally 2 valves shall be installed at each valve location.

The pipe shall be installed with a minimum cover over the top of the pipe of 2 m and at a minimum grade of 0.1 percent and so that the minimum clearance between any water main crossing over or under other pipes shall be 30 cm.

Where pipe grades are in excess of 20 percent and the length of run exceeds 90 m, then the pipe shall be suitably anchored to prevent any movement. If the grade exceeds 40 percent then the anchoring shall be installed regardless of the length of the run.

Air release valves shall be installed at summit points and blow offs shall be installed at dead ends excepting that if a hydrant is installed within 15 m of the dead end, no blow off shall be required.

Generally, all fittings shall be of the hub type and where required to be fitted with tie rods, the lugs shall have suitable cored holes; lugs that are of the U type are not acceptable. Valves and other appurtenances requiring valve boxes shall be located so that they are located clear of curbs.

The allowable pressure range within any subdivision shall be within  $1.2 \times 10^4$  kg.mm<sup>2</sup> (40 psi) to  $2.9 \times 10^4$  kg.mm<sup>2</sup> (100 psi). The Owner on request will be supplied with sufficient data to ensure that the design of his system meets this criterion. Should the pressure range vary 10 percent above or below the allowable limit, then a suitable pressure regulating station shall provide not less than 2 m headroom and shall be of concrete construction.

## 2. Materials

### (a) Pipe

Water mains shall be either asbestos cement, or plastic conforming to the following specifications:

- (1) Asbestos cement pipe shall be in accordance with AWWA Specification C 400-64T. Pipe shall be Class 150 except where pressure or loading conditions require stronger pipe.
- (2) Plastic pipe shall be C 900 PVC.

### (b) Fittings

Fittings shall be cast iron either flanged or "Terc-O-Tite" or "Titon" as required to suit the pipe. Where required to have tie rods, fittings shall be fitted with lugs with cored holes.

### (c) Gate Valves

Gate valves shall be flanged or hubbed as required and shall conform to AWWA Specification C 500; they shall be complete with 5 cm square square operating nuts.

### (d) Valve Boxes

Valve boxes shall be Terminal City NT type or as otherwise approved by the Municipal Engineer.

### (e) Fire Hydrants

Fire hydrants shall be Terminal City Iron Works Type 1. They shall be designed for a minimum cover of 2 m and shall be subject to a

hydrostatic test of  $8.78 \times 10^4 \text{ kg.mm}^2$  (300 psi) and fitted with threads conforming to B.C. Standard requirements.

(f) Air Release Valves

Air release valves shall be of the double acting type, Terminal City Iron Works AV22.

Fittings, bushings and unions used in the assembly shall be brass, manufactured to American Standards Association (ASA) Specification A40-2, using ASTM B-62 bronze. Nipples shall be standard bronze and threaded at both ends.

(g) Bedding Gravel

The bedding material shall be clean, well graded or crushed gravel conforming to the grain size curve shown on drawing no. 8. If the trench conditions are dry and otherwise suitable, sand bedding may be used, subject to prior written approval of the Municipal Engineer.

(h) Service Connections

Service connection pipes shall be not less than 2 cm diameter, type K soft copper. For services larger than 2 cm diameter, the material to be used shall be approved by the Municipal Engineer. Extension service boxes shall be McAvity W-6220.

Corporation stops shall be Mueller A-225 or approved equal with thaw wire connectors as required.

Curb stops shall be adjustable Mueller A-726 or approval equal, with drain.

Curb boxes shall be adjustable cast iron having a sidewalk pattern top casting.

3. Construction

(a) Clearing and Grubbing

As specified in Schedule "B" for drainage system.

(b) Protective Shoring

As specified on Schedule for drainage system.

(c) Excavation

The trench shall be excavated to a true line and to a depth 15 cm below the bottom of the pipe for asbestos cement pipes and to a depth 7 cm below the pipe for cast iron pipes. If, in the opinion of the Municipal Engineer, the subgrade is soft and inadequate to support the pipe, the Owner shall be instructed to overexcavate and backfill the overexcavated portion with bedding gravel, or to use concrete cradling. The trench bottom width shall not be less than the pipe outside diameter plus 30 cm or more than the pipe outside diameter plus 60 cm.

(d) Bedding and Pipelaying

All watermains shall be laid in bedding material. Asbestos cement pipe shall have a minimum of 15 cm of bedding material below the pipe barrel and compacted in maximum 15 cm lifts to a minimum 30 cm above the top of the pipe. Cast iron pipe shall have a minimum 7 cm bedding material under the pipe barrel and be compacted to the springline of the pipe. Bedding material shall be compacted in place over the full width of the trench bottom. Tolerances shall be:

- (1) Elevation - 2.5 cm      (2) Alignment - 7 cm

(e) Backfilling

As specified in Schedule "B" for drainage system.

(f) Fire Hydrants

Gate valves shall be installed on hydrant leads and shall be secured against blowing off by 1.6 cm steel tie rods. Hydrants shall be installed with the stem vertical. A minimum 15 cm of bedding gravel shall be compacted in place for the full width of the trench under the hydrant assembly, to serve as a sump as well as for bedding. The bedding gravel shall be carried to the springline for cast iron pipes and to 30 cm above the crown for asbestos cement pipes. The installation shall conform to the typical drawing no. 14. Tolerances shall be:

- (1) Elevation - 2.5 cm      (2) Alignment - 7 cm

(g) Gate Valves

Valves shall be supported independently of the pipe. Telescopic valve boxes shall be set over each valve. Adjustment of valve boxes to suit finished grade shall form part of roadworks, Schedule "A".

(h) Air Release Valves and Blow-offs

Air release valves as blow-offs shall be installed as shown on drawings no. 15 and 16.

(i) Thrust Blocks

Thrust blocks shall be provided on line valves, crosses, bends, and caps, etc. Their sizes shall be calculated on the basis of undisturbed soil bearing strength of  $4.4 \times 10^5 \text{ kg.mm}^2$  (1500 psi). On fittings 30 cm in diameter, or less, sizes of thrust blocks may be in accordance with drawings no. 17 and 18.

(j) Pressure Test

Hydrostatic pressure tests shall be conducted after all mains and service connections have been completely installed and backfilled. The duration of each test shall be a minimum of 2 hours, and the test section shall be subjected to a pressure of  $4.4 \times 10^4 \text{ kg.mm}^2$  (150 psi) or  $1\frac{1}{2}$  times the operating pressure, whichever is greater. The allowable leakage for the test section will be calculated using the formula  $L = \frac{ND/P}{4440}$

in which: L is the allowable leakage in GPH  
N is the number of joints in test section  
D is the nominal pipe diameter  
P is the test pressure

No allowance shall be made for service connection leakage.

(k) Service Connections

Service connections shall be installed as shown on drawing no. 19 at locations shown on drawing no. 6..

(l) Flushing

Upon completion of backfilling and satisfactory performance of all pressure tests, the water system shall be thoroughly flushed clean prior to and after the disinfection of the mains.

(m) Disinfection

All water mains, appurtenances and house connections installed to service the subdivision will be disinfected in accordance with current AWWA Specifications. Disinfection shall be completed to the satisfaction of the Municipal Engineer before the works are placed in service.

(n) Clean-up

Clean-up shall be completed as specified in Schedule "A".

(o) Connections to the Existing System

Connections to the existing system shall be made by the Village at the cost of the Owner after all pipes have been tested, disinfected and flushed to the satisfaction of the Municipal Engineer; the materials required for the connection shall be furnished by the Owner.

SCHEDULE "D"

THIS INDENTURE made the

day of

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BETWEEN:

(hereinafter called the "Grantor")

OF THE FIRST PART

AND:

VILLAGE OF GRANISLE, a Municipal Corporation,  
having its municipal offices at Granisle, in  
the Province of British Columbia.

(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 Village of Granisle, in the Province of British Columbia and being more particularly known and described as:

(hereinafter called the "Lands of the Grantor")

AND WHEREAS to facilitate the installation of a system of water-works, sewerage-works and water drainage-works the Grantor has agreed to execute these presents;

NOW THEREFORE THIS AGREEMENT WITNESSETH that in consideration of the sum of ONE DOLLAR (\$1.00) 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 other valuable consideration;

1.0 THE GRANTOR DOETH HEREBY:

1.1 Grant, convey, confirm and transfer, in perpetuity, unto the Grantee the full, free and uninterrupted right, license, liberty, privilege, permission and right-of-way to lay down, install, construct, entrench, operate, maintain, inspect, alter, remove, replace, bury, use and otherwise establish one or more systems of water-works for the distribution of water, sewerage-works for the collection, conveyance and disposal of sewage and drainage-works for the impounding, conveying, discharging of surface and other waters, or all three, or a combination of all three UPON, OVER, UNDER AND ACROSS part or parts of the Lands of the Grantor as shown outlined in red on Plan number

(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, contractors and all other licensees of the Grantee together with machinery, vehicles, equipment, and materials be entitled at all times to enter, use, pass and repass, labour, 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;

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.

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

systems 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 systems 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 systems installed in the Perpetual Right-of-Way and in particular without in anyway limiting the generality of the foregoing will not construct open drains or ditches along or across any of the systems 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.

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

4.1 The said systems referred to in paragraph 1.1 above, together with all pipes, valves, conduits, casings, fittings, lines, meters, appliances, attachments or devices used in connection therewith shall constitute the "Works" (and are hereinbefore and hereinafter so described);

4.2 Notwithstanding any rule of law or equity to the contrary, the Works brought on to, set, laid, erected in, upon or under 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 this 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 interest:

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 severel as well as joint;

4.8 This Agreement shall enure 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 used, 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 contest 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.

SIGNED, SEALED AND DELIVERED )  
by the Grantor this )  
day of 198 )  
in the presence of: )

\_\_\_\_\_  
Signature of Witness )

\_\_\_\_\_  
Address )

\_\_\_\_\_  
Occupation )  
(as to all signatures of )  
Grantor) )

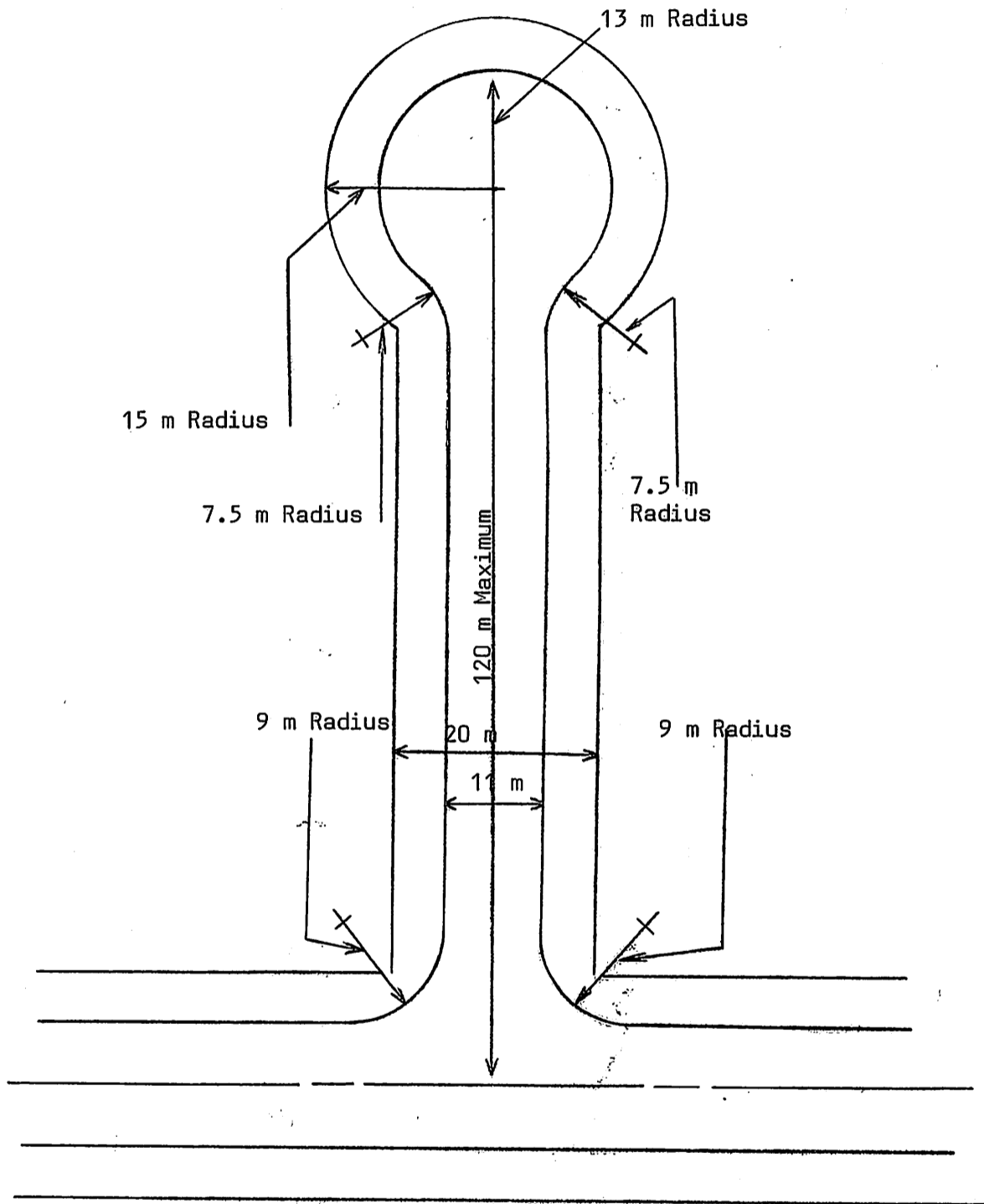
The Corporate Seal of the )  
Grantor was hereunto affixed )  
this day of )  
198 in the presence of: )

\_\_\_\_\_  
\_\_\_\_\_  
)

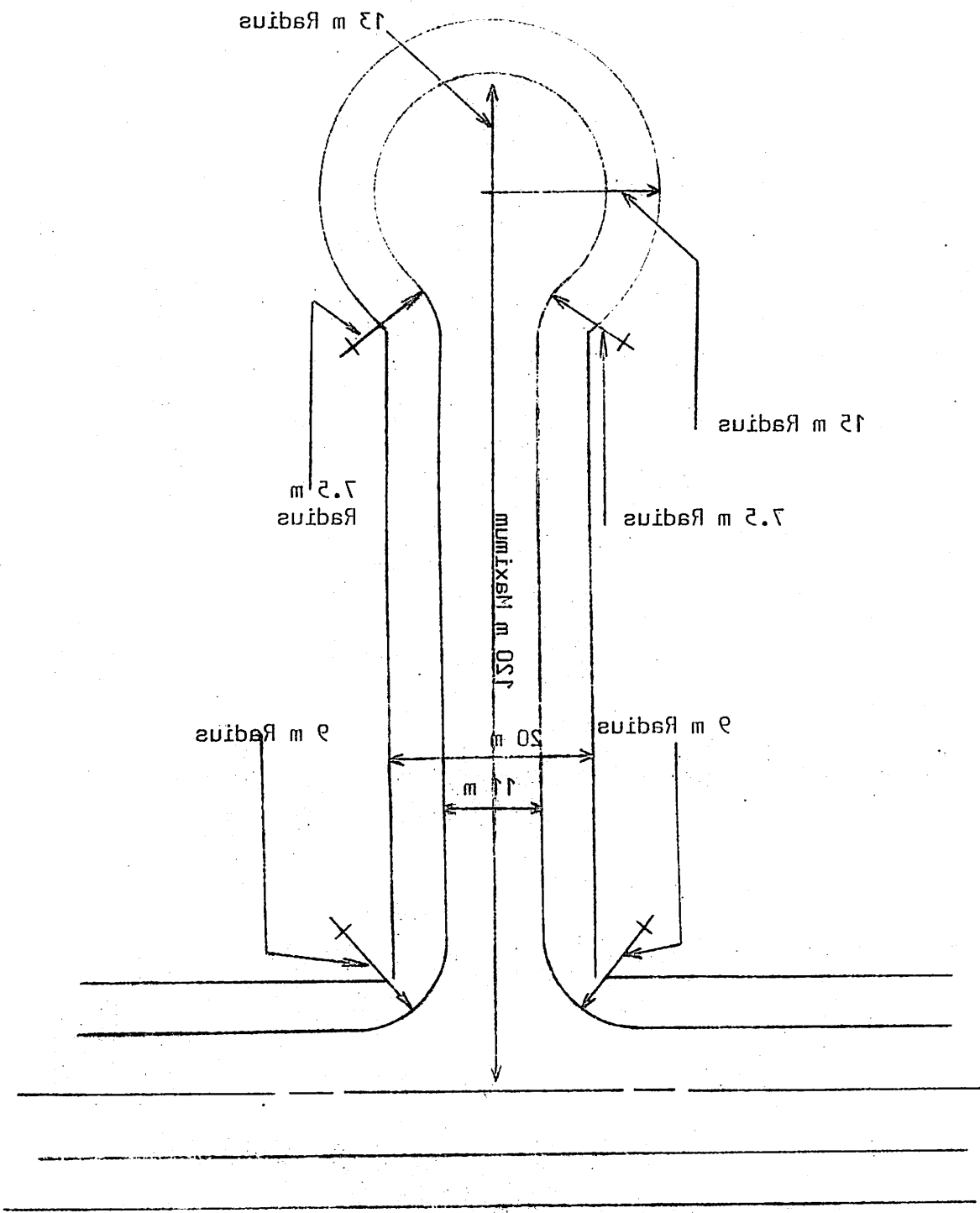
The Corporate Seal of the )  
Village of Granisle was )  
hereunto affixed this )  
day of 198 )  
in the presence of: )

\_\_\_\_\_  
Mayor )

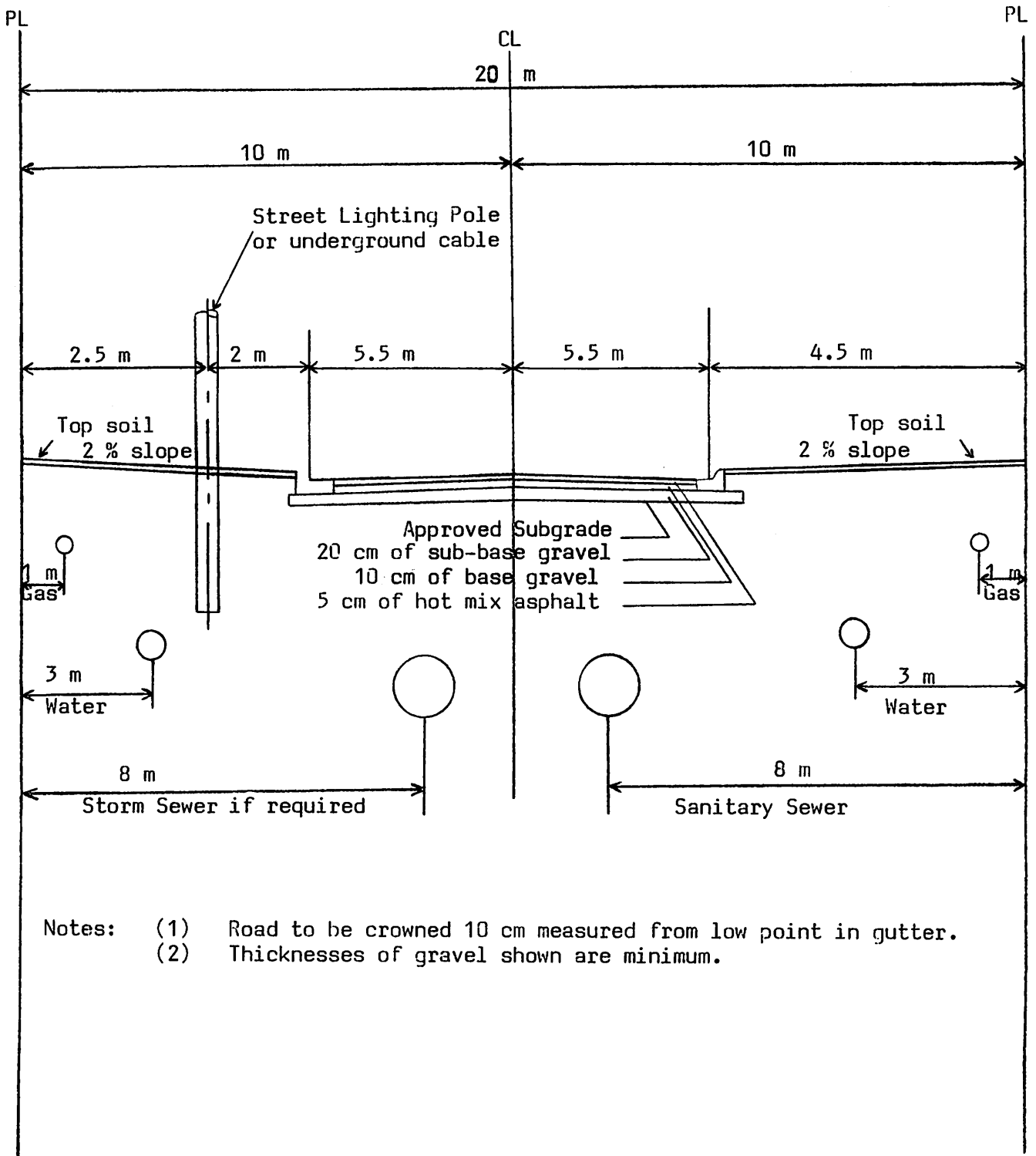
\_\_\_\_\_  
Clerk )



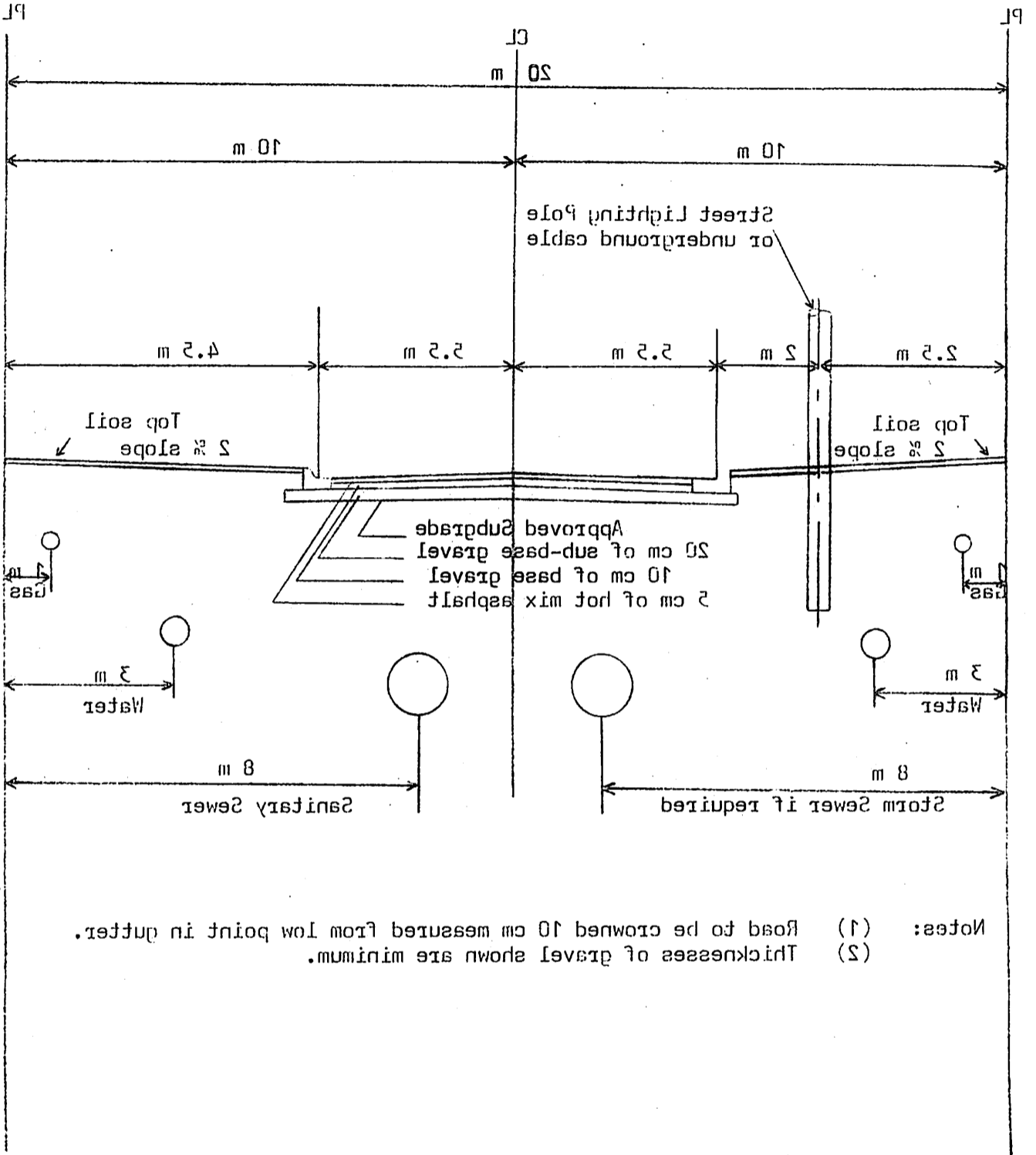
Drawing No. 1



Drawing No. 1

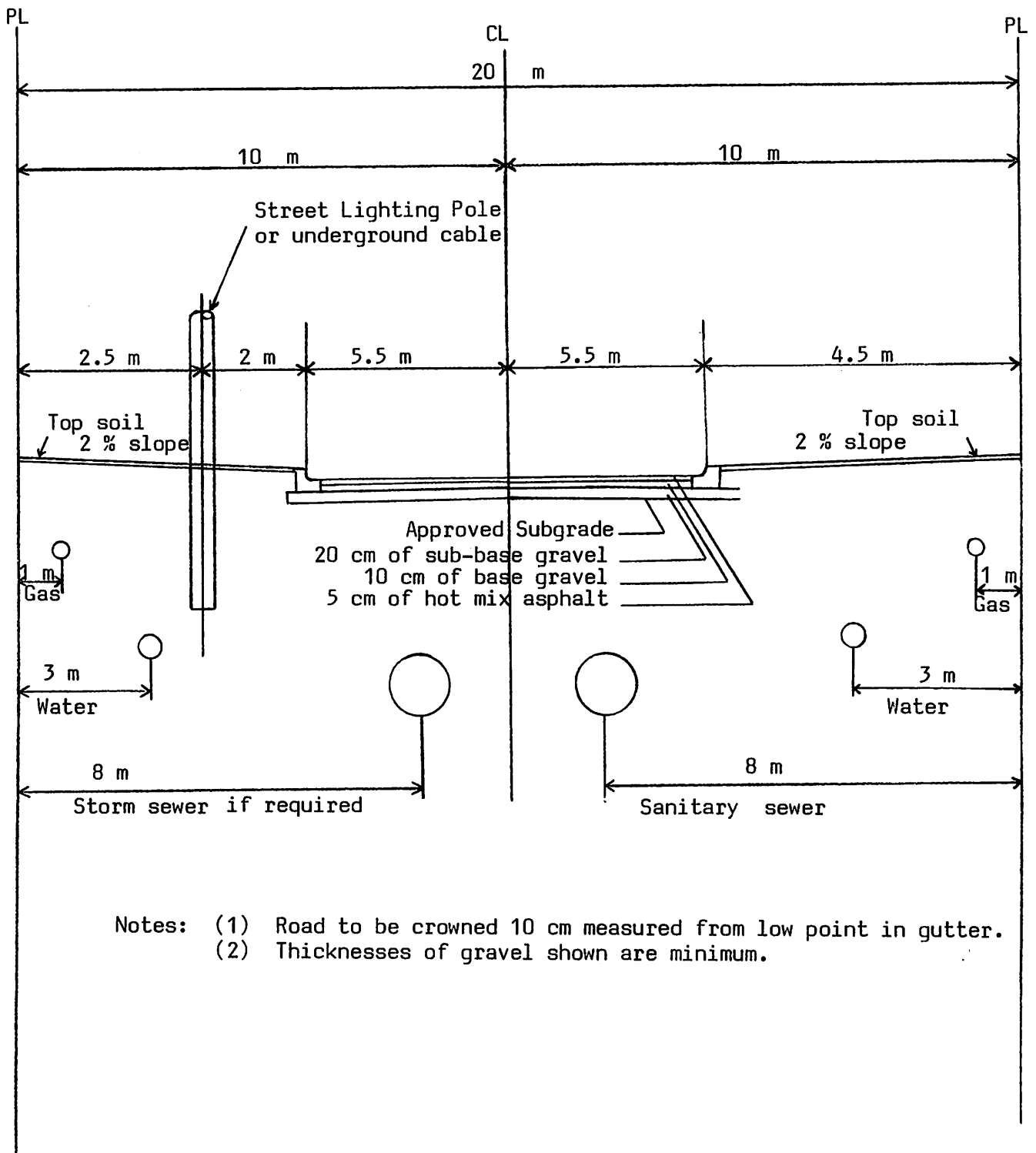


Drawing No. 2



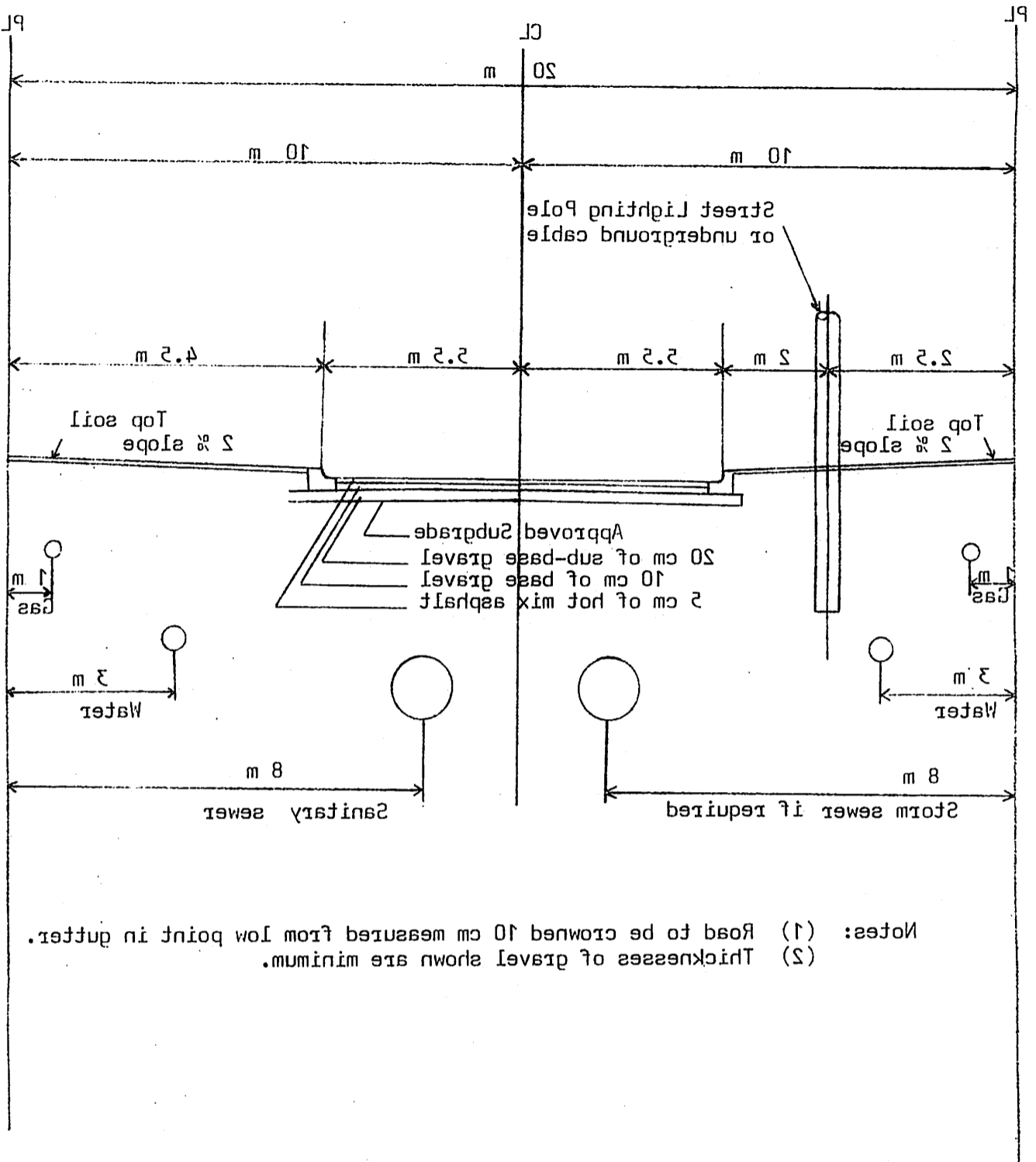
Notes: (1) Road to be crowned 10 cm measured from low point in gutter.  
 (2) Thicknesses of gravel shown are minimum.

Drawing No. 2



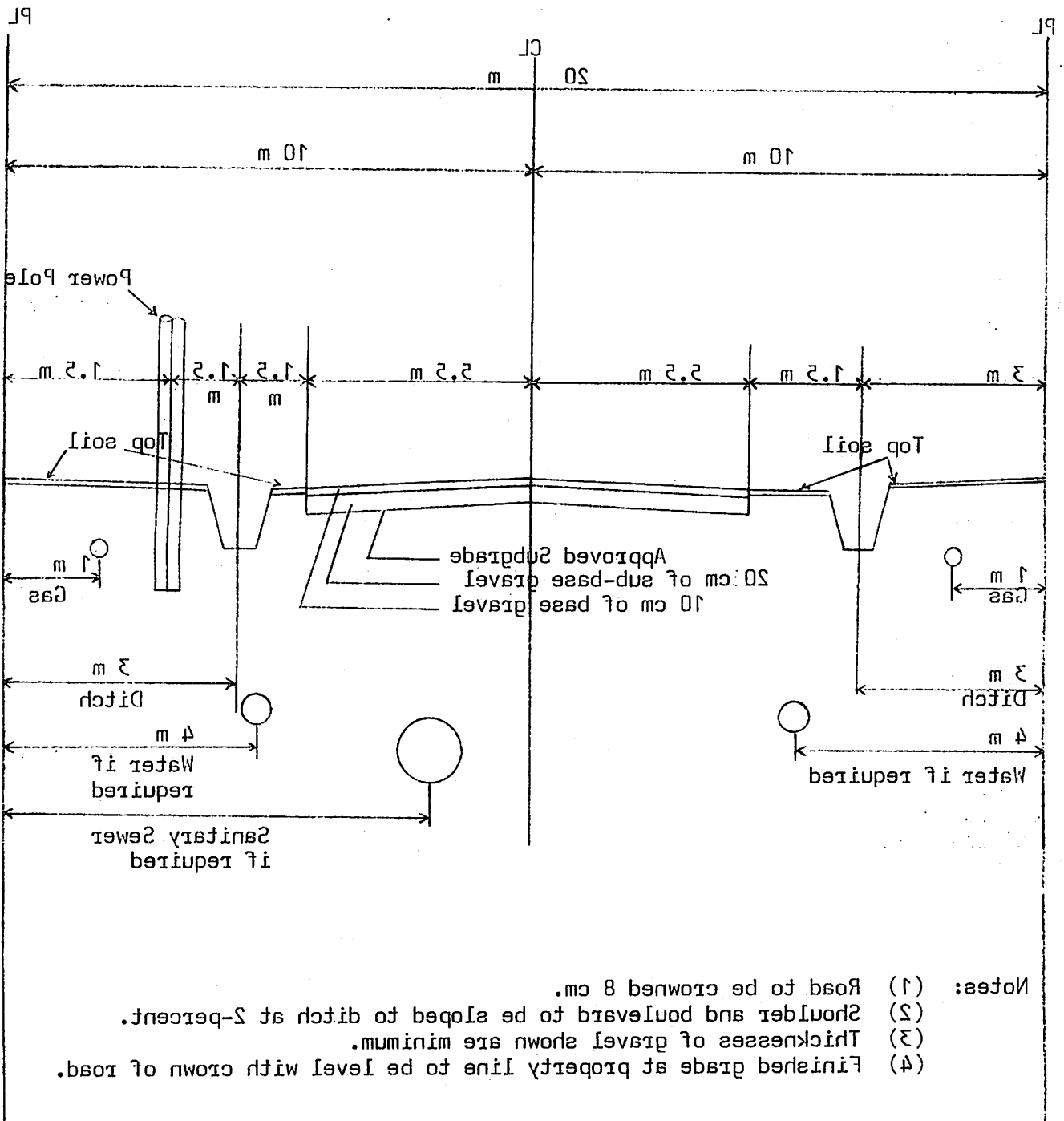
- Notes: (1) Road to be crowned 10 cm measured from low point in gutter.  
(2) Thicknesses of gravel shown are minimum.

Drawing No. 3



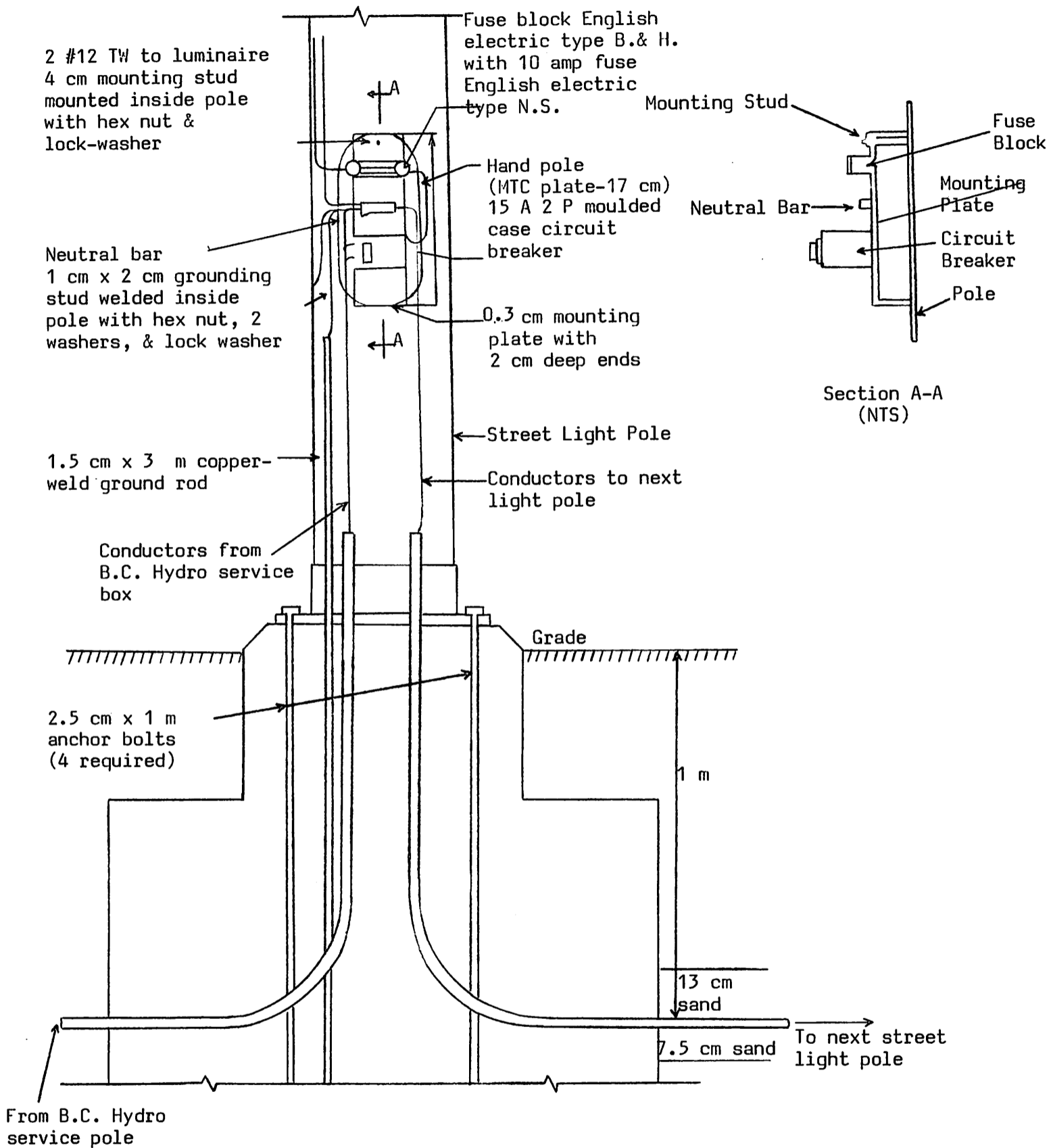
Drawing No. 3



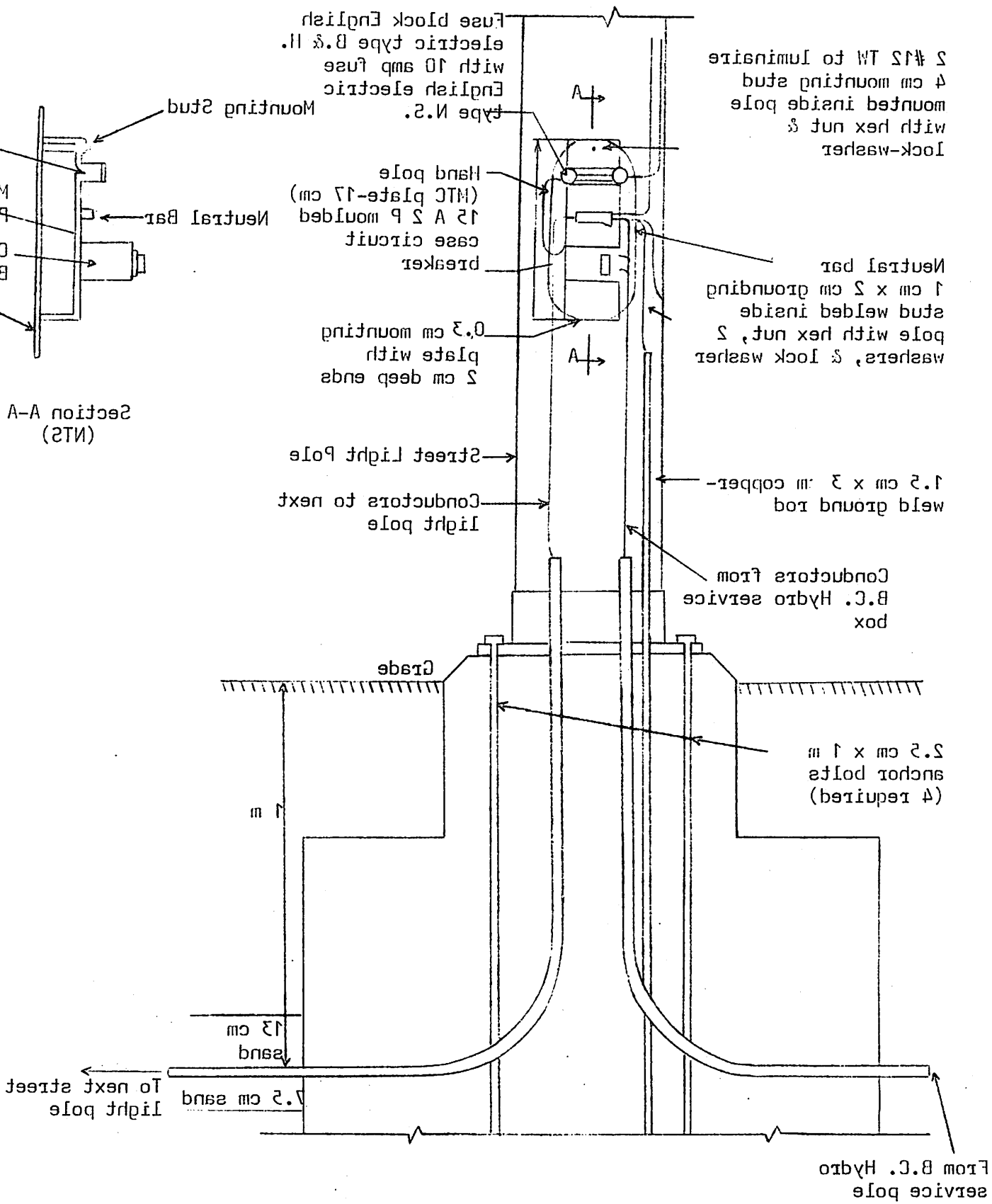


- Notes:
- (1) Road to be crowned 8 cm.
  - (2) Shoulder and boulevard to be sloped to ditch at 2-percent.
  - (3) Thicknesses of gravel shown are minimum.
  - (4) Finished grade at property line to be level with crown of road.

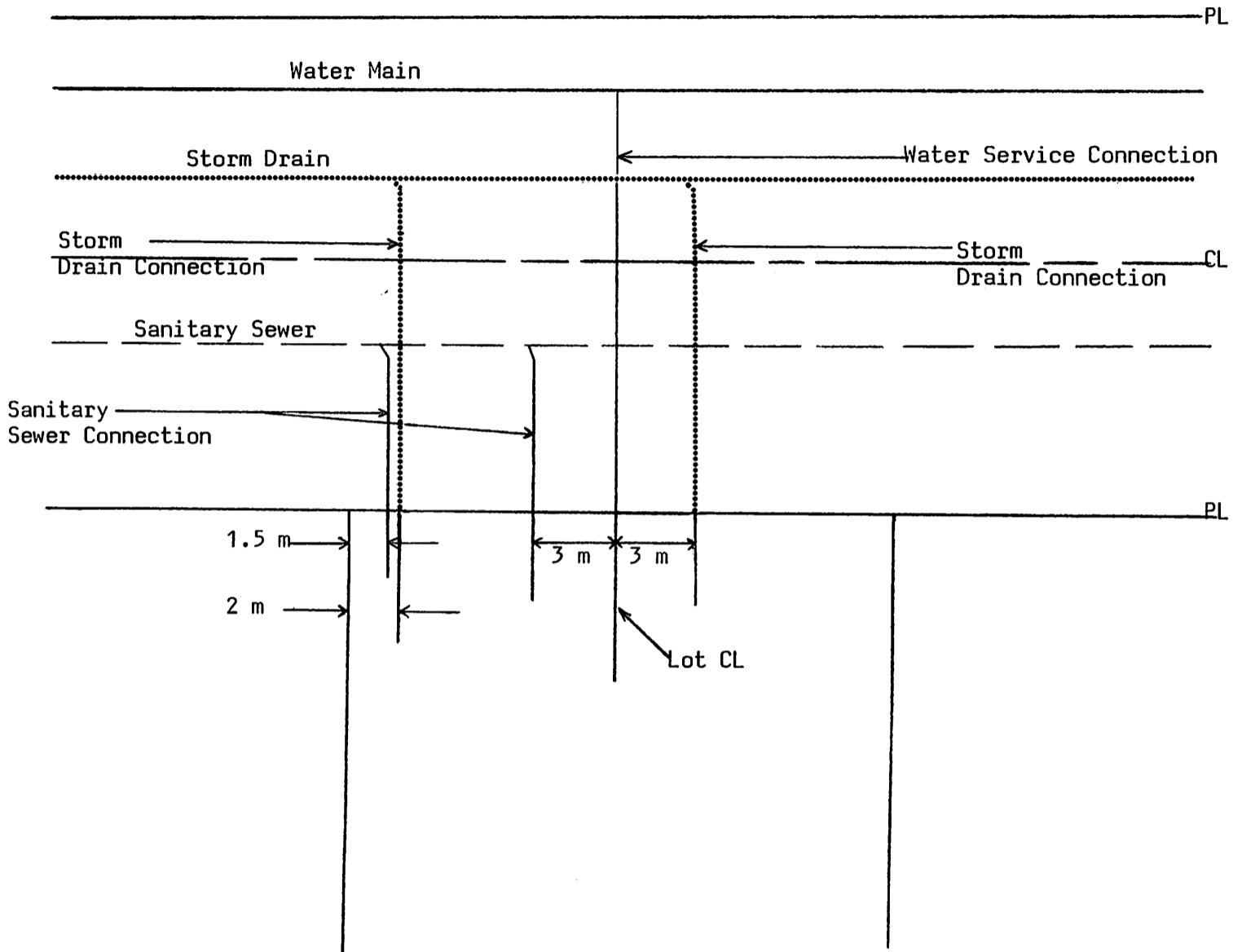
Drawing No. 4



Note: The contractor shall install service conduit from pole to B.C. Hydro underground service box. B.C. Hydro will fit conduit into service box, pull in conductors, and connect.

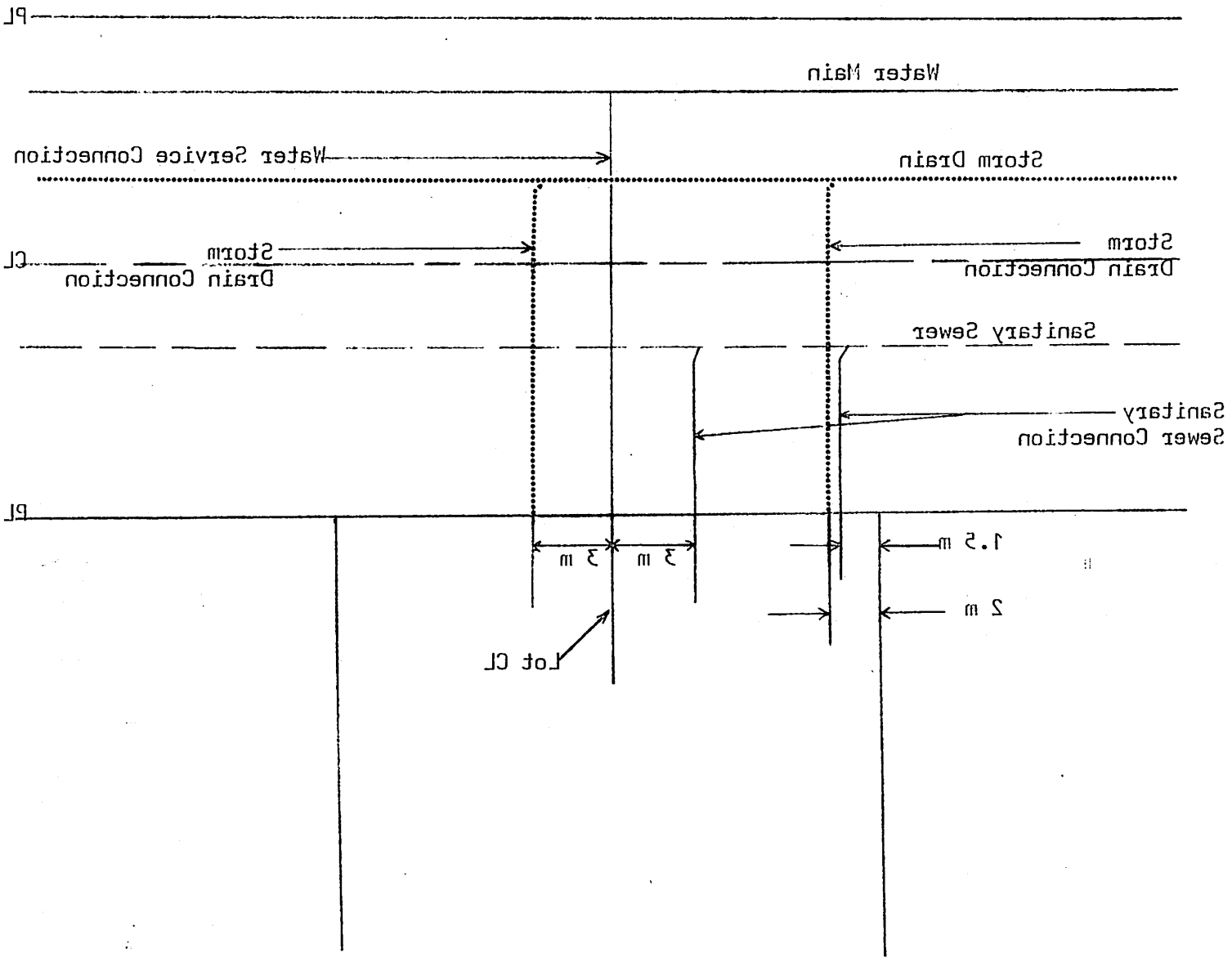


Note: The contractor shall install service conduit from pole to B.C. Hydro underground service box. B.C. Hydro will fit conduit into service box, pull in conductors, and connect.



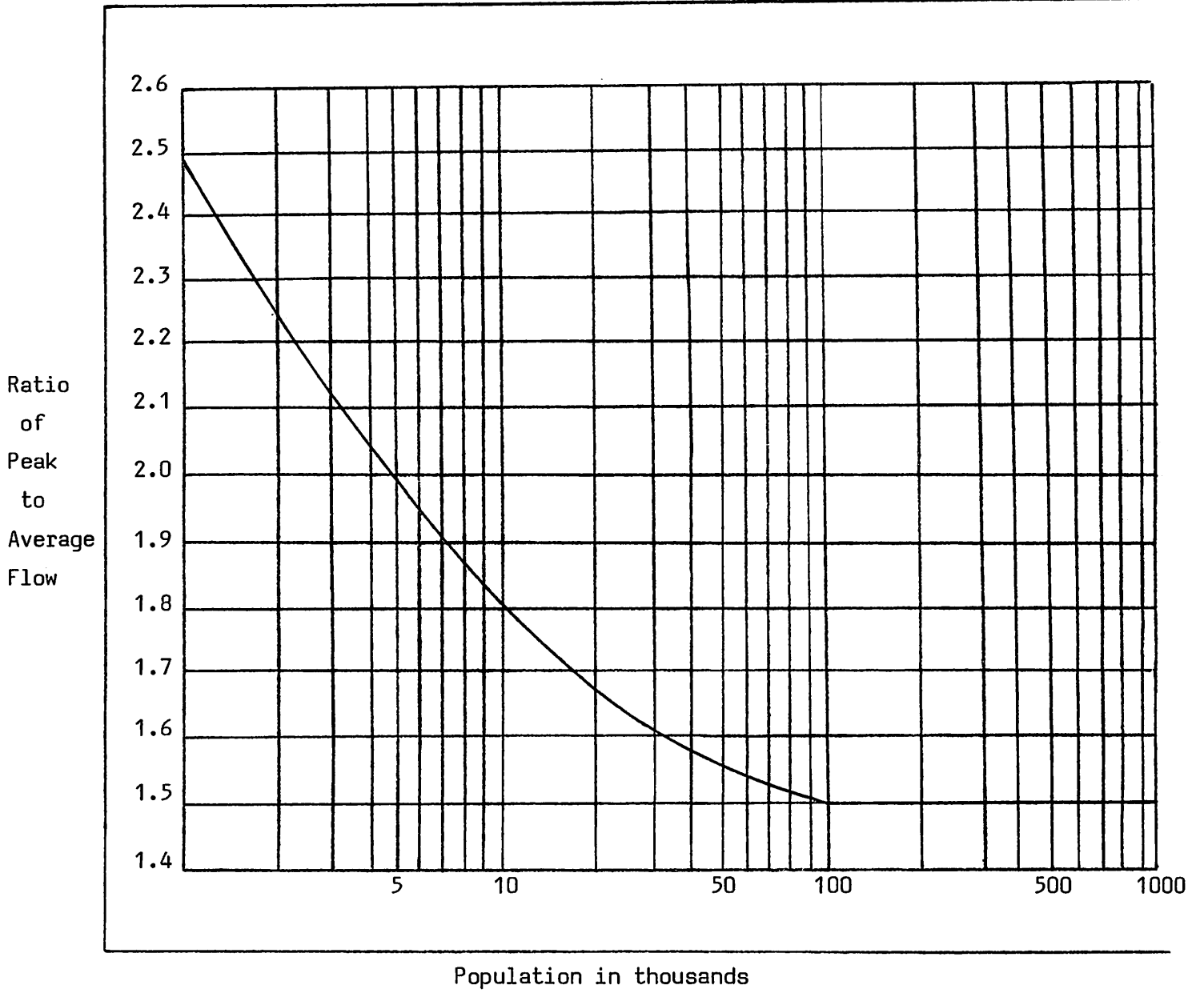
- Notes: (1) Service connections for drainage and sewer shall be measured from the centre of the lot for level lots.
- (2) For sloped lots the service connections shall be located clear of the proposed driveways, but not less than the distance shown from the corner of the lot.

Drawing No. 6

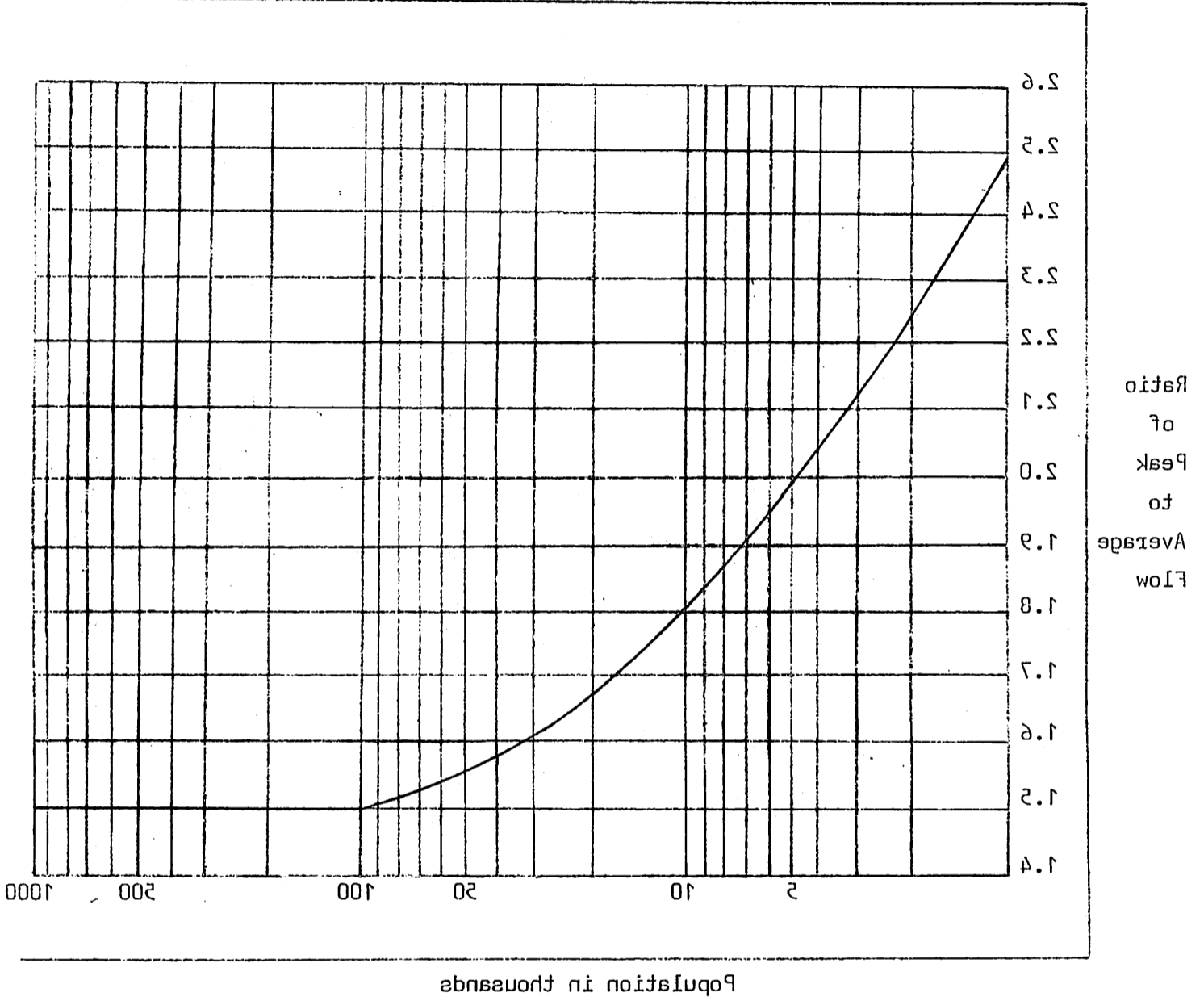


- Notes:
- (1) Service connections for drainage and sewer shall be measured from the centre of the lot for level lots.
  - (2) For sloped lots the service connections shall be located clear of the proposed driveways, but not less than the distance shown from the corner of the lot.

Drawing No. 6

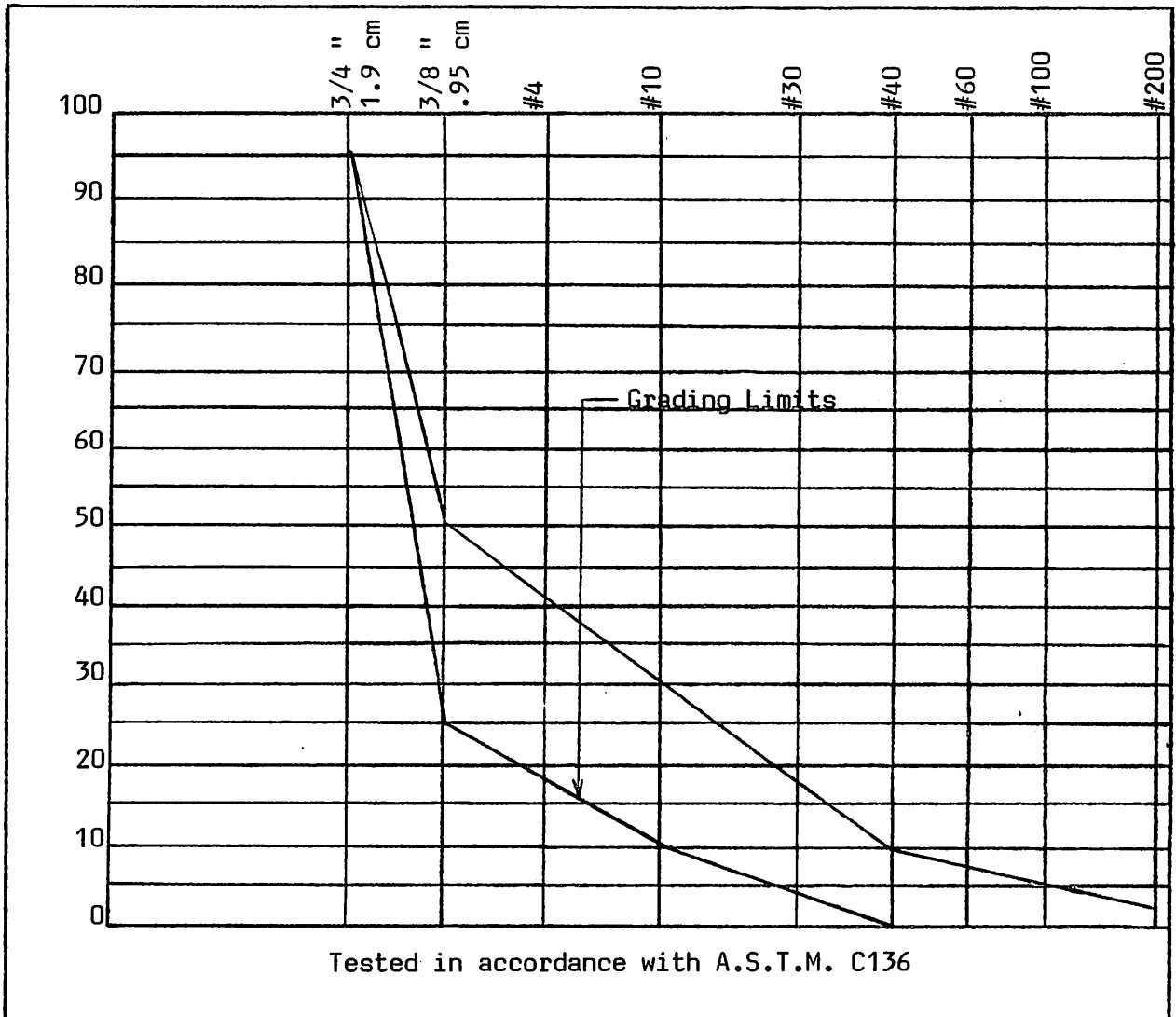


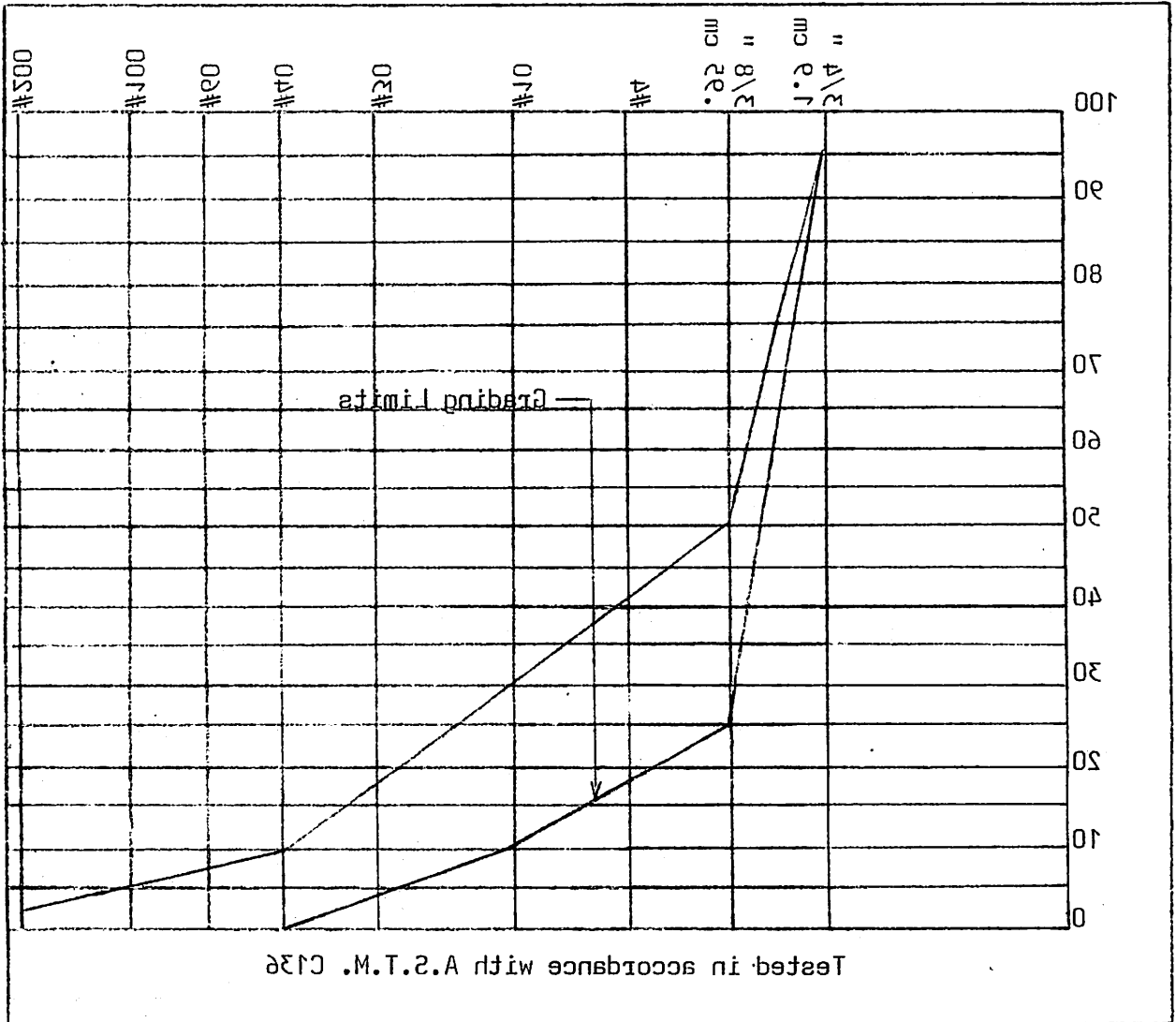
Drawing No. 7



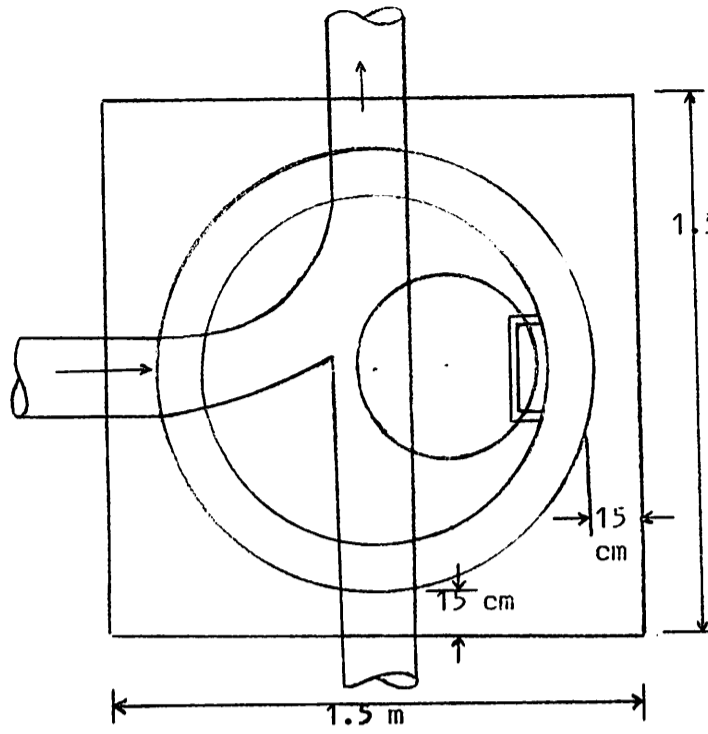
Drawing No. 7

Sieve Sizes

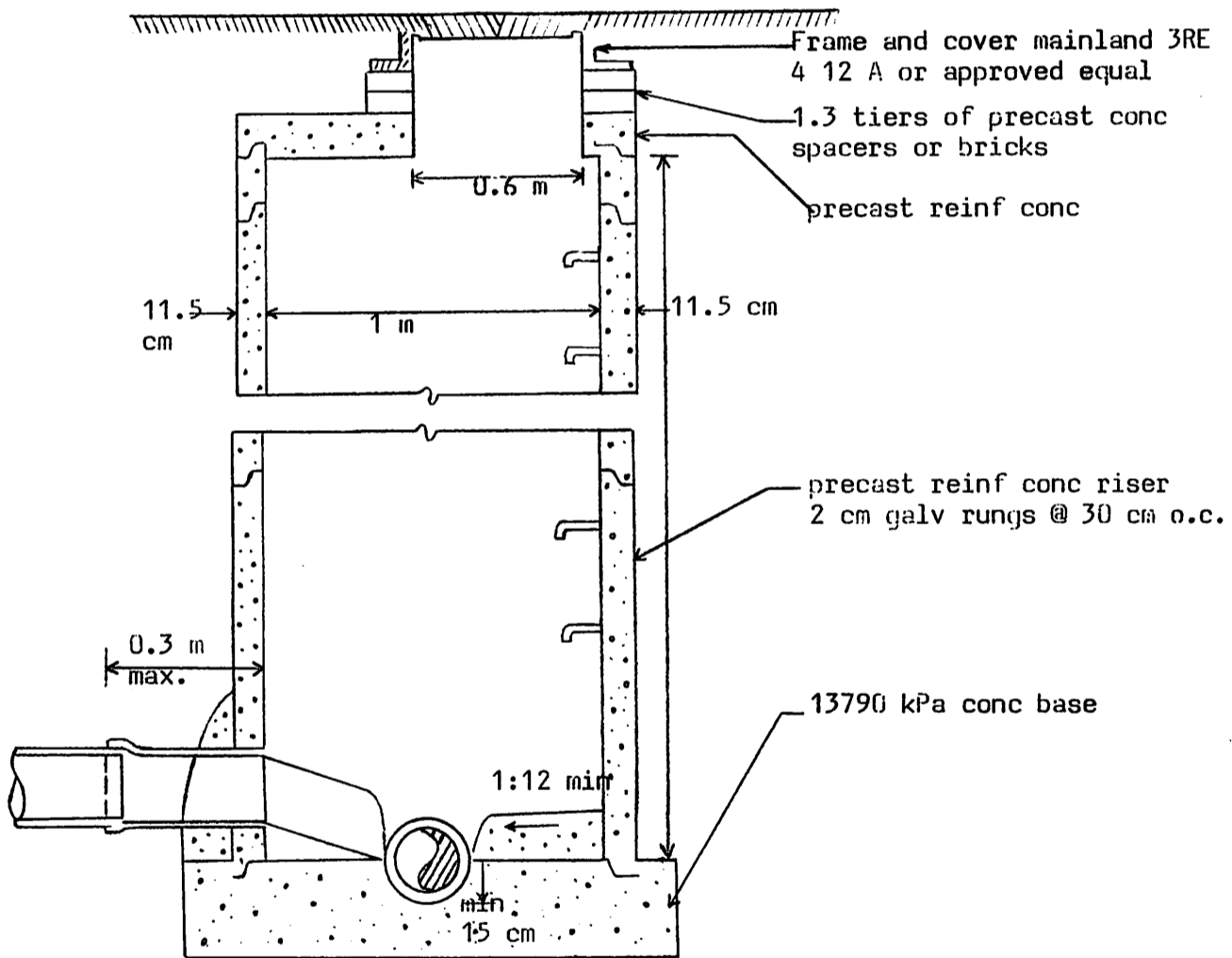




Drawing No. 8

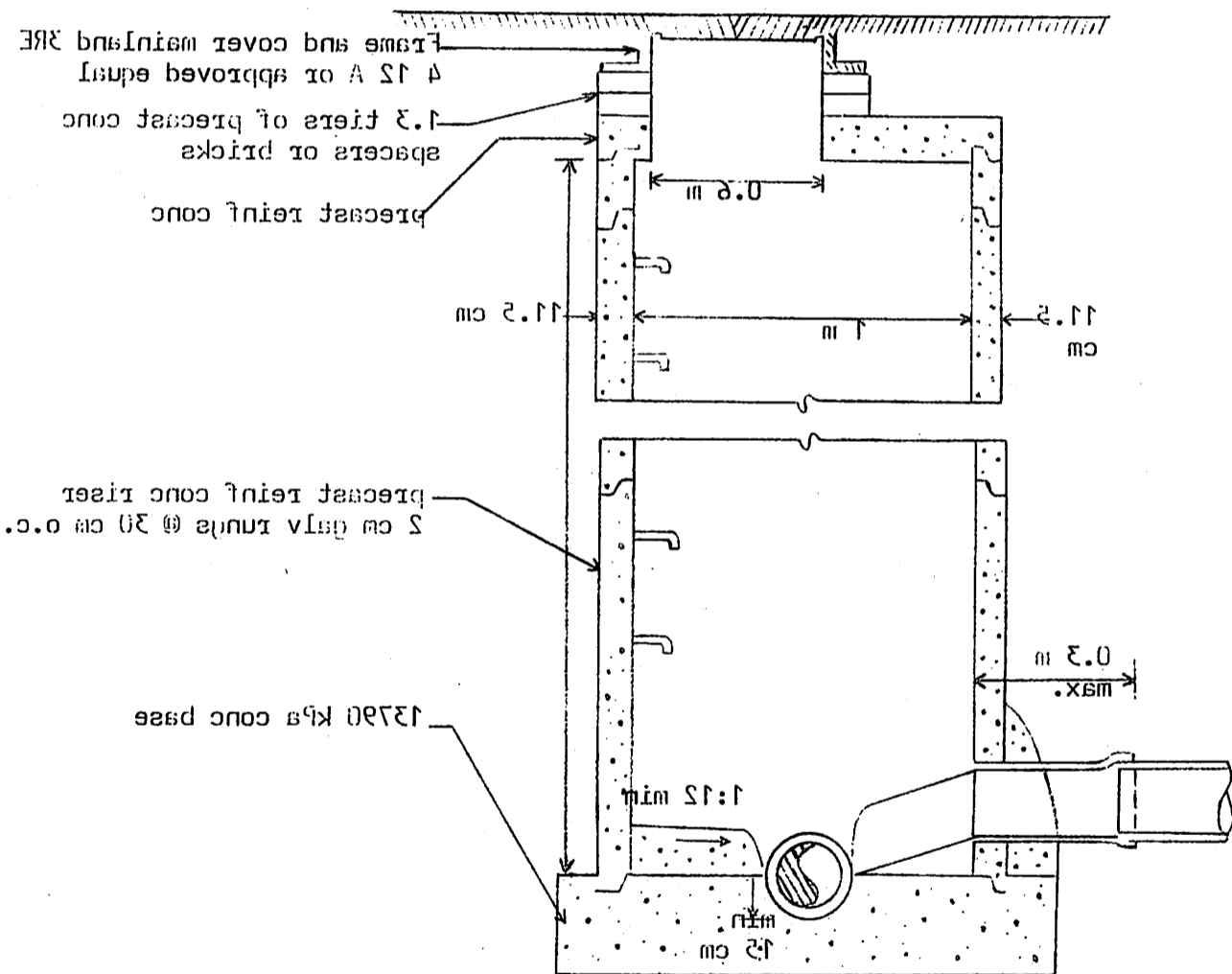
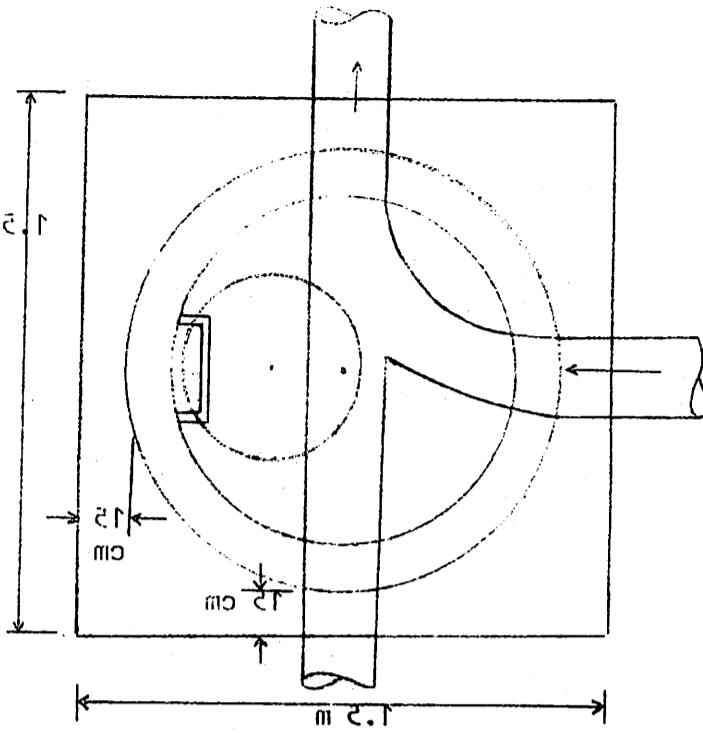


Note: M.H. Cover to be marked sewer for sanitary sewer & drain for storm drain.

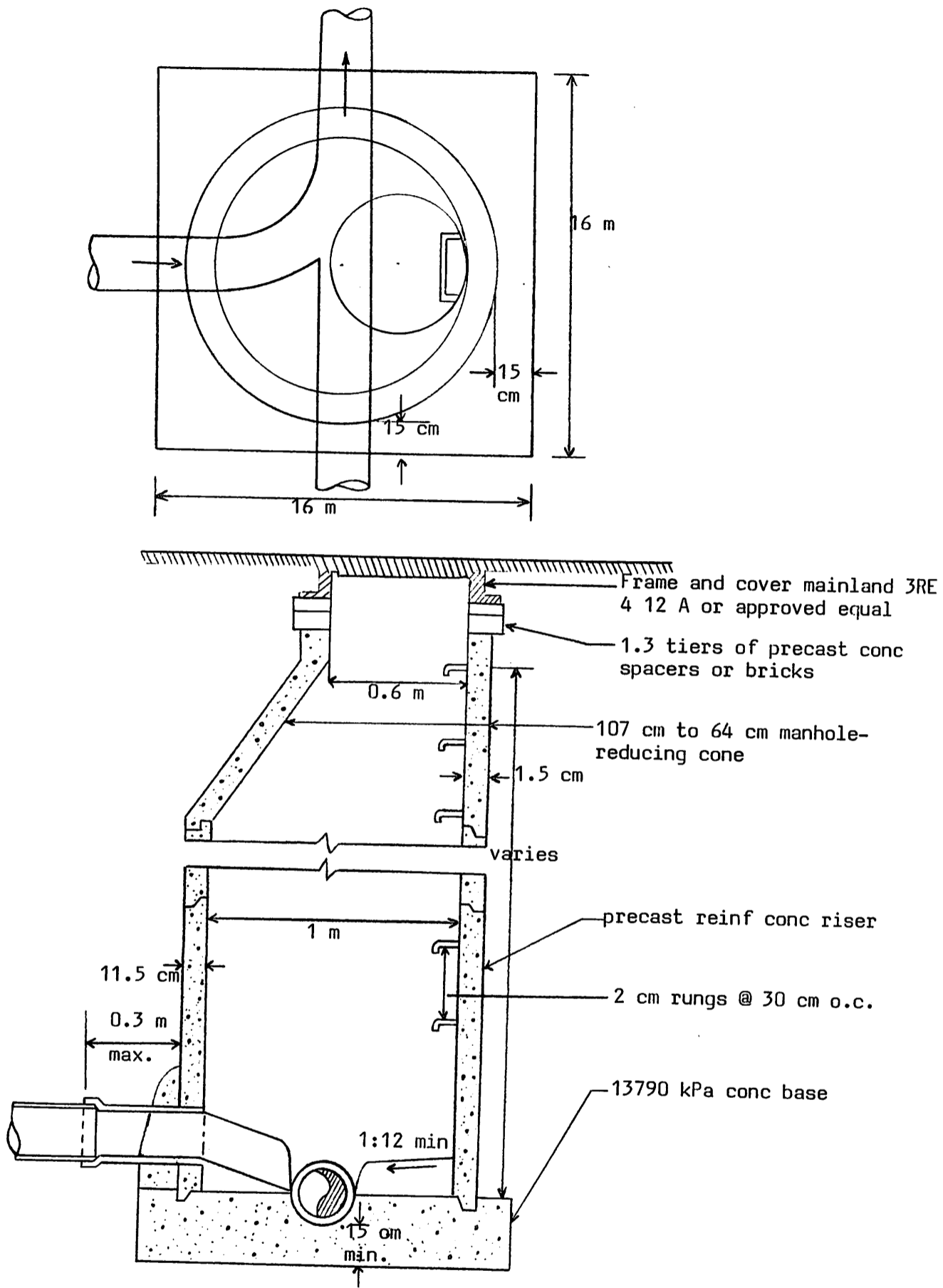


Drawing No. 9

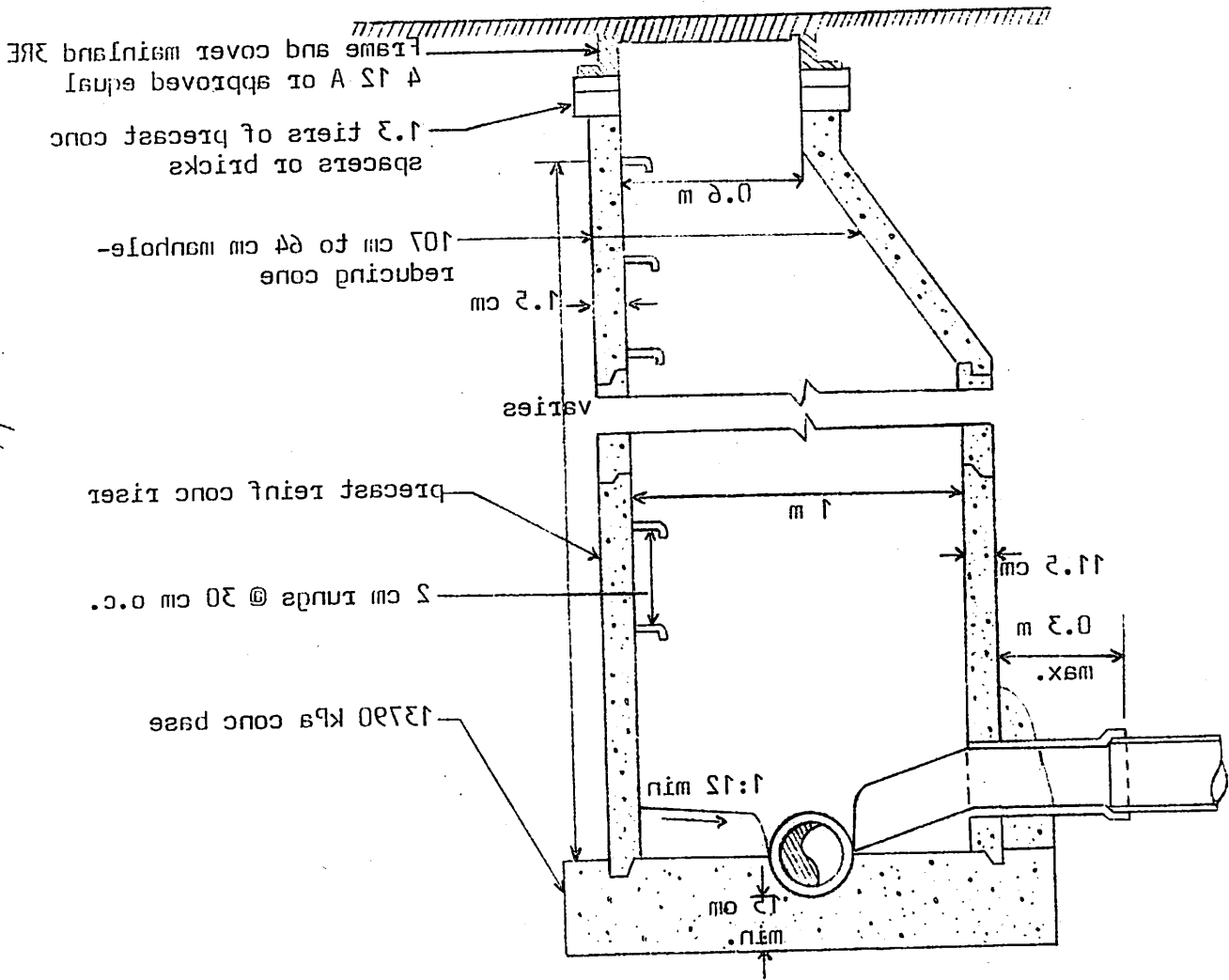
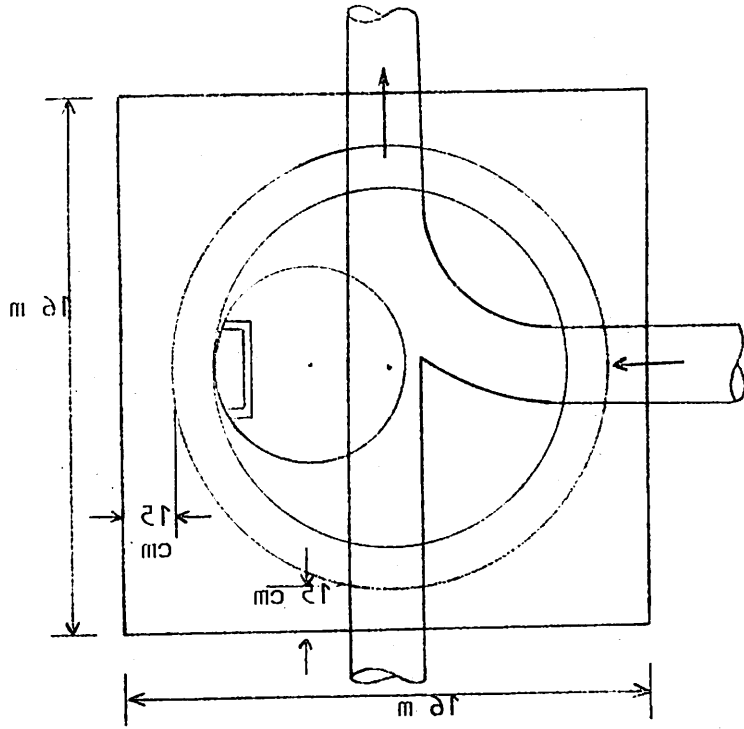
Note: M.H. Cover to be marked sewer for sanitary sewer & drain for storm drain.



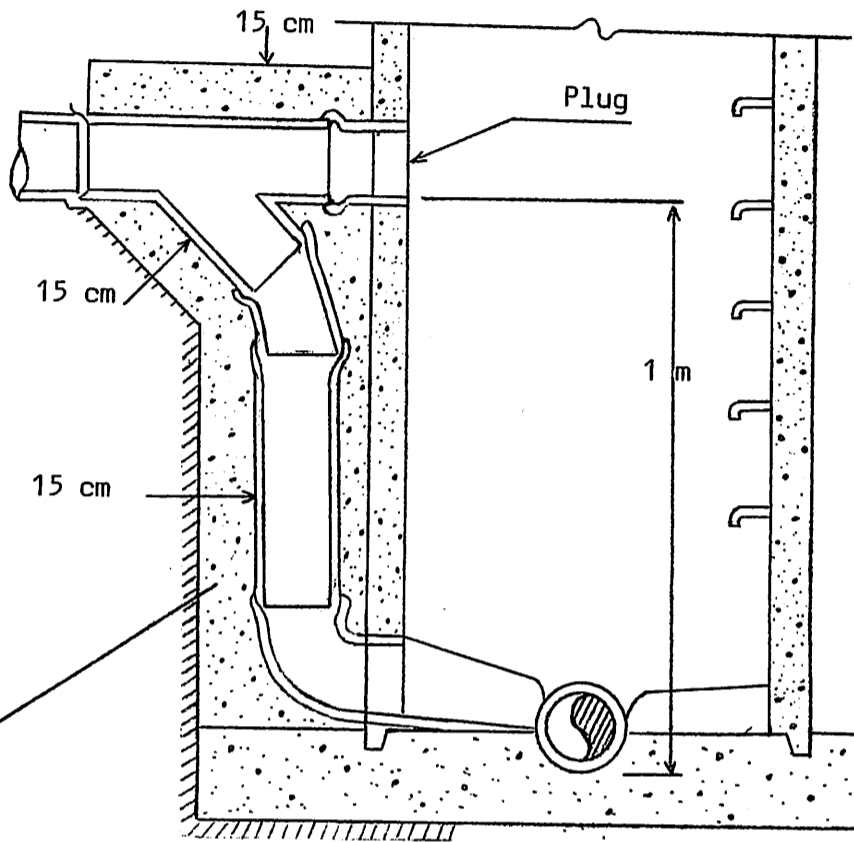
Drawing No. 2



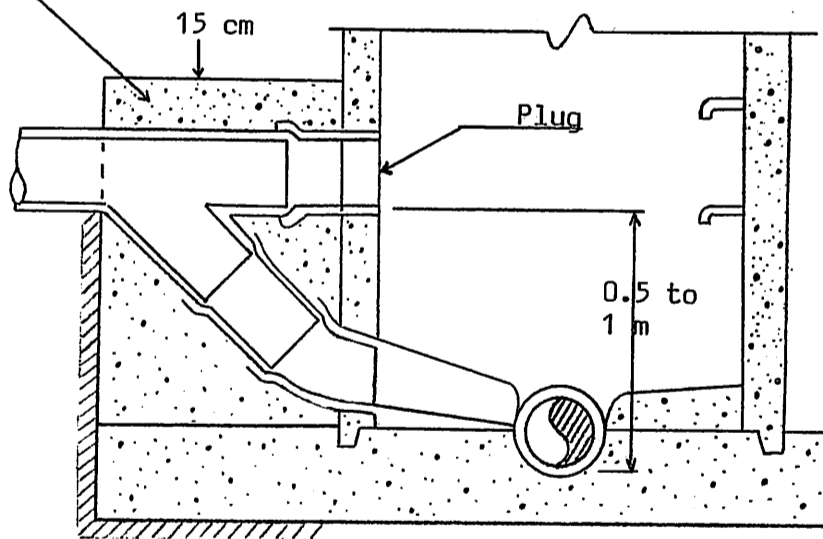
Drawing No. 10



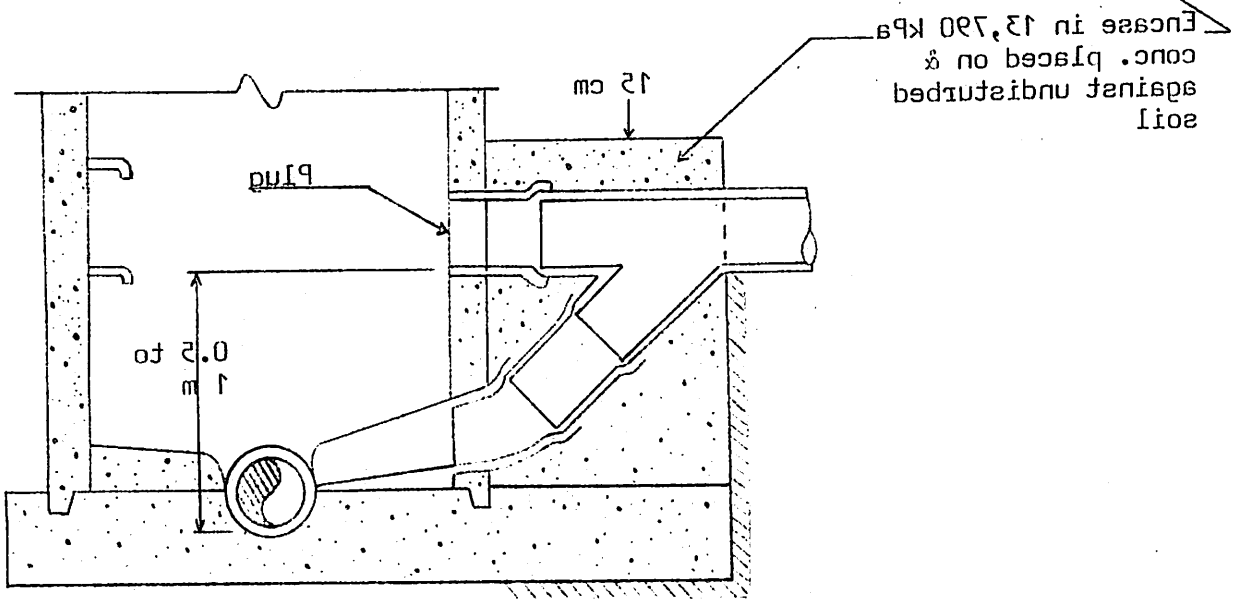
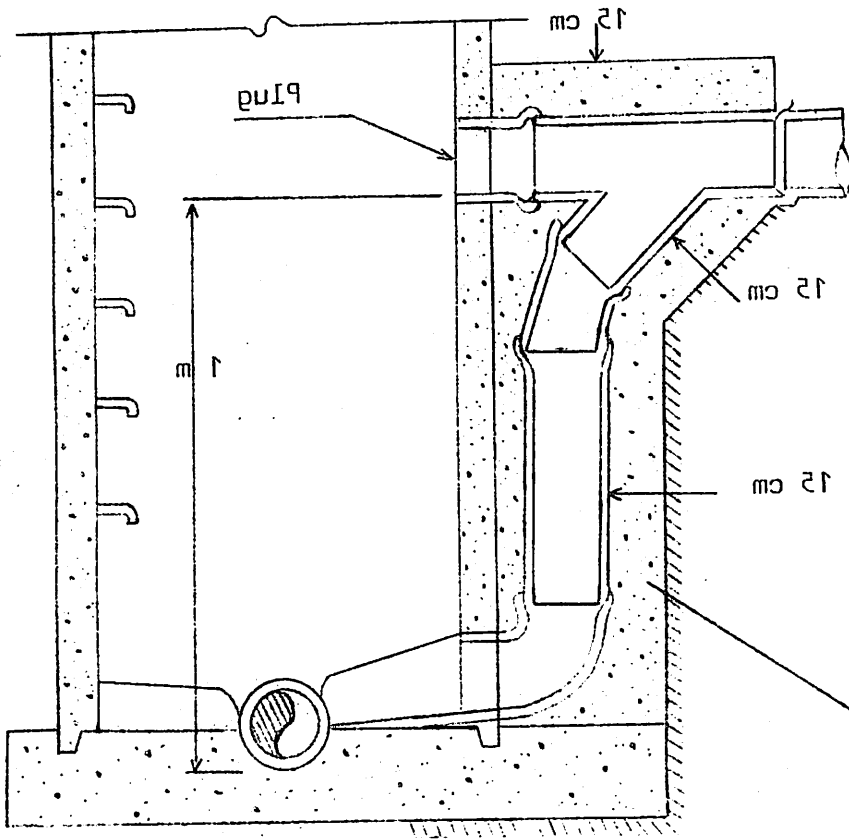
Drawing No. 10



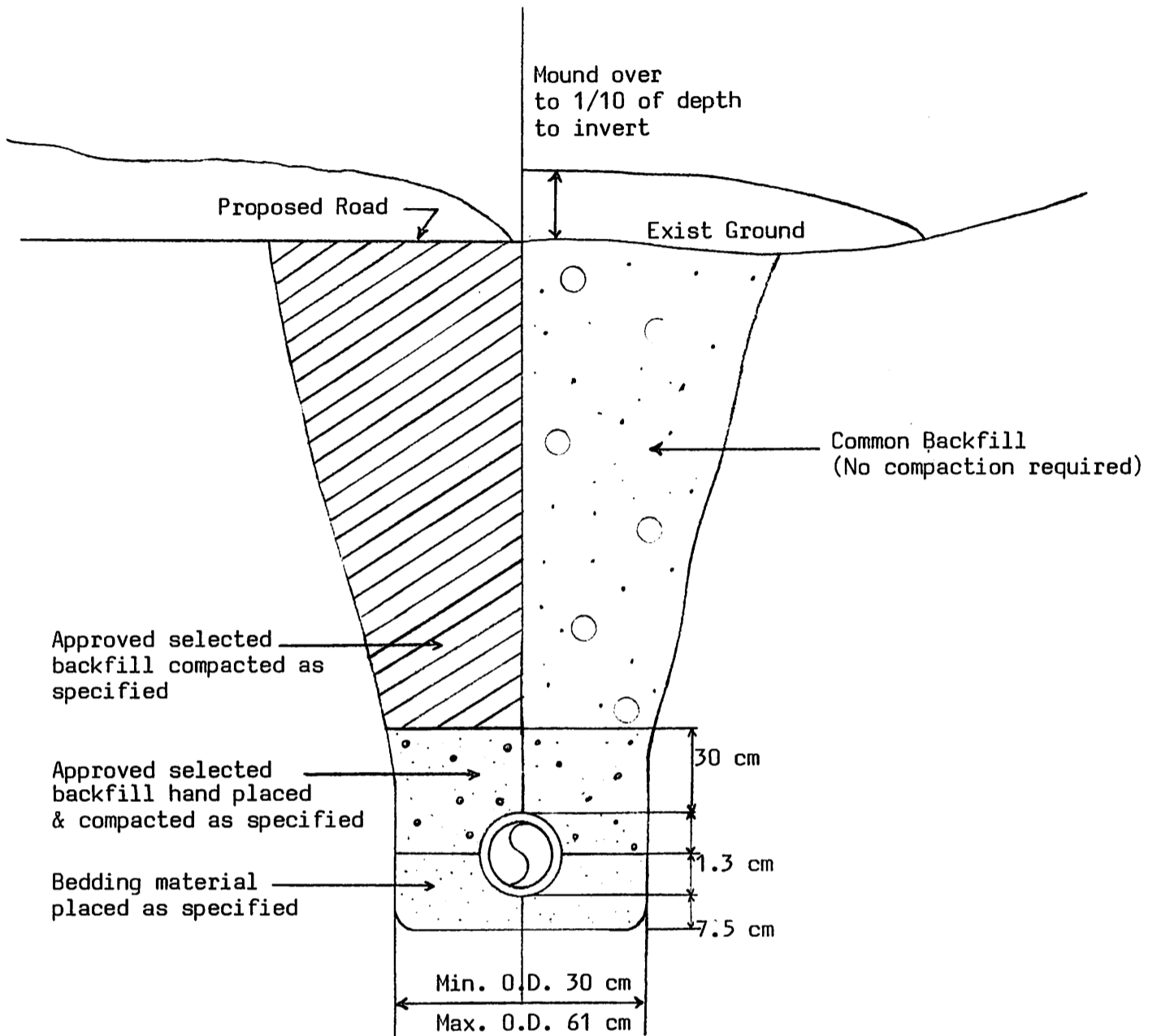
Encase in 13,790 kPa conc. placed on & against undisturbed soil



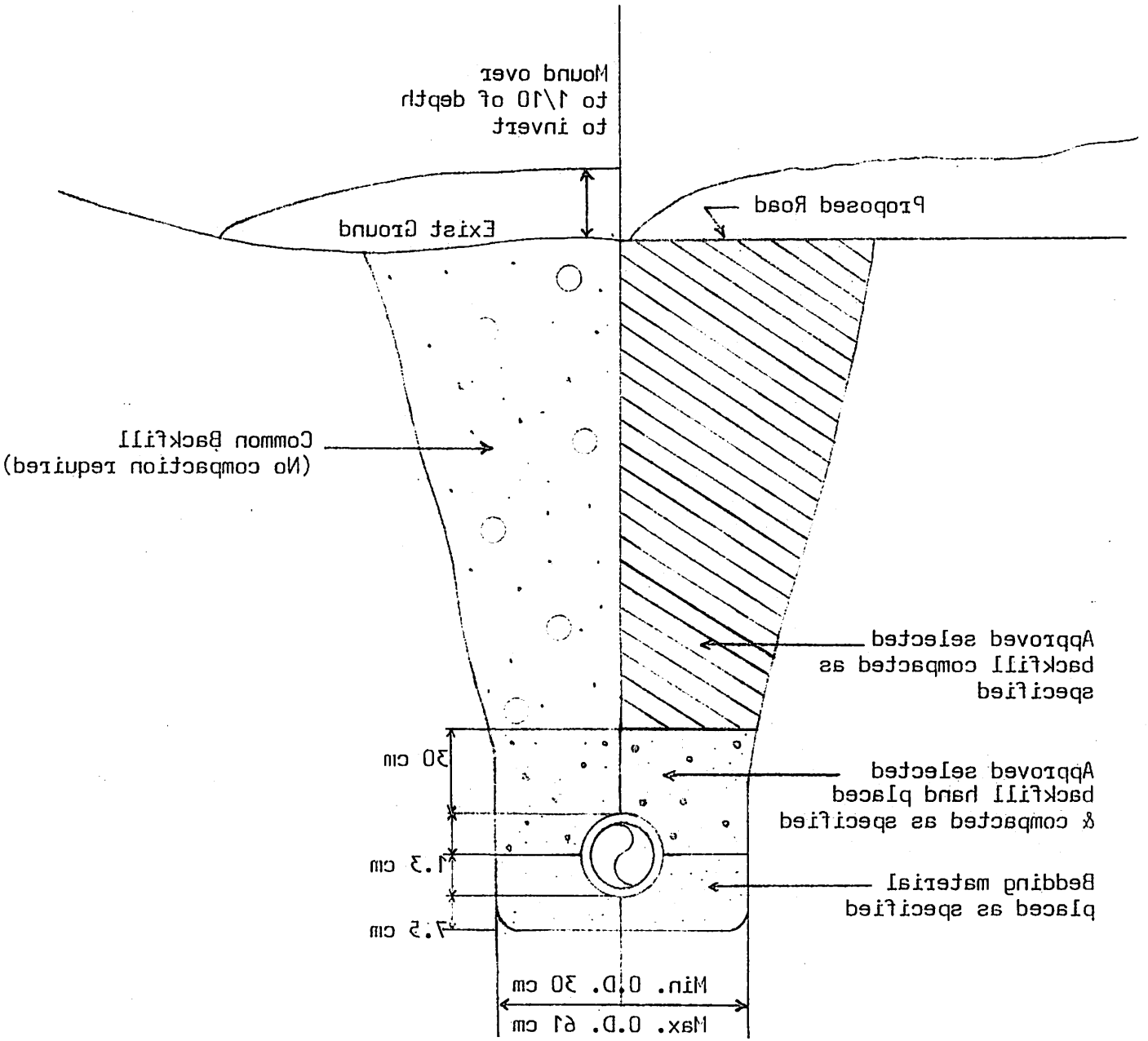
Drawing No. 11



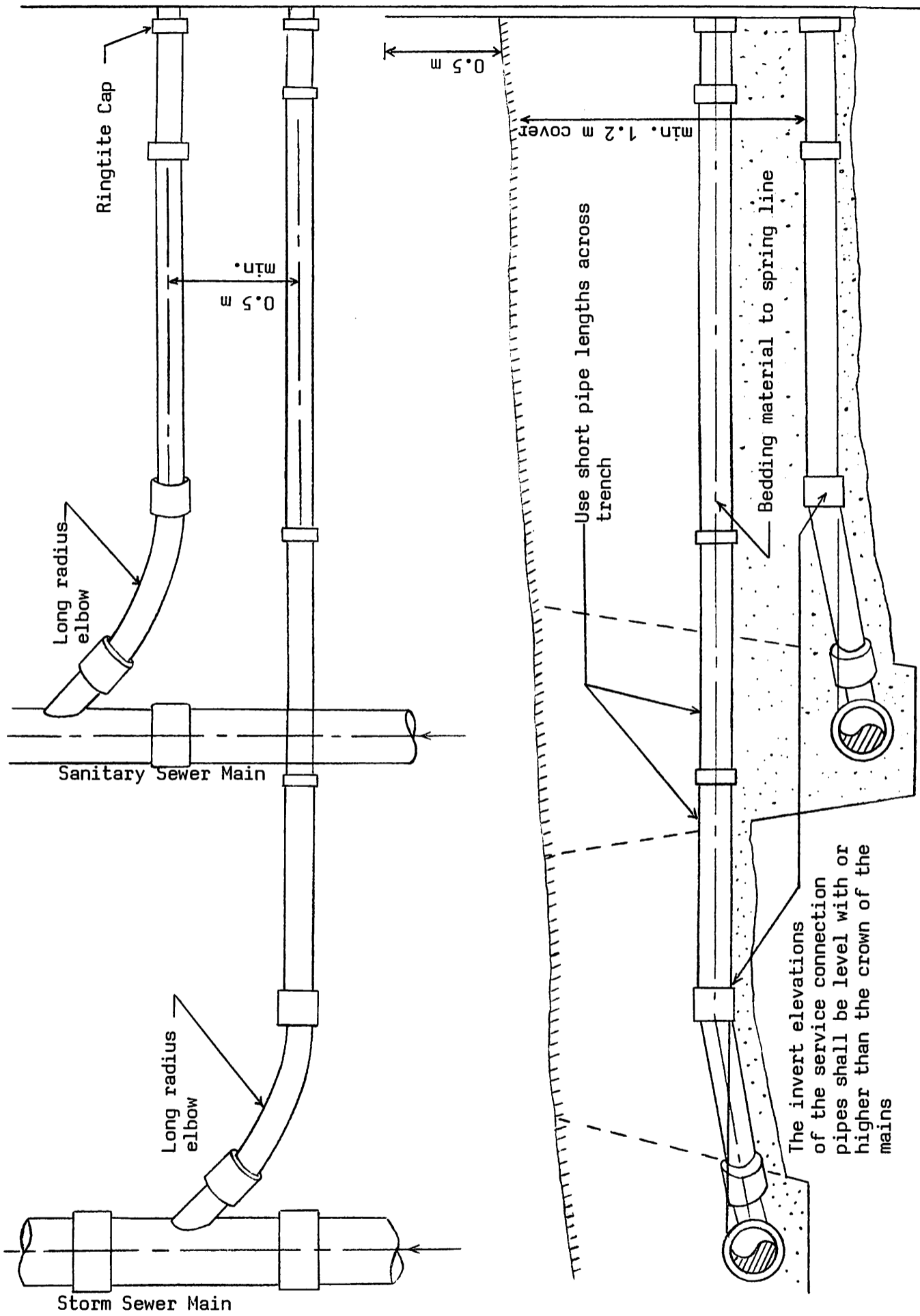
Drawing No. 11



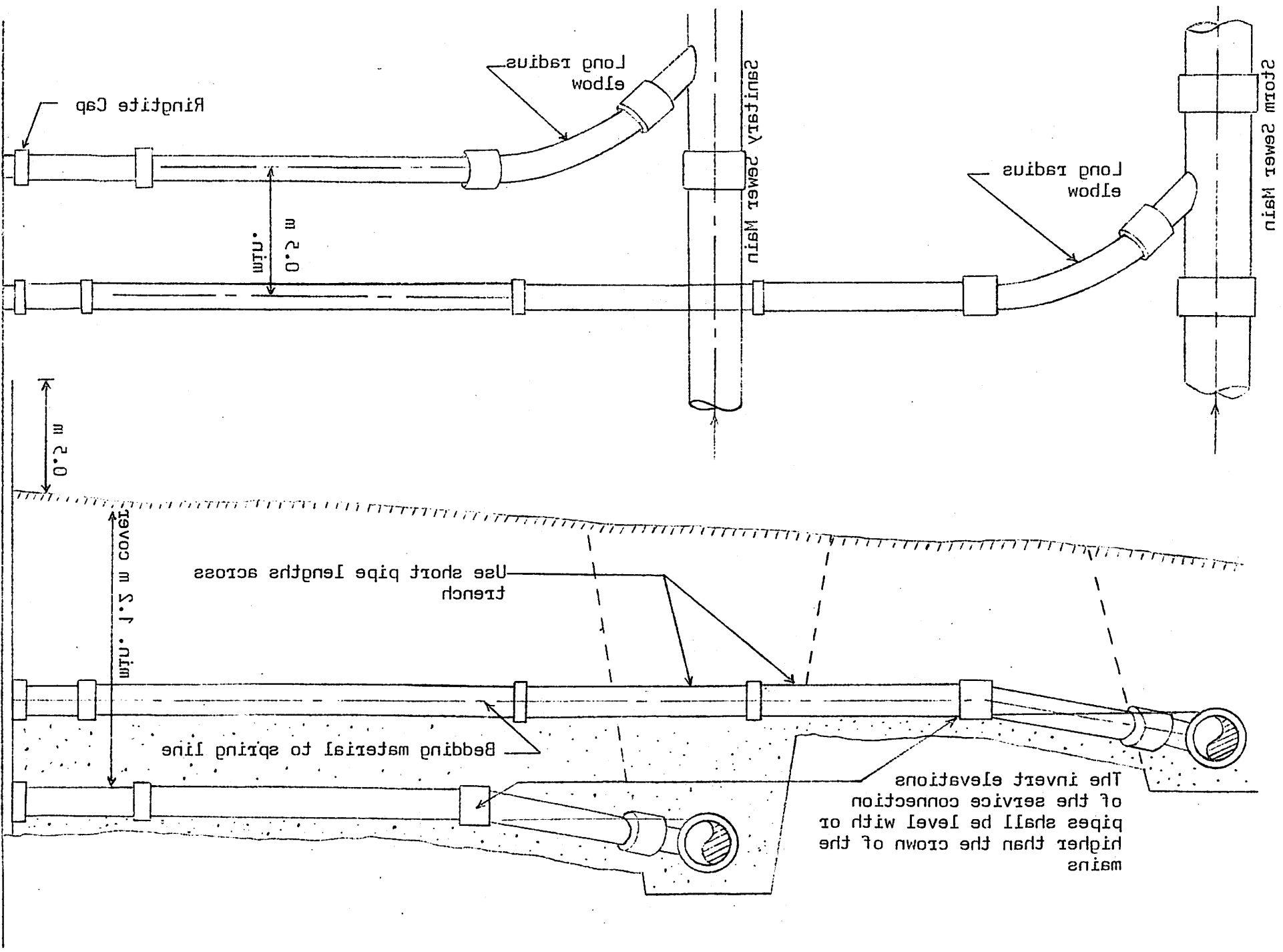
Drawing No. 12

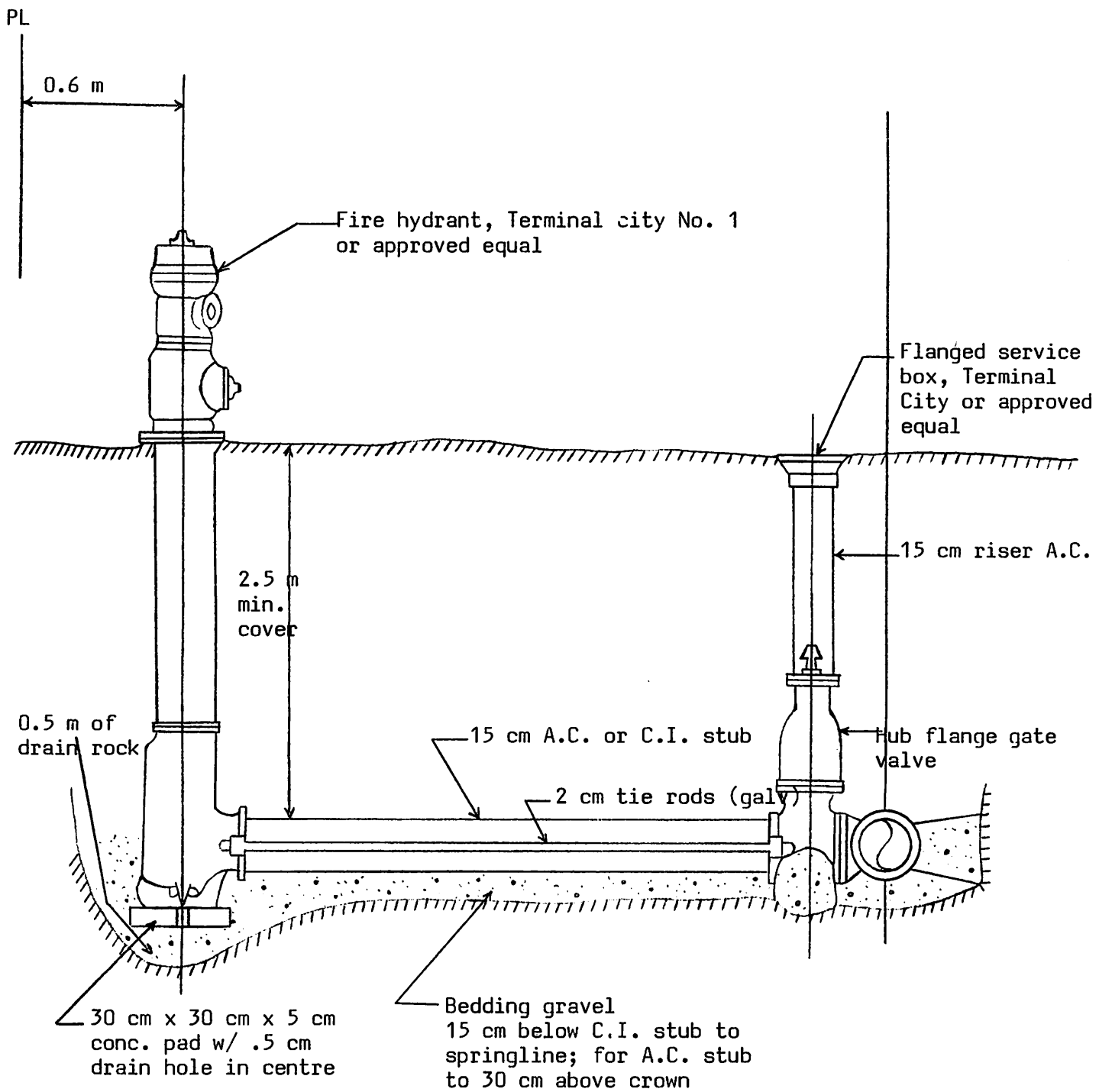


Drawing No. 12



Drawing No. 13

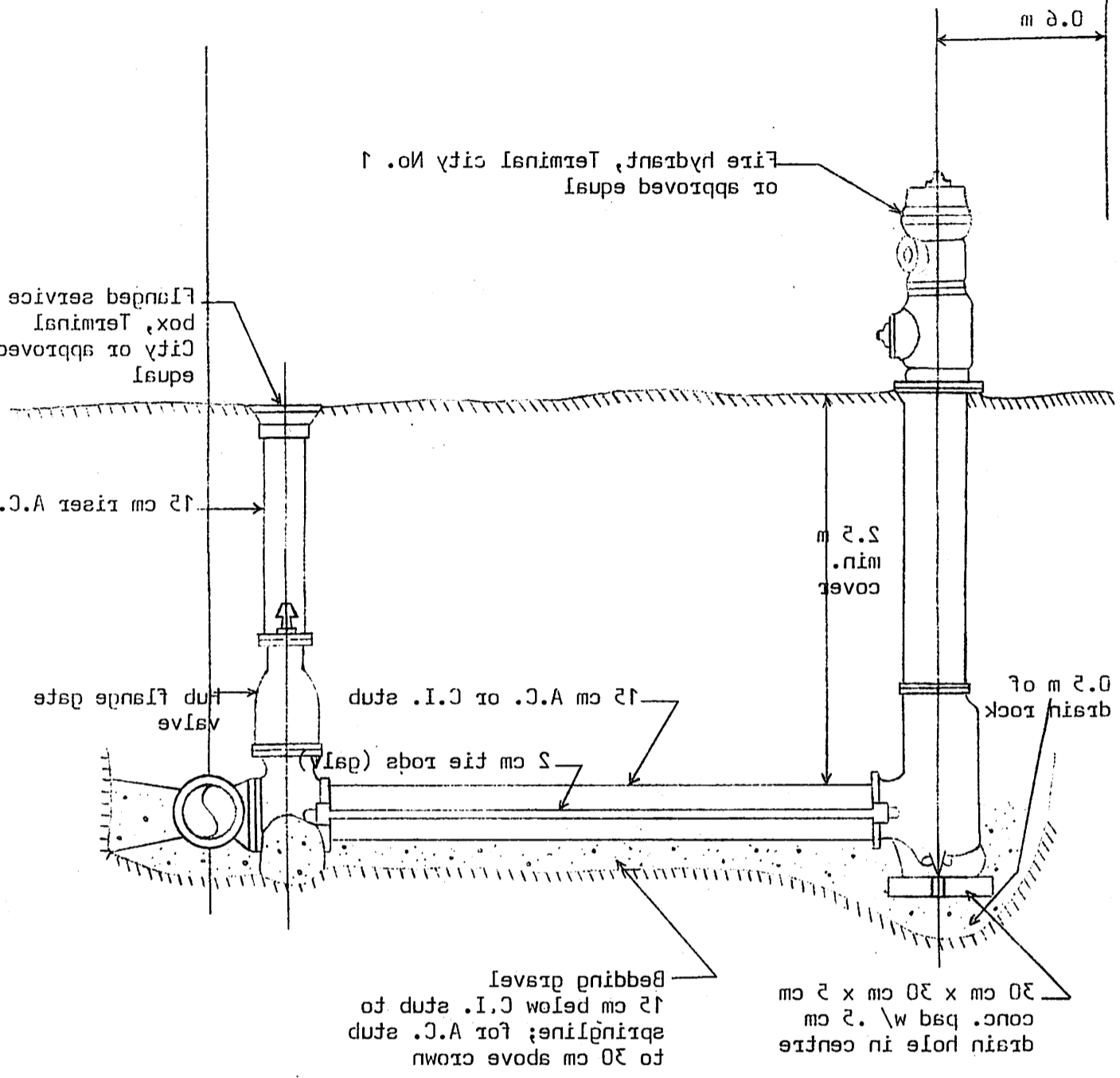




Note: Lugs for tie rods to have coned holes.

Drawing No. 14

PL



30 cm x 30 cm x 5 cm  
conc. pad w/ 5 cm  
drain hole in centre

0.2 m of  
drain rock

2.5 m  
min.  
cover

15 cm A.C. riser A.C.

Flanged service  
box, Terminal  
City or approved  
equal

Hub flange gate  
valve

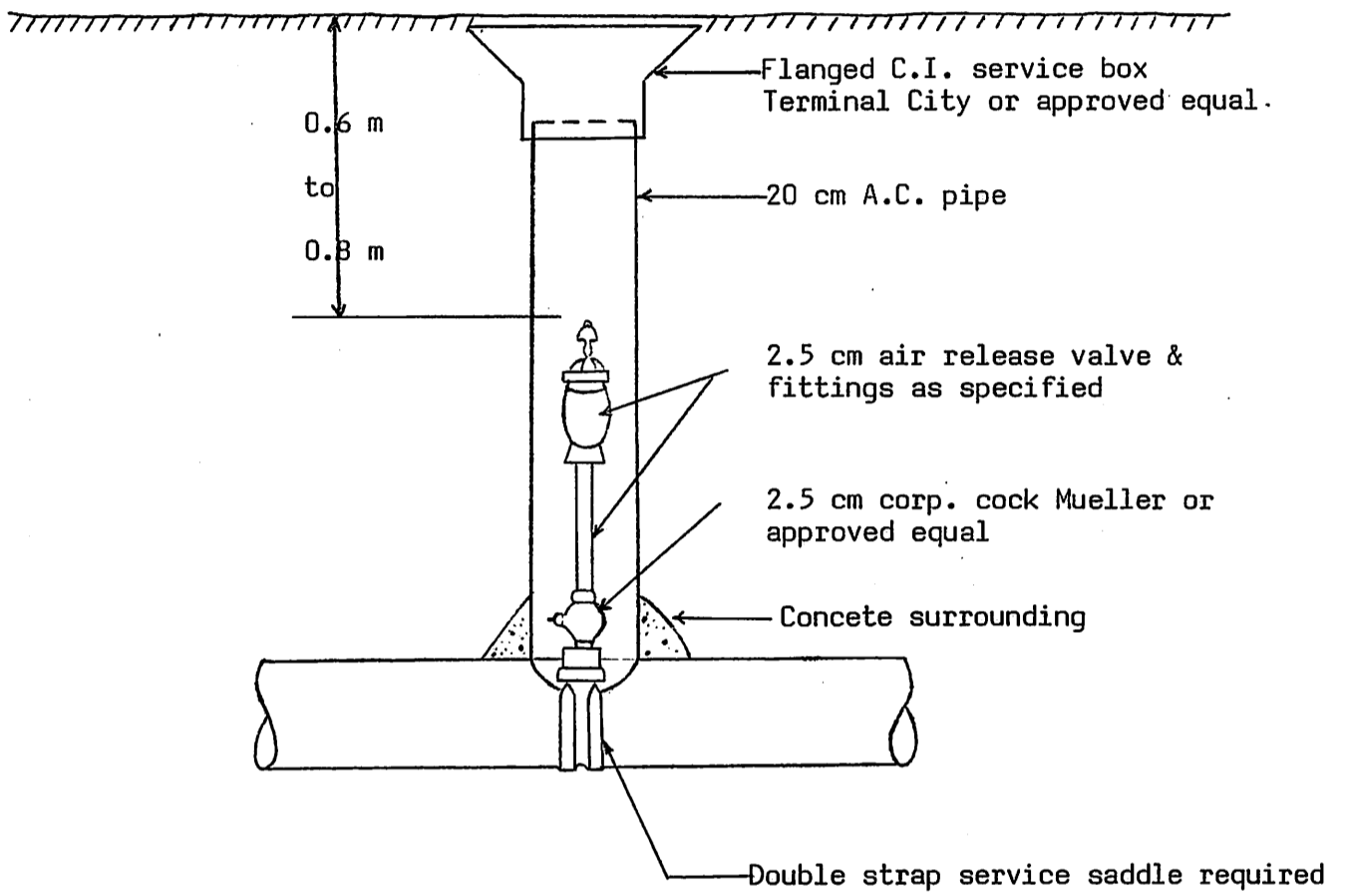
15 cm A.C. or C.I. stub

2 cm tie rods (galv)

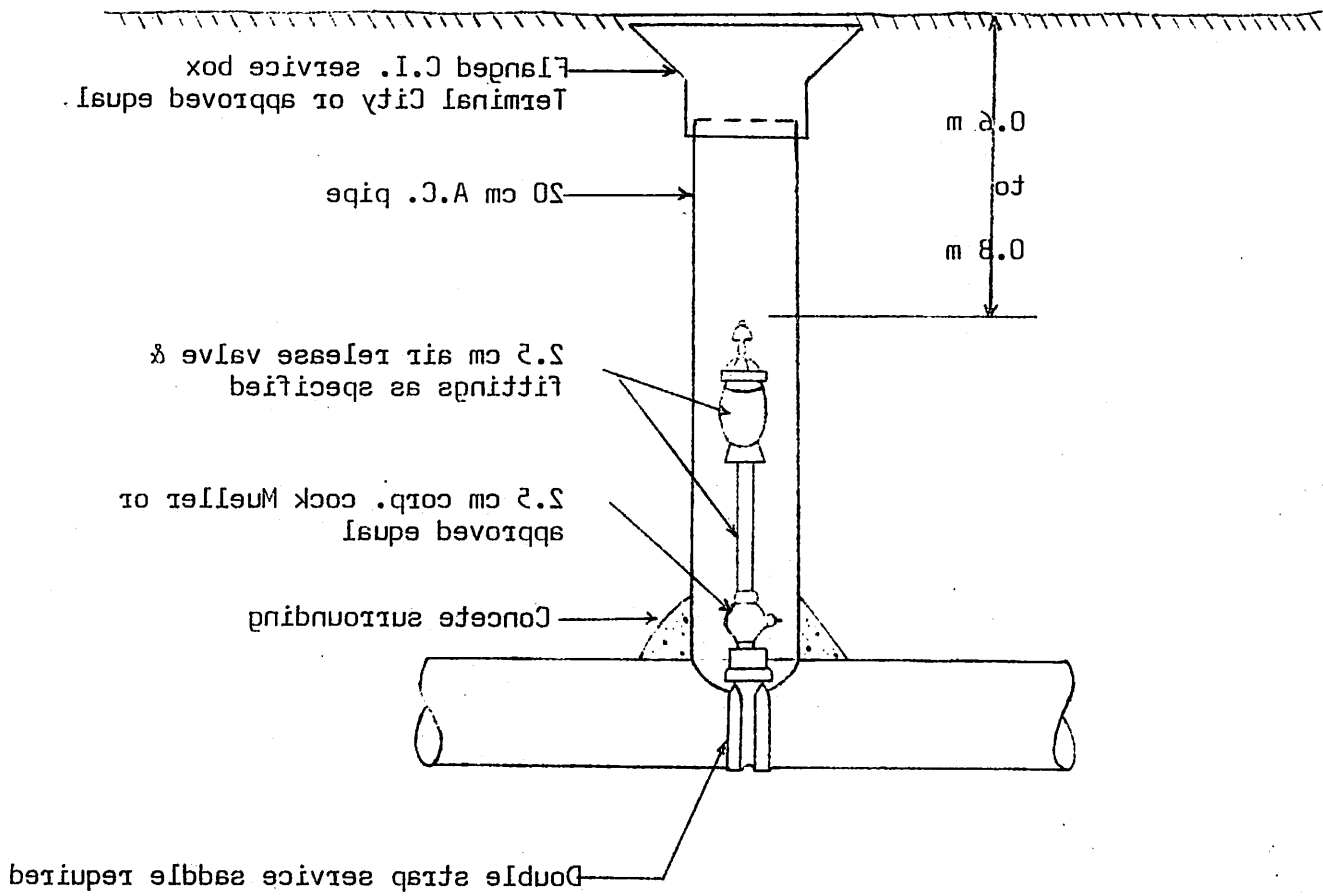
Bedding gravel  
15 cm below C.I. stub to  
springline; for A.C. stub  
to 30 cm above crown

Note: Lugs for tie rods to have coned holes.

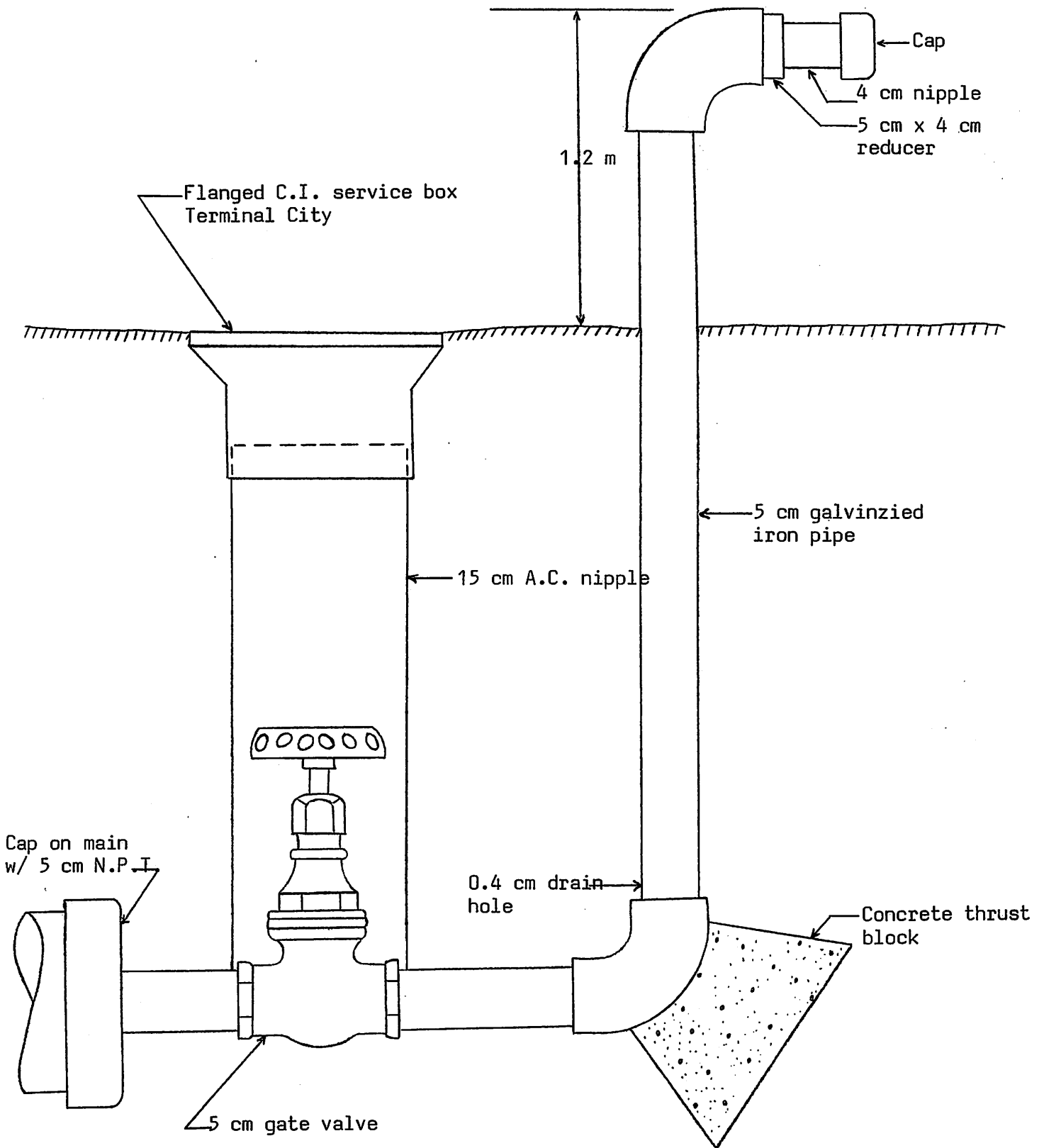
Drawing No. 14



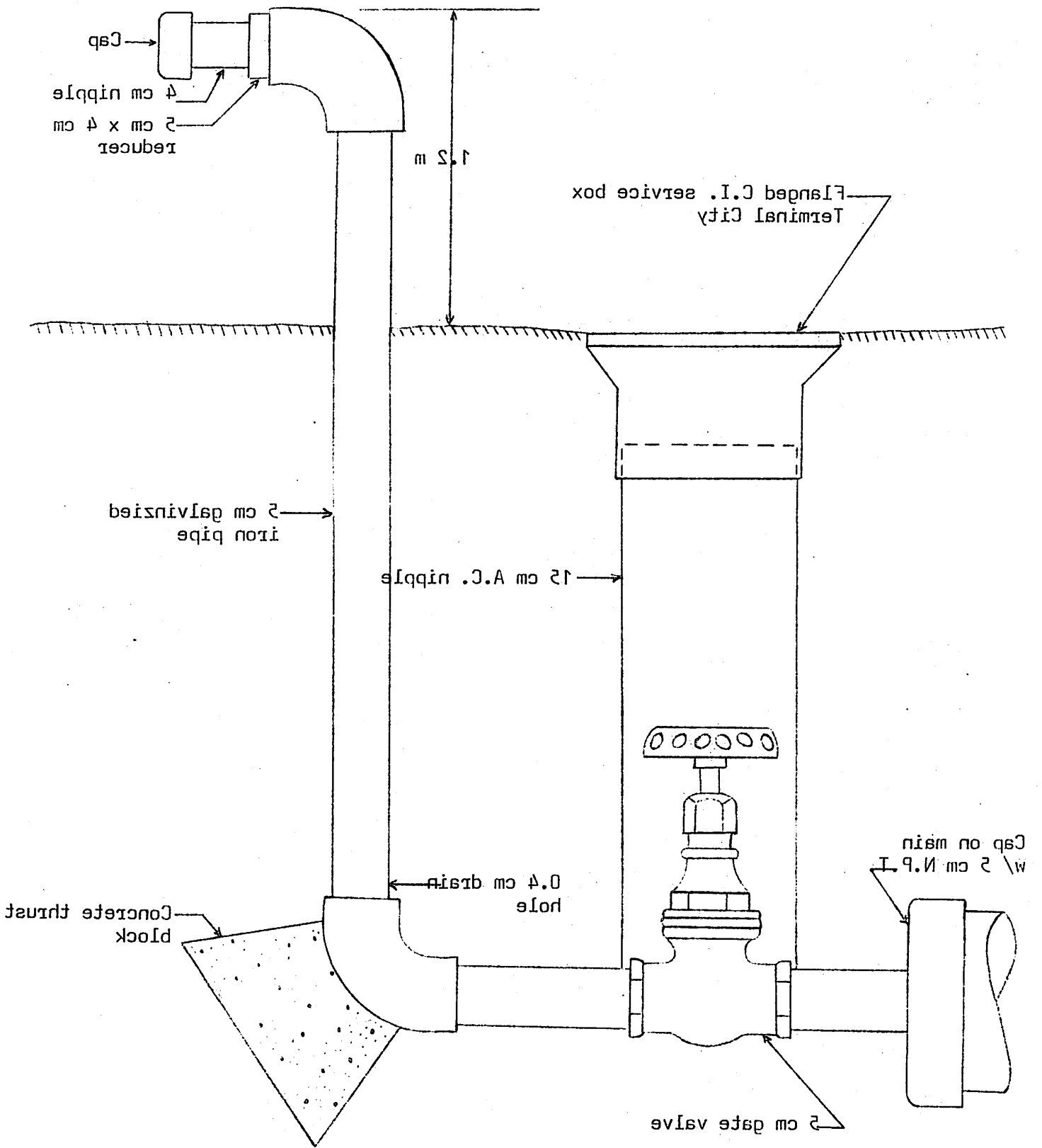
Drawing No. 15



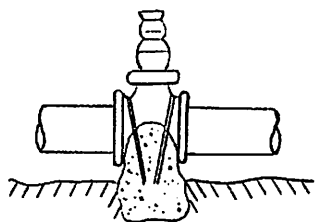
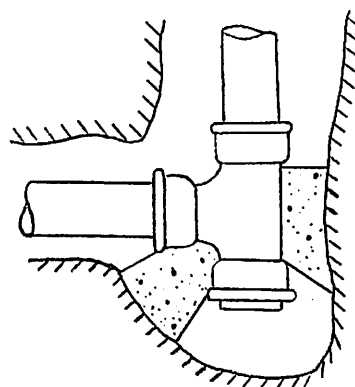
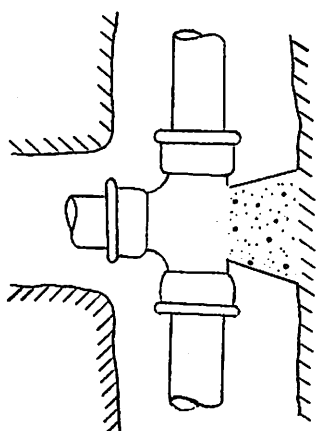
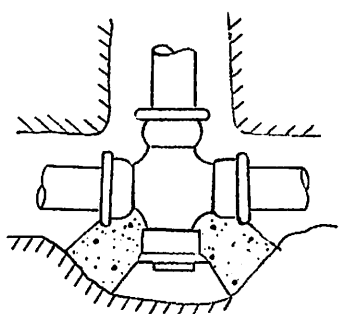
Drawing No. 12



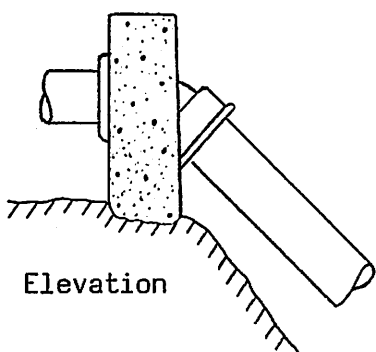
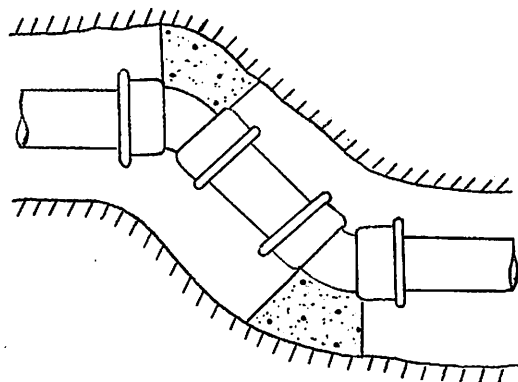
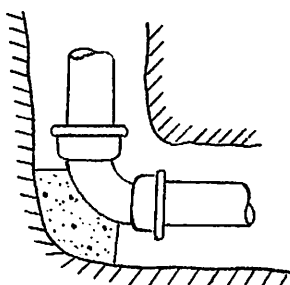
Drawing No. 16



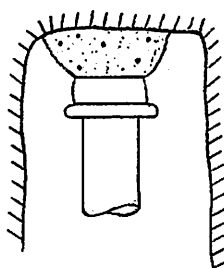
Drawing No. 16

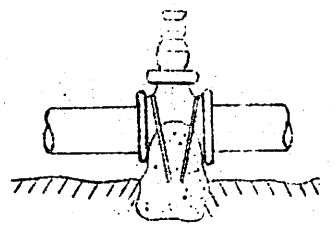
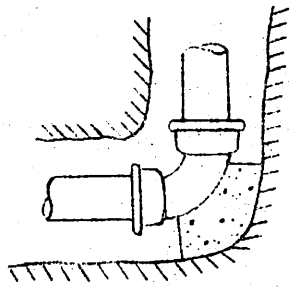
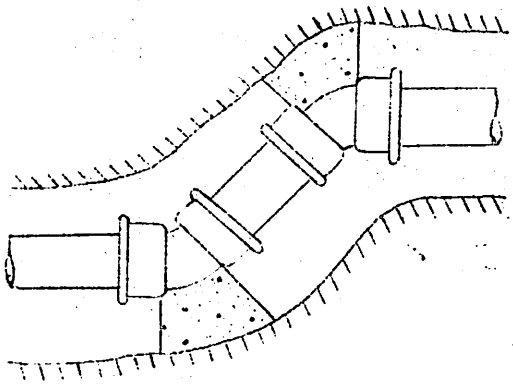
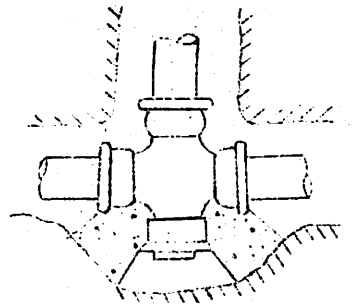
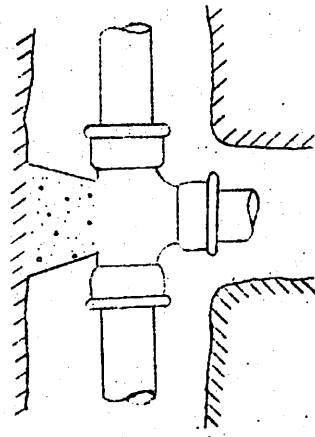
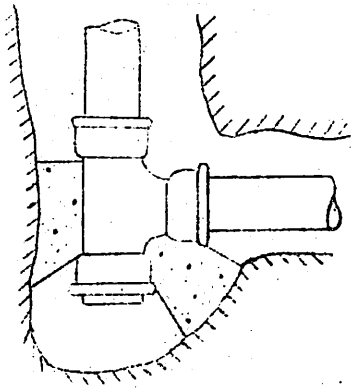


Elevation

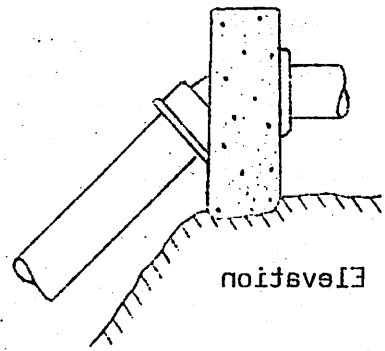
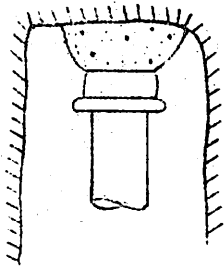


Elevation





Elevation

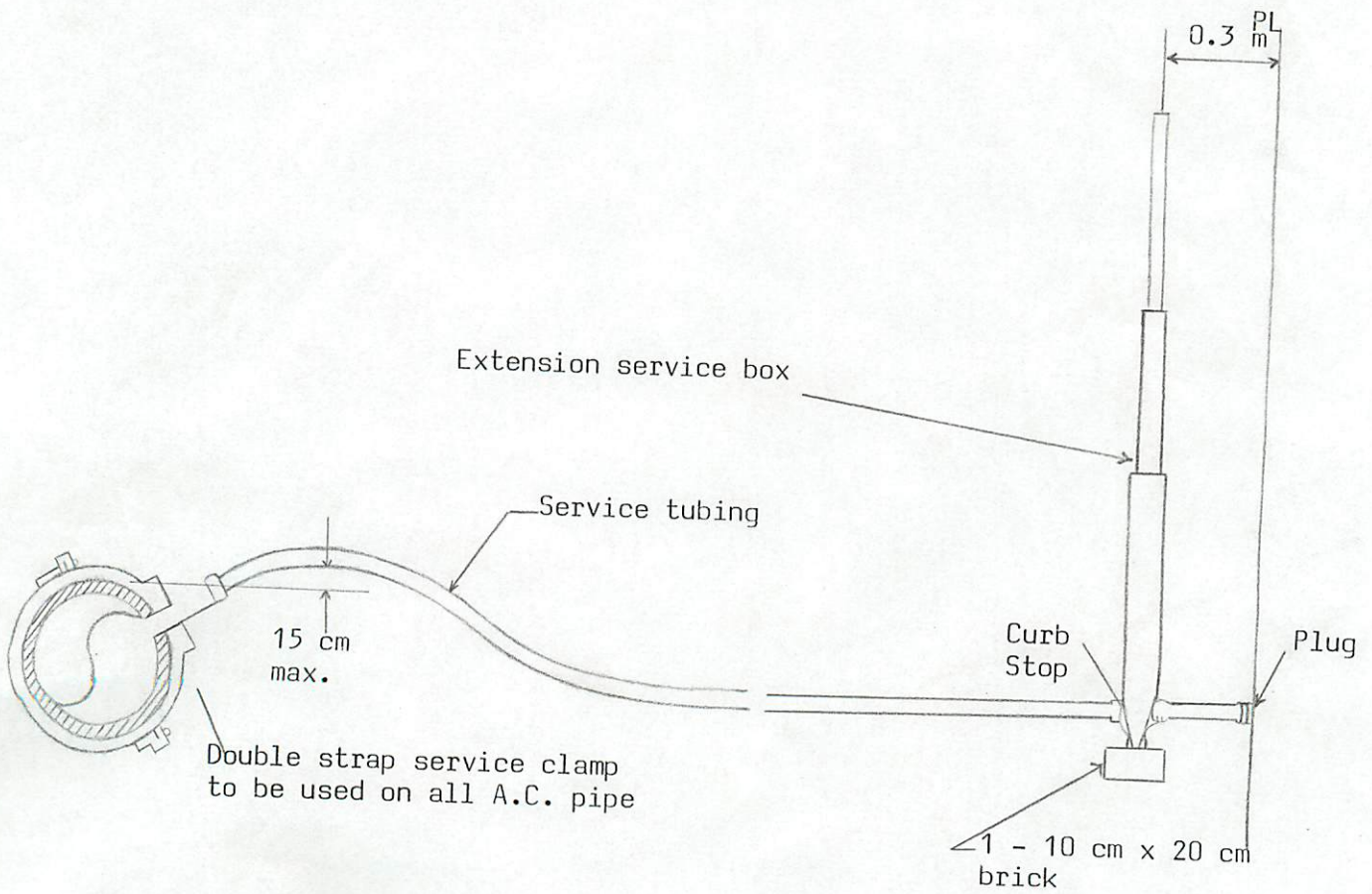
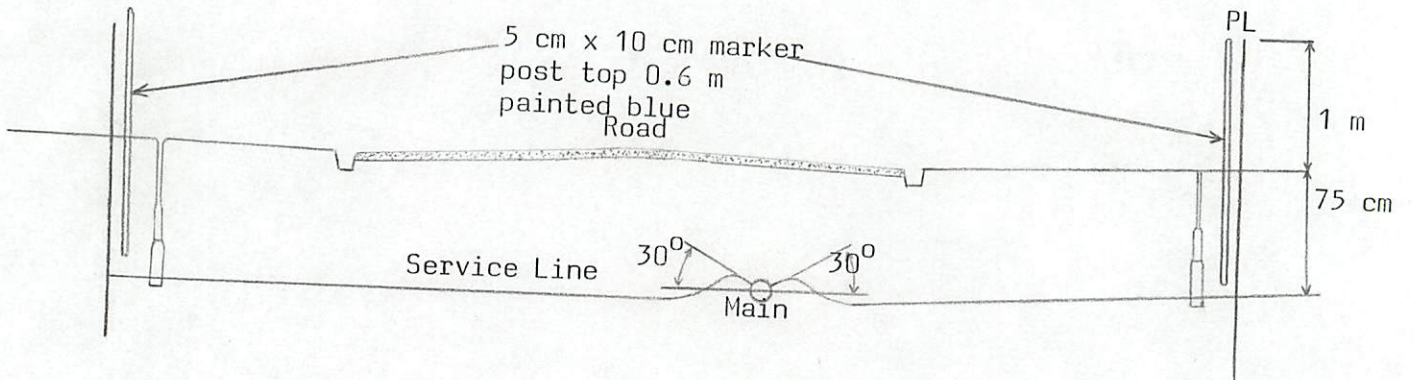


Elevation

		MINIMUM BLOCK BASE AREA (m <sup>2</sup> )				
SOIL TYPE	PIPE DIAM.	CAPS PLUGS & TEES	E L B O W S			
			90°	45°	22.5°	11.25°
HARDPAN	10 cm	0.02	0.03	0.01	0.007	0.004
	15 cm	0.04	0.05	0.03	0.01	0.007
	20 cm	0.06	0.08	0.05	0.03	0.02
	30 cm	0.13	0.18	0.09	0.05	0.03
HARD CLAY	10 cm	0.03	0.04	0.02	0.01	0.006
	15 cm	0.06	0.08	0.05	0.02	0.01
	20 cm	0.10	0.14	0.07	0.04	0.02
	30 cm	0.21	0.30	0.16	0.08	0.04
SAND	10 cm	0.06	0.08	0.05	0.02	0.01
	15 cm	0.17	0.17	0.10	0.05	0.02
	20 cm	0.20	0.28	0.15	0.08	0.04
	30 cm	0.43	0.60	0.32	0.17	0.08
SOFT CLAY	10 cm	0.17	0.24	0.13	0.07	0.04
	15 cm	0.34	0.49	0.27	0.14	0.07
	20 cm	0.59	0.85	0.46	0.23	0.12
	30 cm	1.27	1.79	0.98	0.49	0.25

- NOTES:
1. Concrete thrust blocks shall extend into undisturbed, stable soil.
  2. Concrete shall be 13790 kPa at 8 days.
  3. Concrete shall be kept clear of pipes where possible.
  4. At vertical bends or for pipes greater than 30 cm, the thrust block shall be installed as directed by the municipal engineer.
  5. Minimum areas shown are for maximum 6895 kPa line working pressure

Drawing No. 18



Drawing No. 19