Municipal Servicing Standards

Revised June 2014

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1.0 Introduction

1.1. Forward

The intent of this manual is to provide an information guide to set standards governing design, preparation and submission of plans and specifications for construction of municipal improvements in the Municipal District of Lesser Slave River No. 124. It is intended for use by Developers, Engineering Consultants, Utility Companies and Municipal District Departments. These standards are provided to set out the "minimum" allowable levels to which the requisite improvements are to be built. In instances where the standards do not cover a particular situation or occurrence, good engineering judgment shall be used. All development shall comply with the requirements of the Municipal District of Lesser Slave River No. 124, all applicable Land Use Bylaws and Provincial and Federal legislation.

No departure from these standards shall be permitted without the written approval of the Director of Field Services. The Municipal District shall be the final authority on any disputed plans. Minor revisions may be given verbal approval by the Director of Field Services, but a change order shall be issued to record such revisions.

All completed plans, records and documents shall be submitted a minimum of 30 days prior to final design acceptance by the Municipal District.

No construction shall commence until all designs have been accepted by the Municipal District and the following has been submitted:

1) Design drawings
2) Letters of Credit
3) Authority Contacts & Approvals
4) Development Agreement
5) All Levies & Fees

1.2. General

This publication entitled, **"Design Guidelines and Construction Standards"**, documents performance, preferred materials or methods and logistical considerations. Readers will use this information for the design and construction of the Municipal District infrastructure. Over time, certain products or approaches to construction have proven successful and the Municipal District, private consultants and contractors working in Alberta have adopted them.

The information presented in this document has been prepared by following recognized engineering principles and practices, and is intended to be used for general information purposes only. The information is in conformance with applicable codes and standards that are mandatory for the safe and efficient operation of municipal facilities. Independent engineering consultants compiled the information in this document to support and justify the rationale governing the various design standards and details that are to be incorporated into the design and construction of municipal infrastructure and facilities.

The Developer shall be responsible for, pay to and fully indemnify the Municipal District for all legal, planning, and engineering costs, fees, expenses, and disbursements incurred by the Municipal

District through its solicitors, planners, and engineers for all services in connection with the preliminary review of subdivision and development proposals.

Although due diligence has been exercised in preparing this document, the Municipal District does not accept responsibility for errors or omissions. Users of this document are responsible for ensuring that the information they extract from it is appropriate and valid for their particular application. This document and its contents are not intended to be used as a reference in purchasing specifications, contracts, regulations, statutes or any other legal document. References made in this document to specific manufacturers, service companies, methods, processes, products or services do not imply an endorsement, recommendation, or warranty by the Municipal District.

1.3. Criteria for Design Guidelines and Construction Standards and Drawings

The Design Guidelines and Construction Standards and Drawings do not replace mandatory codes or regulations. Where necessary, they complement the following:

1) Where the Municipal District believes more stringent requirements should apply to the National Fire Code of Canada or to local municipal requirements;
2) Where the Municipal District believes a need to augment or clarify a code requirement;
3) Where the Municipal District experience has shown conditions peculiar to northern communities require an approach different from typical Canadian construction industry practice; and
4) Where the Municipal District has developed preferences for specific products, systems or methods.

1.3.1. Developer Guidelines

1.3.1.1 Preliminary Review Requirements for Multi-Lot Subdivision Application

Developers that make application for multi-lot subdivision must prepare support documentation that will address all potential issues/concerns that may arise from the preliminary review of the proposal by the Municipal District and referral agencies. Listed below are items that need to be addressed in a background report for consideration in the planning process for a multi-lot subdivision. The application and background report documentation (text and maps) in support of the proposal must contain:

1) **Development objectives** for the proposed use.
2) **Summary of Compliance** with applicable existing statutory plans and municipal policies/standards; Compliance with the Municipal Development Plan, applicable Area Structure Plan and applicable municipal policies/standards.
3) **Summary of Compliance** with the LUB regulations and requirements.
4) **Delineation of Geographic Boundaries,** and a concise statement on the subject site's relationship and linkages with surrounding lands, including a justification as to why the particular boundaries are proposed.
5) **Environmental Concerns;** address protection of habitat and ecological conservation.
6) **Development Limitations;** An indication as to how natural and man-made limitations to development, such as flood susceptibility, bank subsidence, erosion, railway lines, oil and

gas wells, pipelines, and other facilities (including active, inactive, abandoned, and decommissioned facilities, sour gas, etc.), gravel operations or resources, airports, agricultural operations, historical resources, other nearby land uses, etc. will be addressed.

7) **Potential Conflicts;** The potential population resulting from the proposal, and how built form, amenities, aesthetics, landscaping, buffering from potential limiting factors, and potential land use conflict will be dealt with.

8) **Access;** An indication as to how access will be provided to the subject site.

9) **Servicing;** An indication as to how water supply, sanitary sewer, and storm management facilities necessary in order to provide water supply, sewage collection and disposal, and storm management services will be provided to the site, including their locations both on and off the site.

10) **Community Impact;** An indication of:

- the impact on adjacent land uses,
- the impact on community services, such as fire protection,
- the municipal servicing costs associated with the development, landscaping, and
- risk assessment, especially as it relates to "heavy" industrial development.

11) **Development Timing;** describe the proposed timing of each part of the proposed development phases.

1.3.1.2 Submission for Preliminary Engineering Review

The following shall be submitted to the Municipality for the purpose of preliminary design review.

1) Engineering drawings as detailed in Section 2.0 – General Conditions and Engineering Procedures and Section 2.3.5.1 – Engineering Design Approval Proccess.

2) One (1) copy of the construction contract specifications and unit cost if tendered or an engineering estimate for the cost of construction of the development including:

- Surface Improvements (roadway clearing, loaming, seeding, grading, base and paving)
- Water Supply System (wells, pipelines and related appurtenances, co-op memberships)
- Franchise Utilities
- Engineering and Testing (surveys, design, inspections and quality control)
- Third party Quality Assurance Testing

3) One Geotechnical Report, including an analysis of ground water table and soil percolation tests, and slope stability requirements.

4) Confirmation of water if a supply connection to the Municipal water distribution system or other supply. Provide necessary permits, plans and specifications for the water supply system.

5) Confirmation from Alberta and Federal agencies that the licenses and permits as required for the construction of the project are in place or obtainable.

6) A Storm Water Management Plan.

7) A construction schedule outlining the sequence of construction activities with applicable dates.

8) Confirmation from Utility companies of line alignments, easement requirements and servicing costs.

9) Proof of the ability to secure liability insurance coverage in the amount specified in the Development Agreement naming the Municipality as a named insured.

10) It should be noted that security requirements will be required which will be determined by the size and nature of the development. The value of the security will be stated as a condition of the Development Agreement. The security is generally provided to ensure the surface reclamation of any disturbed areas, construction and compliance with applicable conditions of the Development Agreement.

1.3.1.3 Application Review

Once the application has been submitted a preliminary review and report will be prepared by the Municipal District and sent to the Developer. The review report will outline the issues that the Developer must address before the Municipality will consider the subdivision application complete.

In addition to the foregoing, the Municipality at its sole discretion may require further additional information, reports from a third party or an independent engineering analysis prior to finalizing the development review process.

The receipt of these plans must not be interpreted as permission to commence construction. The Municipality will grant written permission to construct only after all parties have endorsed the Development Agreement.

1.4. Application of Standards

The Rationale contained in this document relates directly to the following:

1) This Design Guidelines and Construction Standards document will be used for direct incorporation of the information into a construction package for tendering municipal improvements. Sufficient detail has been provided to minimize errors during the construction of municipal infrastructure. The safety, security and reliability of each proposed design and equipment are of paramount importance to northern communities, which are extremely dependent upon cost effective and reliable functionality of their infrastructure.

2) Standard Detail Drawings. This section containing the standard detail drawings is intended to be referenced and incorporated into all municipal infrastructure projects and their construction. In addition, it is through ongoing and future experience that the drawings and details will be further refined to incorporate new, improved, and innovative methods of reducing both the construction and maintenance costs and operational problems.

Photocopying is encouraged or an electronic version of the applicable sections may be made available through written request, to form part of the contract documents for new, expanded, or renovated municipal infrastructure projects.

1.5. Revisions

Readers are encouraged to comment or submit revisions at any time to the Municipal District. The Municipal District will propose and broadly distribute these comments and revisions for review. The Municipal District anticipates an annual review process to ensure this document reflects the collective knowledge of all parties involved in municipal construction projects in the Municipal District. The revisions to this edition of the Design Guidelines and Construction Standards were collected by the Municipal District with the assistance of EXH Engineering Services Ltd.

This is the first edition of the Design Guidelines and Construction Standards. It has been extensively edited and improved. Improvements include the rearranging of material presented, the revision of phrases and words to improve usage. Because of the extensive editing, indicating all changes is not possible. However, where significant changes to these Design Guidelines and Construction Standards occur, a vertical line in the left margin shows those sections, as done with this paragraph.

The Municipal District will undertake reviews to confirm, revise, or update future design standards and guidelines. Hence, the Municipal District invites comments and suggested revisions to the following address:

Municipal District of Lesser Slave River

3000 15 Avenue

Slave Lake, AB T0G 2A0

Phone: (780) 849-4888

Fax: (780) 849-4939

E-Mail: md124@md124.ca

Brief description of the proposed revision:

Rationale: (Relate experiences that led to the proposed revision)

Name _____

Company _____

Title _____

Address _____

City _____

Telephone _____

Facsimile _____

Email _____

1.6. Contract Design Change Proposals

1.6.1. General

After the tender is awarded or a subdivision proposal is received, the Contractor has the option of submitting a Contract Design Change Proposal for an alternate design, or change to the Municipal District's design or any component thereof, provided cost savings can be achieved without compromising the integrity and quality of the project. These proposals will be accepted or rejected by the Municipal District or the Engineer at its sole discretion. Proposals shall be submitted through the Municipal District's Engineer.

Project Net Cost Savings will be shared on a 65% / 35% basis between the Contractor and the Municipal District. These net savings shall be identified, itemized, confirmed and fixed prior to the Municipal District giving approval to proceed with the proposed changes.

When a Contract Design Change Proposal is submitted, a preliminary technical review will be conducted by the Municipal District's Engineer to ensure it meets the Municipal District's requirements. A one-week period will be required for this review, after which the proposal will be accepted or rejected. If the proposal is accepted, the Contractor shall complete a detailed design as required.

When submitting a Design Change Proposal, the Contractor shall also provide non-refundable certified cheques in accordance with the following:

1) Preliminary Technical Review – At the time the proposal is submitted, the Contractor shall provide a non-refundable certified cheque in the amount of $500.
2) Final Design Review – If the Project Net Cost Savings (PNCS) is more than $10,000.00, the Contractor shall provide an additional non-refundable certified cheque in the amount of $3,000.00 at the final design review stage. If the PNCS is less than or equal to $10,000.00, the Contractor will not be required to provide the $3,000.00.

Contract Design Change Proposals shall be sufficiently complete at the preliminary technical review stage so that the Municipal District can fully access alternatives for equivalencies, and compliance to standards and practices, including functionality, serviceability, durability, maintainability, and overall cost effectiveness. The Municipal District may recommend or request adjustments or alterations to the proposal to make it acceptable.

Acceptance or rejection of the proposal at any time during the initial review process will not be considered a basis for claim or relieve the Contractor of any obligations of the Contract.

Once both parties have agreed to the terms and conditions of the proposal, the Contract will be modified through a supplementary agreement (Contract Change) to incorporate the changes agreed upon; all other Contract conditions will remain in effect.

1.6.2. Payment

Project Net Cost Savings (PNCS) shall be taken as the cost difference between the Municipal District's tendered design and the Contractor's proposed design, net any additional costs or savings incurred by the Municipal District. The Contractor's Cost for Contract Changes (CCCC) shall include, but are not limited to, any required design work, the preparation of the proposal submission, the involvement of the Contractor's Engineer if necessary, and all costs associated with construction and profit. The Municipal District's costs and/or savings (OC) shall include those

that are project related but outside the terms of the Contract, such as, but are not limited to, consultant costs for participating in the review of the Contractor's proposal, project testing, measurement, inspection including any specialized inspection required by the Municipal District, and management;

PNCS - Project Net Cost Savings
OTDC - Municipal District's Tender Design Cost
CCCC - Contractor's Cost for Contract Changes
OC - Municipal District's Cost (Savings(+), Additional Costs(-))

Payment to the Contractor to complete the work identified in the proposal will be made through progress payments, in accordance with the terms and conditions agreed to for the proposal. This payment shall not exceed the Contractor's estimate for the work as identified in the proposal.

Payment of the Contractor's 65% share of the Project Net Cost Savings will be made as a lump sum payment to the Contractor once the project is ready for the Construction Completion Inspection.

1.6.3. Contract Design Change Proposals

1.6.3.1 General Requirements

Proposals will be evaluated for compliance with Technical Standards and Guidelines for the Work items in the proposal. If a proposed alternate does not meet or exceed the Engineering standards, guidelines, practices or specifications, it is the responsibility of the Contractor to undertake the level of engineering necessary to justify the deviation. Details of the justification, with supporting documentation, must be provided to the Municipal District's Engineer with the submission.

For environmental and other approval requirements, the Contractor shall note that the conditions on any existing permits and approvals are only applicable for the existing contract. When required, the Contractor must resubmit the plans and drawings for review and obtain new or revised permits and approvals.

1.6.3.2 Preliminary Technical Review – Submission Requirements for the Contract Design Change Proposals

The preliminary technical review will be conducted by the Municipal District's Engineer to assess the proposal for equivalencies and compliance to the relevant engineering standards, guidelines and practices. For the submission at this stage, where plans and drawings are required to illustrate the proposal, the Contractor may make use of, and modify as required, the Municipal District's plans. For major design changes, the Contractor shall prepare additional sketch plans, as required, that reasonably represent the design alternate or change.

To permit the Municipal District and the Municipal District's Engineer to assess the proposal, the Contractor shall provide a written submission to the Municipal District's Engineer which includes, when applicable, information on the following items:

1) Describe the difference between the existing Contract requirements and the proposal.
2) Indicate the Contractor's Cost for Contract Changes (CCCC) as identified herein, with supporting calculations and cost estimates.
3) Identify potential impacts of the proposal on stakeholders, including, but not limited to, landowners, municipalities, utility companies, and other government agencies, with respect to access, usage, and right-of-way agreements. The Contractor shall outline how he will resolve these issues.

4) Indicate the date by which the proposal must be accepted to realize the cost savings identified, and also identify the effect, if any, the proposal has on the Contract Completion Date and, when applicable, the number of Site Occupancy days identified in the contract.

5) Identify the key human resources to be employed in preparing the proposal, including details of their past related project experience.

6) Where significant change to the Contract is proposed, provide evidence that the Contractor's Bonding Company is aware of, and supports, the proposal submission.

The following are typical requirements for a submission that involves major changes to the Municipal District's tendered design. Items from this list will apply as appropriate to minor changes and the nature of the change.

1) Plan View showing structure layout, geometrics and alignment, changes, and right-of-way limits.

2) Elevation View showing elevations, dimensions and technical data.

3) Section View showing dimensioned details.

4) Description of materials to be used and finish treatment.

5) Geotechnical: indicate any additional testing requirements, changes in materials, slope changes or erosion control requirements.

6) Surfacing Design changes: including first course gravel, base courses, asphaltic concrete pavement, and Portland cement concrete pavement. Provide details of changes to surfacing strategy, structural design, aggregate requirements, binder material, geometrics and clearances. Provide details of any effects the proposed changes would have on design life of the surfacing structure.

7) Safety: show changes required to any fencing, signage, barriers, pavement markings or other features necessary to maintain project safety.

1.6.3.3 Detailed Design Review – Requirements for Contract Design Change Proposals

If the proposal is accepted, the Contractor shall complete a detailed engineering design. The design drawings shall be in similar format, and carried out to the same level of detail, as the original design.

The alternate design or change shall be designed and independently checked by Professional Engineers, registered in the Province of Alberta, and shall be complete in all respects, including all drawings and other information necessary to perform the Work. The designer shall stamp the drawings.

Upon receiving the detailed design submission, the Municipal District will require a total period of eight (8) working days for reviewing the design drawings and details. The Municipal District and its Consultant assume no responsibility for correctness or adequacy of the design as a result of this review. The Contractor's Engineer will assume professional responsibility, as Engineer of Record, for all engineering aspects associated with the proposed changes.

The detailed design shall meet appropriate technical standards and guidelines for the Work item in the proposal.

1.6.3.4 Other Requirements and Conditions for Contract Design Change Proposal

During the detailed design process or construction phase, the Contractor shall be responsible for making adjustments or alterations at his own cost, for whatever cause, to the proposal to make it congruent with the specified requirements for a complete job.

No portion of construction can commence until the design or change has been accepted for that portion of the Work.

The Municipal District's Engineer will be responsible for resident engineering services during construction. The Contractor shall make provision for the involvement of his Engineer as necessary. If the proposal involves inspection work which is unfamiliar or beyond the capabilities of the Municipal District's Consultant, and a specialist is required, all cost for additional or specialized inspection will be the responsibility of the Municipal District.

In the development or preparation of the proposal, the Contractor shall not employ the Municipal District's Engineer who is providing engineering services on this contract.

2.0 General Conditions and Engineering Procedures for Municipal Development

2.1. Scope

These design standards shall apply to the design and installation of the municipal infrastructure for new subdivisions and developments in the Municipal District of Lesser Slave River No. 124. This includes the installation of water mains, sanitary sewers, and storm sewer services to existing properties, including surface reconstruction; the installation or alterations to roads, sidewalks, curbs and gutters adjacent to existing properties; and the surface drainage of commercial, industrial, institutional and multi family developments within the Municipal District of Lesser Slave River No. 124. These design standards also apply to all respective connections and appurtenances and any other services that are required to be designed and/or installed.

These design standards do not cover the design or installation of street lighting, ornamental lighting, power, gas, telephone and television services, but do include coordination with the various utility companies. The general location of such services must be approved by the Municipal District.

The Standard Drawings, as referred to in various sections, will form an integral part of these design standards. Standard drawings are provided in Section 18.

No departure from these design standards will be permitted except with written approval from the Director of Field Services. A Change Order shall be issued recording such revision.

2.2. Definitions

In these design standards, unless the context otherwise indicates, the following words shall have the meaning hereinafter assigned to them.

Applicant / Developer shall mean a person who has applied for the subdivision, development or installation to serve an existing parcel of land, whether as the owner or an agent for the owner of the land included therein.

Contractor will mean any person, persons or corporations that shall undertake the installation of Municipal Services on behalf of either the Applicant or the Municipal District.

Developer's Engineer shall mean a qualified Professional Engineer registered and licensed to practice in the Province of Alberta, who is appointed or engaged by the Developer to be responsible for the design and preparation of drawings and specifications and provision of engineering supervision during the construction of the municipal improvements for the development area.

Director of Field Services means the Director of Field Services of the Municipal District of Lesser Slave River no. 124 or their assigned designate.

Municipal District, Engineer, Contractor: persons, firms or corporations identified in the Design Guidelines and Construction Standards. Such parties are referred to throughout the document as if singular in number and masculine in gender. The terms Owner, Municipal District or Engineer include their authorized representatives as designated, in writing, to each of the other parties.

Municipal District shall mean or refer to the Municipal District of Lesser Slave River No. 124, in the Province of Alberta.

Municipal Improvements or "infrastructure" may also mean "Local Improvements" and shall mean both underground and surface structures including, but not necessarily limited to, watermains, sewer systems, storm drainage systems, roadways, walkways, park areas, shallow utilities, signage, fencing, street lighting, and other improvements as required by the Municipal District, all of which shall become the property of the Municipal District to operate and maintain.

Prime Contractor as defined by Occupational Health and Safety.

2.3. Procedure

2.3.1. Engineering Design

The Applicant shall retain the services of a Professional Engineer, registered and licensed to practice in the Province of Alberta, who shall be responsible for the design and preparation of drawings and specifications for all infrastructure including, lighting, telephone, and power that is to be constructed within and/or related to the proposed development area, as required, within the Municipal District. All required municipal improvements shall be designed in accordance with accepted engineering practices and shall meet or exceed the Municipal District Design Guidelines and Construction Standards as set out herein. If landscaping plans are deemed necessary by the Director of Field Services, the landscape plans will be prepared and stamped by a Landscape Architect or a Professional Engineer, as required by Provincial Legislation.

For the installation of services or municipal infrastructure to serve an existing property, the applicant shall make application in writing on the appropriate form provided by the Municipal District. These applications do not necessarily require engineer design; however, the applicant must provide proof that the installation will conform to these design standards. If the Director of Field Services deems it necessary that the installation be monitored by a professional engineer, the applicant shall pay all costs for the monitoring.

The design drawings must show all existing and proposed services. It shall be the responsibility of the Developer's Engineer to coordinate with the utility companies to establish the location of their existing and proposed services.

The Developer's Engineer shall be responsible for carrying out all surveys and investigations necessary to prepare the design. It shall further be the responsibility of the Developer's Engineer to identify the need for any easements or additional right-of-way required. The plans and related documents shall be prepared by a qualified licensed Alberta Land Surveyor at the Developer's expense.

The Developer's Engineer shall bring to the attention of the Applicant the need for any right-of-way, outside the subdivision, that the Applicant will have to obtain. The Applicant shall provide proof of right-of-way to the Municipal District prior to the installation of services on such properties. Rights-of-way shall be assigned in the name of the Municipal District or, as applicable, the utility company. The Applicant is to pay all costs associated with registering the right-of-way and fulfil all terms and conditions associated with establishing rights-of-way.

Alberta Environment must review engineered drawings for all water, wastewater, or stormwater extensions or new installations. All drawings must be approved by Alberta Environment (AE) prior to construction.

While the Developer's Engineer may arrange to have certain portions of the work carried out by other qualified persons, he shall remain responsible for the coordination of the work and certification of its quality and accuracy.

2.3.2. Geotechnical Report

As part of the Subdivision application, the Developer shall submit a Geotechnical Engineering Report, prepared by a qualified registered Professional Engineer that identifies and evaluates the subsurface ground characteristics of the subdivision development area.

Such report shall identify soil types and conditions, including frost susceptibility, soil stability, and water table elevations, as well as any potential difficulties that could be encountered during the construction of the municipal improvements.

As a requirement of the Municipal District, additional geotechnical information may be requested outlining recommended design and construction measures and techniques that must be followed to satisfactorily develop the subdivision, particularly related to water and sewer main construction and roadway structures.

2.3.3. Submission of Engineering Design

Upon completion of the design drawings, the Developer's Engineer will submit to the Director of Field Services, three (3) complete sets of stamped and signed drawings and specifications of the proposed works, including the following:

1) Calculations of sanitary and storm sewer capacity, as shown on the overall sewer and water plan, and pipe loading, where these services are to be installed.
2) Water distribution analysis as specified in Water Distribution Systems.
3) A print of the registerable plan of the subdivision (if not already supplied by the Applicant).
4) A copy of the soils investigation report, judged by the Municipal District to be pertinent to the stage of subdivision.
5) A copy of the Contract Documents proposed for construction purposes.
6) All proposed streets should be named on the drawings. All street names are to be approved by the Director of Field Services.

2.3.4. Design Review

All design drawings, specifications, and relevant data will be examined by the Director of Field Services and any revisions directed to the Developer's Engineer and/or marked on the prints during the review shall be incorporated in the final design drawings.

2.3.5. Engineering Design Approval Process

2.3.5.1 Engineering Information Submissions

Two Copies of the following information must be submitted as part of a Subdivision Application:

1) The results of a Geotechnical/Hydrogeological report completed by a qualified registered Geotechnical engineering firm. At this stage, the level of detail of this investigation should be to an extent sufficient to allow for a general assessment of the sites geotechnical/hydrogeological conditions and their effect on the development and whether or not any contamination exists. The report should outline their findings and any general recommendations.
2) An Environmental Site Assessment of the development area completed in accordance with the applicable Canadian Standards Association and other applicable Standards.

3) If a creek or major water course crosses the site, a plan of the floodplain, and letter outlining the recommended solution to ensure that the development analysis at 1:100 year flood event would not be exposed to flooding.

4) Overall plans of the water and sanitary sewer servicing and storm water management schemes together with a discussion of the schemes and particularly addressing confirmation (with the Municipal District) that capacity is available in existing municipal systems to accommodate the flows required or generated by the development. Supporting calculations are required.

2.3.5.2 Before First Stage Subdivision Application

Two copies of the following information must be submitted prior to submission of the subdivision application for the first stage of development.

1) An engineering design report for the area

   - Overall plan of the proposed water and/or sanitary sewer systems showing sizes and locations of all lines, discussion, and supporting detailed network analyses and calculations to demonstrate that the systems will provide the required level of service.
   - Overall road layout of local roads, collector roads, intersections with arterial roads, road and right-of-way widths, cross-sections, estimates of average daily two-way traffic.
   - A storm water management analysis presenting the proposed scheme; an overall plan, cross sections, its drainage basin, and the downstream receiving stream; supporting detailed hydrology and hydraulic calculations including an analysis of the capacity of the downstream receiving channel, and methods to be incorporated and erosion and sedimentation control. If the implementation of the scheme is to be staged, the staging method should be presented.

2.3.5.3 Detailed Engineering Design

The following will be submitted as part of the application for detailed design approval:

1) A cover letter indicating the subject and purpose of the application, list of attachments, an estimated construction starting date and the proposed schedule for the site meetings.

2) Two complete sets of engineering drawings; Sets which contain the required drawings as outlined in Section 3, Preparation of Engineering drawings will be accepted for processing.

3) One set of specifications and a set of tender forms, if requested by the Municipal District.

4) Two copies of a Geotechnical/Hydrogeological Report presenting the results of a field investigation completed by a qualified registered geotechnical engineering firm. At this stage, the level of detail of this investigation, analysis, and report should be much more extensive than the first stage and address the following:

   - Identify areas of high groundwater tables and estimate weeping tile flow rates.
   - Identify conditions that will require special design considerations.
   - Provide detailed recommendations for design and construction of roadways, pavement structure designs, deep and shallow utilities, site grading, storm water management and buildings.

- Clearly identify the limits of any site contamination and outline the site remediation to be completed.
- Soil alkalinity (sulphate levels) and resistivity test results and recommendations regarding concrete to be used and corrosion protection.
- Identify any conditions that will have special operation and/or maintenance implications.
- Top of bank setbacks adjacent to Creeks or ravines with stability problems.

5) Two copies of an Engineering Design Brief for the stage of development clearly demonstrating that the designs for the infrastructure systems for the stage fit into the overall development systems designs presented in the Area Structure Plan. A water network analysis should be included to demonstrate that the system for the isolated stage of the development will provide the necessary fire flows. The details of any interim storm water management or staged servicing schemes or temporary facilities (emergency access, construction access, etc.) must also be presented.
6) An estimated construction schedule outlining the sequence of construction to be followed and applicable critical dates.
7) Additional technical detail required to satisfy the conditions of subdivision approval.
8) A cost estimate for proposed underground improvements and above ground improvements.
9) A detail schedule of the length of local roads (including cul-de-sacs) and cost per meter and the length of collector roads and cost per meter.
10) Copies of all letters of application for all applicable approvals, permits, licenses, or agreement from Provincial, Federal or private agencies.
11) Copies of the formal approvals, permits, licenses or agreements must be received before construction commencement.

Upon completion of all revisions, the Developer's Engineer shall submit four (4) complete sets of signed and stamped Contract Drawings and Specifications to the Director of Field Services.

When the design is approved, the Director of Field Services shall stamp "Approved for Construction" on the drawings, returning one set of the drawings to the Developer's Engineer, or issue a letter advising that the design is accepted and listing any conditions of acceptance.

No work shall commence within any new parcel of land or any of the services to be provided by the Applicant until the Municipal District has examined and stamped the revised Contract Drawings.

2.3.5.4 Responsibilities

1) The developer will be responsible for complying with the requirements outlined in these Standards and all other applicable legislation, regulations, codes, standards, agreements, permits, and license. The Municipal District may request additional information as deemed necessary.
2) The developer will arrange and negotiate any and all easements across private lands, private utility crossing agreements and other similar agreements, which may be needed with landowners in the area. The Municipal District will only become involved if a mutually

agreeable solution cannot be reached through negotiation between the parties involved and the viability of an approved subdivision is jeopardized. Note that a Development Agreement must be in place before the Municipal District can take any action.

3) The Municipal District will, on request, supply all available information on existing utilities including available capacities, locations, restrictions and limitations. However the applicant must confirm the information provided, in the field, as the Municipal District does not guarantee the accuracy or completeness of any information provided.

4) Periodically the Municipal District will amend the Standards and issue a formal addendum to all holders of the Standards who are registered with the Municipal District.

5) Nothing in these standards relieves either the Municipal District or the Developer of any of the obligations contained in the Development Agreement.

2.3.6. Rights-of-Way and Easements

Where easement or right-of-way documents are deemed necessary, they will be prepared by a registered Alberta Land Surveyor at the Applicant's expense. Rights-of-way and/or easements will be provided for all utilities not located on streets, lanes, or utility lots, including rights-of-way for ditches or water courses accommodating surface runoff. Rights-of-way shall be registered in the name of the Municipal District or, as appropriate, in the name of the utility company. Ownership to be confirmed with the Municipal District.

2.3.7. Construction Standards

Clearing and Salvage - All clearing and salvage operations shall follow current regulations and guidelines as outlined by Alberta Forestry, Lands and Wildlife. All brush and debris resulting from such clearing operations shall be burned or otherwise removed from the road right-of-way. No burying of debris is permitted within the right-of-way.

Topsoil Removal and Placement - Prior to construction, all topsoil shall be removed from the entire length and width of the work area. Topsoil shall be stockpiled at a suitable location. After completion of the grading work, the developer shall place the topsoil on the back slopes and half way up the side slopes of the road and locations as directed by the Director of Field Services, to a uniform depth throughout.

Culvert Installation - All culverts shall be installed on a hard bed and back filled with select well compacted material as shown on Standard Drawing No.10.26

Compaction - Embankments shall be constructed and compacted in lifts not exceeding 150mm. No rocks exceeding 150 mm are to be placed within the top 300 mm of grade. The road bed shall be sufficiently compacted to withstand a proof rolling test in which the passage of a fully loaded tandem gravel truck leaves depressions no greater than 10mm, or a minimum of 95% of Standard Proctor Density for the top 1.0 m of the embankment. Developer shall supply materials and equipment required for this inspection.

Landscaping and Seeding - Any drainage channels and road ditches shall be provided with ditch checks or other means of erosion control acceptable to the Director of Field Services. All disturbed areas are to be seeded with the following seed mixture:

Slender Wheat Grass	Agropyron trachycaulum	35%
Rocky Mountain Fescue	Festuca saximontana	20%
Tickle Grass	Agrostis scabra	10%

Fringed Brome [1]	Bromus ciliatus	10%
Canada Wildrye	Elymus Canadensis	10%
Tufted Hairgrass	Deschampsia cespitosa	10%
Fowl Bluegrass	Poa palustris	5%

[1] Fringed Brome seed shall be coated

The seeding must be completed in order to adequately promote growth within 1 year.

Fertilizer may be required. The fertilizer requirements, composition and application rate must be determined through project specific soil analysis.

2.3.8. Construction Approval

Upon receipt of "Approved for Construction" drawings and specifications, the Applicant may proceed to install Municipal services subject to the following:

1) Satisfactory execution of a Development Agreement pertaining to the development or subdivision.
2) "Letter of Authorization" from Alberta Environment, through the Developer's Engineer, and a copy received by the Director of Field Services.
3) A list of materials that are being installed and a construction schedule submitted to the Municipal District's engineering office.

A copy of all approved drawings and specifications will be maintained by the applicant at the construction site during the installation of services and be made readily available to Municipal District representatives.

Underground subdivision services will not be permitted to operate as part of existing Municipal services until the respective subdivision services have been inspected, tested by the Developer's Engineer and the test results have been approved in writing by the Director of Field Services.

2.3.9. Engineering Supervision

The applicant shall retain the services of a professional engineer who shall be responsible for the layout to ensure finished construction conforms to the lines and grades shown on the approved plans for inspection and approval of all materials to be used, and for supervision of installation of all services, that are the responsibility of the Applicant. The Developer's Engineer, or his authorized representative, shall be available at all times to visit the site during the installation of services.

The Developer's Engineer will be responsible for maintaining field surveys and recording of all record drawings.

In addition to supervision carried out by the Developer's Engineer, the Director of Field Services, or his agent, may periodically inspect any work being completed. The Director of Field Services will bring the use of any unacceptable materials or practices to the attention of the Contractor and/or the Developer's Engineer. If remedial action is not taken to the satisfaction of the Director of Field Services, he may order the work to cease until such time as the corrective action has been taken.

If the Developer's Engineer wishes to make any changes in the design, either before or during the execution of the work, he will first submit a marked print, showing proposed revisions, to the Director of Field Services. If approval is granted for revision, the original drawing will be immediately revised and new prints issued.

2.3.10. Testing

It will be the responsibility of the Developer's Engineer to ensure that testing of all materials called for in the specifications is carried out by an accredited testing firm. Copies of all test results shall be forwarded to the Director of Field Services as soon as possible after completing the tests. The costs of the tests shall be borne by the Developer.

2.3.11. Record Drawings

Within three weeks of the Construction Completion Certificate of the underground improvements, the Developer's Engineer shall deliver to the Director of Field Services record drawings indicating the service connections, tie-ins, invert charts on plan/profiles, and service invert elevations on lot grading plans. All record drawings must also be submitted in digital format compatible with the Municipal District's latest version of AutoCAD.

No development permits or building permits will be processed until the Municipal District receives a set of record drawings, including completed design building grades for each lot. As an exception, one show home may be constructed with the written approval by the Director of Field Services, provided the subdivision design grades have been submitted and approved.

Within two months of completion of roadway base course and asphalt, the Developer's Engineer shall deliver good quality Mylar originals of the record drawings, one complete set of prints and a digital copy (in the Municipal District's latest AutoCAD software version) of the record drawings to the Director of Field Services.

2.3.12. Municipal Acceptance and Maintenance Period

The Developer shall apply for a Construction Completion Certificate for each group of improvements for each stage of development. A Construction Completion Certificate will be required by the Developer from the Municipal District for each group of the following improvements to be constructed and installed by the Developer; namely:

1) Sanitary and storm sewers, and water distribution system, including service connections for water and sewer.
2) Sidewalks, curbs and gutters, catch basins, concrete walkways, and paved and graveled lanes.
3) Paved Roads.
4) Landscaping, including boulevards, uniform fencing, and subdivision signage.

The Developer shall make application to the Municipal District for the issuance of a Construction Completion Certificate. No such application will be considered by the Municipal District unless it is requested in respect of all of the Development Area or one or more approved stages of development.

The Municipal District may issue a Construction Completion Certificate, issue a Conditional Construction Completion Certificate or provide a list of deficiencies that must be corrected in order to obtain a Construction Completion Certificate. The details of the process will be outlined in the development agreement.

The Developer shall maintain all Municipal improvements constructed pursuant to this Agreement to the standard to which they were constructed, reasonable wear and tear excepted, for the

period commencing upon the issuance of a Construction Completion Certificate and continuing for the periods as stated as below:

1) Underground Services and Utilities - 24 months
2) Roads and Sidewalks - 24 months
3) Uniform Fencing, grass and sod for landscape areas - 12 months

Upon completion of the Maintenance Period, and after final inspection and correction of all deficiencies thereof, a Final Acceptance Certificate will be issued by the Director of Field Services.

2.3.13. Development Permits

No Development Permits or building permits will be issued until the subdivision plan is registered, all essential services have been provided as specified in the Development Agreement and underground utility service record drawings have been submitted and accepted by the Director of Field Services.

2.3.14. Existing Utilities

Prior to connecting to existing utilities, the Municipal District's Utilities Department shall be given a minimum of two working days notification of the work being done.

Once operational, hydrants or main line valves shall only be operated by Municipal District staff.

No sanitary sewers shall be used to discharge storm water

2.3.15. Road Closures and Construction within Road Rights-of-Way

In the event that a road must be partially or fully closed due to construction activity, the party causing this event will provide all detours, signs, flag persons, barricades, and other safety requirements necessary to provide for the orderly control of traffic around the construction area.

2.3.16. Survey Control System

The Developer shall provide a survey control system within, and adjacent to the subdivision. The survey control system shall consist of survey monuments of a design mutually acceptable to the Municipal District and Alberta Environment, Land Administration Division. The survey monuments shall be placed so as to be inter-visible between adjacent pairs and spaced approximately 300 metres apart. Measurements shall be made between monuments, and connection shall be made to existing geodetic monuments to not less than third order of survey specifications, as defined by the Geodetic Survey of Canada, to establish vertical and horizontal coordinates based on a three degree transverse Mercator projection. The Municipal District and Alberta Environment, Land Administration Division, shall be provided with the survey measurements, to the satisfaction of the Director of Surveys, Alberta Environment, Land Administration Division, for the survey control system.

The Developer shall undertake to preserve all existing and new monuments and, should it be necessary to destroy a monument, the Developer shall establish a new one in lieu thereof and provide the Municipal District and Alberta Environment, Land Administration Division, with survey measurements for it to the satisfaction of the Director of Surveys.

Any legal pins disturbed or removed during construction shall be replaced prior to Final Acceptance by the Municipal District. The Developer shall supply a certificate from a registered legal survey that all lot and corner pins are intact.

2.4. Performance Assurance

2.4.1. Bonds

The Municipal District shall have the right to require the Contractor to provide and maintain, in good standing until the fulfillment of the Contract, bonds covering the faithful performance of the Contract and labor and materials payment thereunder, including the requirements of the Warranty provided for in Section 2.4.2 - Warranty, and the payment of all obligations arising under the Contract.

All such bonds shall be issued by a duly incorporated surety company approved by the Municipal District and authorized to transact a business of Suretyship in the Province of Alberta. The forms of such bonds shall be acceptable to the Municipal District.

If the Bid Documents require the successful bidder to provide bonds, the Contractor shall pay for same.

If the Municipal District requests bonds of the Contractor and such bonds were not demanded in the Bid, the Municipal District shall reimburse the Contractor on receipt of a receipted premium demand and the executed bond itself.

The Contractor shall produce all required or requested bonds prior to commencing any work of the Contract.

The Contractor shall provide a "Performance Bond" in the name of the Municipal District for fifty (50%) percent of the contract price, to assure the faithful performance of the contract, including corrections to the work required under warranty, on the standard performance bond, Canadian Construction Association Document No. (S)21.

The Contractor shall provide a "Labor and Material Payment Bond" in the name of the Municipal District of Lesser Slave River No. 124, for fifty (50%) percent of the contract price, to assure the contractor makes payment to all parties directly contracted to him, on the Standard Bond form, Canadian Construction Association Document No. (S)22.

2.4.2. Warranty

The Warranty Period of the Work referred to in this clause shall start, subject as hereinafter provided, on the date noted on the Construction Completion Certificate.

The Warranty Period for items of the Work that cannot be completed expeditiously on account of climatic or other reasons beyond the control of the Contractor, and that do not impair the usefulness of the Work for the purpose intended, and are identified as such in the Construction Completion Certificate, shall start on the date of completion of the entire Work.

The Contractor shall promptly correct, at his own expense, any defects in the Work due to faulty products or workmanship appearing within the specified warranty period below, from the start of the Warranty period or within such extended period as may be specifically stated in the Specifications. A like Warranty, and for a like period, shall apply to any repaired or replaced product or workmanship, starting on the date of completion of the repair or the replacement.

The warranty period for all underground construction is for a period of two (2) years from the date of issue of the Construction Completion Certificate.

The warranty period for all surface construction is for a period of two (2) years from the date of issue of the Construction Completion Certificate.

To ensure the Municipal District has benefit of any and all Product or system warranties offered by manufacturers or others, the Contractor shall ensure that all Warranties are assignable and are assigned to the Municipal District of Lesser Slave River No. 124 in the Municipal District of Lesser Slave River No. 124's name. Such assignment shall not relieve the Contractor of his obligations under Section 2.4.2 - Warranty.

The Contractor shall correct, at his own expense, all damage resulting from any defects or corrections to any defects required under the conditions of Section 2.4.2 paragraph 3 above.

The Municipal District may, in an emergency or if the Contractor neglects to correct defects for any reason, do the work, or direct someone else on his behalf to do the work, and charge the Contractor accordingly.

No certificate of the Engineer nor payment thereunder shall relieve the Contractor from his responsibility herein.

The Municipal District or the Engineer will promptly give the Contractor written notice of all observed defects.

The Engineer shall, one month prior to termination of the warranty Period, notify the Municipal District and the Contractor, by written notice, that an inspection of the work is required and shall, in such notice, fix a date for such inspection which shall be within the next ten (10) days. The inspection will be carried out by the Engineer, who may be accompanied by the Municipal District and the Contractor. The Engineer will record defects requiring repair or correction and will instruct the Contractor, in writing, to remedy such defects within fifteen (15) days. If the Contractor refuses or neglects, for any reason, to correct such defects, the Municipal District may correct them or direct someone else, on his behalf, to correct them, and charge the Contractor for all the costs of such correction.

For the duration of the maintenance period, the Contractor shall be responsible for faulty material and/or workmanship, and for maintenance and corrections that are a direct result of faulty material and/or workmanship.

All rectification work made necessary by subsidence of trenches and fill areas, related to the scope of work, will be the responsibility of the Contractor to the end of the maintenance period.

The Contractor is not relieved of his obligation to maintain the system until such time as the Municipal District signs the "Final Acceptance Certificate". The Municipal District may request an extension to the maintenance period due to faulty materials or poor workmanship. The Contractor will be held responsible for maintaining the system for this period of extension at no cost to the Municipal District.

After due notification, in writing, to the Contractor, the Municipal District may proceed with correction of fault at the expense of the Contractor and his surety. In emergency situations endangering life or public property, the Municipal District shall proceed with repairs and thereupon advise the Contractor of the failure, and resulting costs shall be paid by the Contractor.

The Engineer will issue a Final Acceptance Certificate to the Contractor when the maintenance period is complete, all maintenance deficiencies are rectified, and approval has been received from the Municipal District.

2.5. Indemnification and Insurances

2.5.1. Indemnification

The Contractor shall indemnify and hold harmless the Municipal District and the Engineer, their agents and employees, from and against all claims, demands, losses, costs, damages, actions, suits, or proceedings arising out of, or attributable to, the Contractor's performance of the Contract. Without limiting the generality of the foregoing, such indemnity shall extend to claims for liens filed under the appropriate Lien Legislation after the time available to the Contractor for filing liens.

Nothing in the Contract Documents or any approval, expressed or implied, of the Engineer or the Municipal District, shall relieve the Contractor of any liability for latent defects or inherent vice which may be imposed by law.

2.5.2. Insurance

The Contractor shall maintain Comprehensive General Liability and Property Insurance applicable to the Work and all parties thereto for the full term of the Contract including the Warranty period(s), unless specified otherwise.

The Contractor shall provide proof of all insurance to the Municipal District prior to commencing the Work.

A listing of the required insurance must be specified in the Contract Documents.

2.5.3. Protection of Work and Property

The Contractor shall protect all property adjacent to the Place of the Work from damage as the result of his operations under the Contract.

The Contractor shall protect the Work and the Municipal District's property from damage, and shall be responsible for any damage that may arise as the result of his operations under the Contract.

2.6. Worker's Compensation

Prior to commencing Work, and prior to receiving payment for Substantial Performance of the Work and the final payment, and at any time during the term of Contract, when requested by the Engineer, the Contractor shall provide evidence that the Contractor and all Subcontractors have complied with all requirements of the Province with respect to Workers' Compensation, including payments due thereunder.

2.7. Engineer

2.7.1. Engineer's Decisions

The Engineer shall decide on questions arising under the Contract Documents between the Municipal District and the Contractor and shall interpret the requirements therein. Such decisions shall be given in writing. The Engineer shall use his powers under the Contract to enforce its faithful performance by both parties hereto.

The Contractor shall notify the Engineer, in writing, within five (5) working days should he hold that a decision by the Engineer is in error or at variance with the Contract Documents.

If the question of error or variance is not resolved within five (5) working days, and the Engineer decides that the work in dispute shall be carried out, the Contractor shall act according to the Engineer's written decision.

Should the Engineer's employment be terminated, the Municipal District shall appoint an Engineer whose status, under the Contract, shall be that of the former Engineer.

Nothing contained in the Contract Documents shall create any contractual relationship between the Engineer and the Contractor.

The Engineer will not, except by written notice to the Contractor, stop or delay any part of the Work pending instructions or proposed changes in the Work.

2.7.2. Inspection of the Work

The Municipal District, the Engineer and their authorized representatives shall have access to the Work at any time for inspection wherever it is in preparation or progress. The Contractor shall co-operate to provide reasonable facilities for such access. If such inspection shows that any Product or workmanship is not in accordance with the Contract Documents, such Product or workmanship shall be rejected.

If special tests, inspections or approvals are required by the Contract Documents, the Engineer's instructions or the law of the Place of the Work, the Contractor shall give the Engineer and the affected authority adequate notice requesting inspection. Inspection by the Engineer will be made promptly. The Contractor shall arrange inspections by other authorities and shall notify the Engineer of the date and time. The Contractor shall furnish, promptly to the Engineer, two (2) copies of all certificates and inspection reports relating to the Work.

If, without the approval of the Engineer or the affected authority, the Contractor covers, or permits to be covered, any of the Work that is subject to inspection before any special tests and approvals are completed, the Contractor shall uncover the Work, have the inspections satisfactorily completed and make good the Work at his own expense.

Examination of any questioned work, beyond the Engineers usual inspections, may be ordered by the Engineer. If such work is found to be in accordance with the Contract Documents, the Municipal District shall pay the cost of examination and replacement. If such work is found not to be in accordance with the Contract documents, the Contractor shall pay the cost of examination and replacement.

2.7.3. Ownership of Documents and Models

All Contract Documents and copies thereof, furnished by the Municipal District or Engineer, are and shall remain the property of the Engineer and are not to be used on other work.

Such documents are not to be copied or revised in any manner without the written authorization of the Engineer.

Models, samples, mock-up panels or units, furnished by the Engineer, Contractor or the Municipal District, are the property of the Municipal District.

3.0 Preparation of Engineering Drawings

The following specifications will govern the preparation of Engineering Drawings for all Municipal District Developments.

3.1. Design Drawings

1) All detailed engineering plans submitted for review and approval must comply with the specifications herein stated.
2) Clarity and legibility shall be the governing criteria when preparing drawings.

3.2. Procedure

3.2.1. Drawing Size, Material

The Standard Drawing size, Arch D sheet (610 mm x 914 mm), Landscape orientation, will be used. Originals will be prepared in ink on Mylar sheets.

3.2.2. Scales

Urban Residential/Industrial and Rural Industrial drawings shall be prepared using the following scales:

1) Overall Plans 1:1000/1:500
2) Plan/Profile Horizontal 1:500 Vertical 1:50
3) Cross-Sections To a scale that clearly illustrates the section or detail.

Rural Residential drawings shall be prepared using the following scales:

1) Overall Plans 1:2000
2) Plan/Profile Horizontal 1:500 Vertical 1:50
3) Typical Cross-Sections and Details To a scale that clearly illustrates the section or detail.

3.2.3. Drawing Technique

Points of drawing technique that are significant to the preparation of drawings are as follows:

1) Care in ensuring balanced distribution of detail throughout the drawing.
2) Letters and figures shall be clearly legible, 2 mm size or larger (Leroy or equivalent), well spaced, properly formed and proportioned.
3) Lines shall be uniform in weight and density.
4) Dimensioning shall be in the SI metric system. Dimensioning of a drawing is extremely important and shall be such that it will not be misinterpreted. Dimensions shall be given from an iron pin, lot line, a centreline or any other reference that can be readily established. Wherever possible, all dimensions shall be provided to a minimum of two (2) property lines.

3.2.4. Title Block

All drawings must clearly show the following in the title block:

1) Developer's / Owner's Name.

2) Developer's Engineer or consulting engineering name.
3) Subdivision name, including staging and / or phasing.
4) Drawing name, number, revision number and issue date.
5) Drawing scale, including horizontal and vertical axis.
6) Space for dates and signature of the designer, draftsperson, reviewer or checker, and approving professional or principal.
7) Space for professional stamps and permits.
8) Space for revisions, including number, date, description, and approved signature.

3.2.5. General Requirements for All Drawings

The Plan/Profiles, Standard Detail Drawings, and Typical Cross-sections shall be drawn to avoid clutter and promote clarity and legibility.

Elevations will be relative to the Geodetic datum. The reference bench marks and elevations will be shown on the design drawings.

A north arrow, the name of the subdivision and, where appropriate, phase as included in the Development Agreement, adjacent lots and plan numbers, street names and the legal description of the parcel being subdivided, will all be shown on the drawing. In general, the north arrows should be orientated toward the top of the plan.

An Engineer's stamp and Permit to Practice stamp, signed by an Engineer registered in the Province of Alberta shall be shown on the engineering drawings.

3.2.6. Required Engineering Drawings

The drawings identified shall clearly highlight the detail as indicated:

1) Cover Sheet:

This will show the name of the subdivision, stage of development, location plan, Municipal District logo, and names of the planner, Developer and Developer's Engineer. Space permitting, the index plan may be included here. A key plan of the Municipal District, or a significant portion thereof, shall be included, illustrating the location of the development or project.

2) General Legend and Abbreviations Plan

This plan shall indicate and define all symbols and abbreviations used in the remainder of the engineering drawings. Alternatively, legends may be shown on individual plans.

3) Index Plan:

This plan shall be prepared at a scale of 1:1000 or a reduction thereof to fit the standard size, Arch D sheet (610 mm x 914 mm), Landscape orientation and shall indicate that portion of the street which relates to a particular plan/profile sheet.

This sheet shall list each drawing included in that particular set of drawings. Each drawing name is to be listed sequentially along with its corresponding drawing number.

4) Legal, Easement and Land Use Plan

This plan shall indicate proposed land uses in the project along with existing and/or proposed land use on adjacent properties. Indicate the existing contours at 1.0 metre intervals (rural

developments) and 0.50 metre intervals (urban developments), the proposed land use and all significant above ground features, such as buildings, structures, trees, utilities and water bodies, etc.

All legal and easement information shall be shown on this plan.

Public Utility Lots (PUL) used for the purpose of overland drainage shall be a minimum of 6.0m and the surfacing of the Public Utility Lot shall be at the discretion of the Municipal District of Lesser Slave River.

Public Utility Lot (PUL) widths shall be a minimum of 4.0 m for a single service and 6.0m for a dual service. A 1.0 m easement is required on each side of a PUL. A single service centered in a 6.0 m PUL will not require additional easements.

5) Sanitary Sewer System, Water System and Storm Sewer System Plan

This plan will be drawn a t a scale of 1:1000 and will indicate the alignments and locations of mains, valves, hydrants, manholes, catch basins and storm catchment with areas labeled in hectares, direction of sewer main flows and locations of receiving channels and drainage courses, service location for storm, sanitary and water.

6) Road, Sidewalk and Walkway Plan:

This plan will be drawn to a scale of 1:1000 and will show all locations and widths of walks, roads, carriageways, lanes, sidewalks, walkways, and right-of-way widths and alignment, catch basins, pipe and culvert locations, sizes, inverts, direction of flow, as well as all proposed approaches and base gravel subdrain locations.

7) Street Hardware Plan

The plan shall be drawn at a scale of 1:1000. A scale of 1:500 may be used for the plan if required for clarity.

All traffic sign locations and the sign to be installed at each location.

All surface infrastructure and other features such as street furniture, hydrants, light poles, power transformers, telephone and cable boxes, supermail boxes, bus shelters or benches, manhole covers and curb cocks.

8) Lot Grading Plan:

This plan will be drawn to a scale of 1:1000 and will indicate the original contours at 0.5 m intervals (shown in screened format), proposed areas of grading, finished lot corner elevations, grades and direction of finished surface drainage flows, proposed curb alignments, sanitary sewer and sump discharge line connection inverts at the property line, bench marks, existing contours, requirements for sumps, fill areas greater than 1m and erosion and sediment control measures.

9) Storm Drainage and Sanitary Sewer Basin Plans:

Large scale plans are required depicting the complete sanitary and storm drainage basins in which the development is located and their limits, location of the overall development, the stage to which the drawing set applies, trunk sewers and sizes for the entire basin, stormwater management facilities, receiving channels and drainage courses and the major drainage system routes for the entire basin (with heavy arrows).

Suitable Development Area Plan:

The plan must comply with the following Definition of a "Suitable Development Area":

The term "Suitable Development Area" was developed by the Standards and Guidelines Branch of Alberta Environment.

Each lot of a proposed country residential subdivision should have a Suitable Development Area. This area is suitable for the construction and use of a residence, accessory buildings, an access road, a privately owned domestic water well and a private sewage disposal systems(ancillary buildings as well as access roads may be constructed outside this developable area at the landowners risk). Specifically, the Suitable Development Area for the unserviced residential lot is:

At least 1 acre (~0.4 hectares) in size.

Does not include any part of a lot that cannot be developed for non environmental reasons, for example, a lot boundary setback strip required by M.D of Lesser Slave River.

Does not include any part of a lot that will require significant modification such as regarding, filling or draining.

Does not include any portion of an Environmentally Significant Area.

Has low water table conditions (low water table conditions are present where the water table is 1.8 meters or more below the ground surface during the frost free period up until the end of August and 2.4meters or below the ground surface during the remainder of the year).

Can have a private sewage disposal system in which there is minimal, long term risk that it will malfunction and contaminate surface and/or groundwater outside of the municipal servicing areas and will be in accordance with the requirements of the "Alberta Private Sewage System Standard of Practice 1999".

Presents minimal risk to property, health and safety by natural environmental hazards such as flooding, erosion and slope instability.

Can have a privately owned domestic water well that provides an adequate, long term supply of potable water.

Shallow Utilities Plan - Power, Gas, Telephone and Cable:

This plan will indicate the alignments of power, gas, telephone, cable, light standards, transformers, boxes, requirements for road crossing conduit and cross sections and shall be drawn to a scale of 1:1000. Utility company approvals must accompany the drawing submission. Gas pipelines shall have a minimum bury of 0.8 metres. Primary cables, secondary power cables and service drops shall be shall be buried 1.2 metres. Existing infrastructure and other relevant features shall also be shown in detail.

12) Detailed Plan/Profile, Standard Detail and Typical Cross Section Drawings:

Plan/Profile drawings shall be drawn to a scale of 1:500. Existing and proposed features are to be clearly delineated.

The profile portion shall have a 10 times vertical exaggeration and show elevations of curb and gutter at critical points and all changes in vertical alignment grades.

Plan portion must show legal subdivision information, lot and block numbers, proposed right-of-ways and easements, alignment of existing and proposed streets, dimensions of right-of-ways, streets, curbs and gutters, horizontal alignment data and location of all existing survey monuments.

Typical cross section drawings must show the location of water mains and hydrants.

3.3. Record Drawings

3.3.1. Scope

This procedure pertains to the record drawings of storm and sanitary sewers, watermains, roads, curbs, sidewalks, culverts and other miscellaneous permanent structures.

3.3.2. General

The record drawings shall be affixed with the stamp and seal of a Professional Engineer who, by signing, is certifying the information to be accurate and correct.

The record drawings will clearly show the locations of all services, curb cocks, valves, hydrants and manholes, using right angle measurement from survey pins.

Red line record drawings are to be submitted for review, indicating changes.

The record drawings are to be submitted to the Director of Field Services on high quality Mylar sepia sheets, within three weeks of the installations, along with one complete set of prints.

The record drawings referred to in this section will also be submitted to the Director of Field Services in digital format, as per the following requirements:

1) Must be compatible with the Municipal District version of AutoCAD.
2) Accompanied by a layer list and description.
3) Will conform to layering and symbol standards as established by the Municipal District or their consultant.
4) Be submitted on CD ROM.

On record drawings submitted to the Municipal District, the following information will be included on each drawing:

1) Date of construction completion.
2) Name of the Contractor.
3) Date on which record details were added.

3.3.3. Storm and Sanitary Sewer

The following information will be included for storm and sanitary sewer systems:

1) Size, pipe material, pipe class, bedding and location of mains.
2) Location of manholes, cleanouts, and other appurtenances.
3) Grades, lengths, inverts of mains and rim elevation.
4) Profile of pipe top and bottom.
5) Corrected flow calculations.

3.3.4. Water

The following information will be included for water systems:

1) Size, type and location of pipe.
2) Location of valves, tees, hydrants and other appurtenances.
3) Profile of pipe top and invert.

3.3.5. Road, Curb, Sidewalks

The following information will be included for roads, curbs, and sidewalk:

1) Location of curbs, sidewalks and elevations of lip-of-gutter.
2) Lip-of gutter for each curb.
3) End of curb, sidewalks and pavement.
4) Type of road structure on overall road plan and each plan profile.
5) A typical cross-section referencing the above and representing all conditions.

3.3.6. Water, Sanitary, and Storm Service Connections

A table on each plan/profile drawing will be prepared giving the following information with respect to service connections:

1) Lot number.
2) Distance of service saddle from the downstream manholes.
3) Invert elevation at the end of sanitary and storm service.

The service connection provided to each lot will be shown on the plan and the location triangulated to the property lot corners.

The typical location of the curb stop will be identified on each plan/profile, (i.e. 0.3 m Front of Walk "F.O.W"., 2.65 m Back of Walk "B.O.W.") by means of a table chart.

3.3.7. Mechanical Systems

Where the subdivision includes mechanical systems, such as lift stations, the Developer will provide detailed drawings of the facility, as well as operation/maintenance manuals, including the make and model of all equipment, to the satisfaction of the Municipal District.

3.3.8. Building Grade Certificates

Prior to issuance of a Construction Completion Certificate for water, sanitary, and storm services, the Developer shall provide to the Municipal District the relevant Building Grade Certificate for each lot in the Development.

As outlined in the Development Agreement, Development Permits or building permits will not be released until all of the conditions outlined in the Development Agreement, Part Three – Development Permits are met.

3.3.9. Building Grade Information

The following information shall be shown on the Building Grade Certificate:

1) Water, sanitary, and/or storm services location and inverts at property line or easement line.
2) Power, telephone, and cable television service location.

3) Sidewalk and boulevard width.
4) Easements.
5) Lot corner surface elevations.
6) Landscape elevations at front of house.
7) Lot drainage pattern.
8) Streetlights, hydrants, etc.

This information shall be provided in the form as shown on the sample Building Grade Certificate, drawing 3.2 in Section 18.0 of Standard Detail Drawings.

4.0 Water Distribution System

4.1. General

The design of the water system shall conform to the "Standards and Guidelines for Municipal Waterworks, Wastewater, and Storm Drainage Systems in Alberta", as published by Alberta Environment and as amended by these Design Guidelines and Construction Standards.

4.1.1. Municipal Water System

The Contractor may be required to tie into a municipal water system or to shut off system valves to undertake the proposed Work. When this is required, the Contractor shall:

1) Give the Municipal District sufficient notice of the proposed Work and schedule so proper planning and approvals can take place.
2) Supply all water necessary for the Work and obtain written permission from the Municipal District prior to using any hydrants.
3) Obtain written permission prior to operating any of the Municipal District's valves and/or hydrants. The Contractor shall be held responsible for any damage done to the hydrants or surrounding area. The Municipal District may require their own personnel to operate their valves and/or hydrants.
4) Make an agreement with the Municipal District for payment of water used.
5) Be responsible for the supply of all water necessary for the Work.
6) Provide 24 hours notice to any property owner affected by water service disruption.
7) Supply an alternative water service if the water disruption is longer than 4 hours.
8) For establishments relying on an uninterrupted water source for their operations, an alternative water source shall be provided.
9) The above noted requirements shall be done at the Contractor's cost.

4.1.2. Design Requirements

The minimum size of distribution main shall be 150 mm diameter for residential, 200 mm diameter for commercial and 300 mm diameter for industrial.

The value of "C" in the Hazen-Williams formula shall be 120 for all types of pipes.

Per capita consumption shall be:

1) Average Daily Demand- 340 lpd
2) Maximum Daily Demand- 2.0 x Average Demands
3) Peak Hourly Demand- 3.0 x Average Demands

The design population shall be the ultimate population for the area under consideration.

For non-residential developments, the minimum water consumption rate shall be equal to 0.20 litres per second per hectare. The applied peaking factor shall be Pf= 10Q-0.45 to a maximum of 25 and a minimum of 2.5, Q being in litres per second. Where possible, water demand shall be based upon site specific requirements for identified uses. Fire flow requirements are to be included in all calculations.

An analysis will be made for Peak Hour Demand, and mains shall be sized such that there will be a minimum residual pressure of 276 kPa (40 psi) at ground level at any location in the system.

Separate analysis shall be made for Maximum Demand plus Fire Flow. The residual pressure at any location at the ground level shall not be less than 140 kPa (20 psi).

Fire flow requirements shall be in accordance with the Fire Underwriters Survey publication entitled "Water Supply for Public Fire Protection – a Guide to Recommended Practice", latest revision thereof. Generally these are:

For single family residential 75 l/second, for multi-family residential 90 l/sec, for Institutional 90 l/sec, commercial 190 l/sec, and light industrial 230 l/sec.

Where the size of the area to be developed warrants, or if required by the Municipal District, a network analysis will be carried out and all relevant information will be submitted with the design documents.

Water main looping will be required where the number of lots exceed 20 unless otherwise approved by the Director of Field Services.

4.1.3. Water Main - Location and Installation

Mains shall be installed to provide a minimum depth of cover of 3.00 metres below the final finished surface grade. Refer to Standard Drawing 4.1.

In all cases a distance of 3.0 m from the centreline of a road shall be maintained.

A minimum of a 3.0 m horizontal separation shall be maintained between a water main and any sewer main. A minimum of a 2.0 m horizontal separation shall be maintained between a water main and any gas line. A minimum of a 1.5 m horizontal separation shall be maintained between a water main and catch basins or storm manholes.

The minimum requirement for pipe bedding shall be Class "B" bedding

Water main installation shall be in accordance with manufacturer's requirements and these Specifications.

4.1.4. Hydrant - Location and Installation

The maximum allowable spacing between fire hydrants shall be 150 m in single-family residential areas and 120 m in multiple-family residential, school, and 100 metres in industrial/commercial areas.

Hydrant locations shall be such that the distance to any building shall be no greater than 75 m. For the case of multi-family and/or commercial buildings with standpipes, the distance shall be 45 m unobstructed driving distances, between hydrant and standpipe.

Hydrants on the distribution main will be installed at the projection of property lines, except:

1) Where the hydrants are installed at the intersections, they shall be installed adjacent to the cut-off corners of the lot.
2) Where the hydrants are installed in a cul-de-sac, they will not be installed within the turning circle but shall be located at the tangent points.
3) Where a hydrant and sanitary manhole fall on the same property line projection, the manhole will be moved a minimum of 5 metres away from a hydrant.

Hydrants shall be located to conform to curb and sidewalk design and shall be installed as follows:

1) The center of the barrel is to be 2 m back of face-of-curb or 0.5 m back of walk. With rural cross-sections, install hydrants 1.0 m from property line.
2) The maximum distance from the face of the curb to the hydrant shall be 3.5 metres.
3) Hydrants shall be installed in accordance with the Standard Drawing 4.2 and the Engineering Standards outlined in these documents.
4) Hydrants shall be plugged or draining depending on the site conditions (high ground water or poor soil drainage);
5) A gate valve will be provided on each hydrant lead;
6) Cathodic protection to be installed as per Standard Drawing 4.8, 4.9 and 4.10.
7) All bolts to be stainless steel.
8) All barrels to be epoxy coated.

Additional hydrants shall be installed at high value properties if deemed necessary by the Municipal District.

4.1.5. Valves - Location and Installation

All valve boxes located in streets shall be left flush with the finished surface. Immediately prior to the final lift of asphalt being placed, these valve boxes shall be raised to final grade. Refer to Standard Drawing 4.3.

Valves on the distribution mains will be installed:

1) At the projection of a property line at intersections or in mid-block, for urban sections. One meter from property line for rural sections.
2) With two valves at a tee and three valves at a cross.

4.1.6. Valve Box

Valve box shall be Norwood Foundry Type A, PVC or Cast. Valve box shall consist of a cast iron bonnet of sufficient size to fit over the valve, and an adjustable cast iron top box with lid. Refer to Standard Drawing 4.4 and 4.5.

Valve boxes shall be of suitable length for depth of bury specified for mains, with possible adjustment of 300 mm up or down from this length.

Valve box extensions shall be cast iron suitable for use with the valve box to be installed.

All cast iron surfaces to have a bituminous coating for corrosion resistance.

Distribution main valves shall be located such that during a shutdown:

1) No more than one hydrant is taken out of service;
2) No more than four valves are required to affect a shutdown;
3) No more than twenty residential units are taken out of service by a shutdown, including cul-de-sacs; and

4) Valves shall be installed in accordance with the Contract Specifications for the project and as per the Standard Drawing.

4.1.7. Thrust Block

At all hydrants, plugs, tees, crosses, bends, and all other points of concentrated thrust, provide reaction blocking (thrust blocks), as detailed, to prevent movement. Place reaction blocking against solid undisturbed ground. Details provided herein are intended to be general, and are based upon soil load values of 7,300 kg/m^2 or more. Where soil will not provide this load value, provide additional bands and clamps, or provide more substantial reaction blocking, as required to take the anticipated reaction. Place blocking to provide access to pipe and fittings for repairs or future extensions of the line.

Thrust blocks shall be provided as shown on Standard Drawings 4.6 and 4.7. Thrust blocking shall be Type 50 sulphate resistant concrete having a minimum compressive strength of 20 MPa at 28 days.

Pipe restraint devices shall be used separately or in conjunction with thrust blocks, where identified as being required, and shall be in accordance with the manufacturer's recommendation. All restraint devices shall be stainless steel or other suitable materials, resistant to corrosion and approved by the Municipal District.

4.1.8. Cathodic Protection

All buried fittings and valves shall be cathodically protected with a 2.3 kg Zinc Anode, and all hydrants shall be cathodically protected with a 5.5 kg Zinc Anode.

Zinc Anodes shall conform to ASTM B418-73, Type II.

Lead Wires No. 10A WG/7, two metres long.

Wire shall be connected to fittings with a cadweld.

A minimum of three litres of water shall be poured on each Anode to initiate the Anode's operation.

Refer to Standard Drawings 4.8, 4.9 and 4.10.

4.1.9. Flushing of Existing and New Water Mains

Prior to flushing of any watermains, the Municipal District of Lesser Slave River Infrastructure Services Office and the Utilities Department must receive a minimum of two working days notice. Only Municipal District personnel will operate existing valves.

4.1.10. Usage of Municipal District Water

The Developer's Engineer shall be responsible for calculating the water used for flushing of mains. This calculation shall be submitted to the Municipal District at the time of the Construction Completion Certificate (CCC). The Developer shall be responsible for the cost of the water used to flush the mains and shall be invoiced accordingly. The cost of this water shall be calculated using the current charges, as may be amended from time to time, as outlined in the Water Rates Bylaw.

4.1.11. Groundwater Supply for Un-serviced Residential Subdivisions

The use of groundwater for un-serviced residential subdivisions shall follow the regulations set in the current edition of Environmental Guidelines for the Review of Subdivisions in Alberta.

5.0 Watermain Construction

5.1. Work Included

Provide all labor, products and equipment required for the work, including but not limited to:

1) excavation
2) bedding under and over pipe
3) watermains and appurtenances
4) testing watermains
5) flushing and disinfecting watermains
6) connection to existing systems
7) thrust blocks

5.2. Quality Standards and Assurances

Products, workmanship and testing shall conform to standards specified in this section.

All products and workmanship may be subject to inspection by the Municipal District.

Perform all tests required by the specification and by authorities having jurisdiction.

Notify the Municipal District and authorities 48 hours prior to testing to permit inspection and allow tests to be witnessed.

Do not cover any work before inspection and testing unless authorized by the Municipal District in writing.

Remove or repair defective products or work which fails to meet specified requirements as directed by the Municipal District, at no additional cost to Owner.

5.2.1. Materials

5.2.2. Polyvinyl Chloride (PVC) Water Pipe

Polyvinyl chloride water pipe shall be equivalent to cast iron pipe outside diameter meeting CAN3-B.137.3 M86 (AWWA C900).

Pipe shall be DR18 Class 150 (dimension ratio 18) and pipe must be blue in colour.

Pipe joints shall be integral gasketed bell ends. Couplings shall be permitted only for closures or special connections.

Gaskets shall conform to AWWA C111.

An affidavit of compliance shall be provided if requested.

5.2.3. Pipe Fitting

Cast iron or ductile iron fittings shall meet the requirements of AWWA Specification C110-77. Pressure rating shall be 1.1 MPa (60 psi).

Joints on fittings shall be the same as specified for pipe.

Fittings shall be externally and internally coated with bituminous material approved for waterworks service.

PVC fittings shall be to CAN3-B.137.3, pressure Class 150, which are designed to accommodate the pipe for which they are used.

PVC fittings shall be gasketed bell end type similar to pipe except where adaptors are required in which case flanged or threaded joints may be permitted subject to approval by the Municipal District. Gaskets to conform to AWWA C111.

Cast ductile iron couplings to be robar couplings or approved equal complete with ANSI 303 stainless steel nuts and bolts compatible with outside diameters of pipes to be joined in locations approved or specified by the Municipal District.

5.2.4. Gate Valves (NRS)

Valves shall be iron body, bronze mounted, double disc or solid-wedge, with full 360 degree rubber to cast iron resilient seat gate valves approved for potable water use, meeting AWWA Specification C509-80 and the following:

1) Valves to be bronze mounted with a grade of bronze completely resistant to de-zincification by water having a ph of 9.0.
2) Valve ends shall be consistent with the type of joint used for pipe and fittings except where otherwise detailed.
3) Valves to be supplied with either bronze or type 304 stainless steel stems.
4) Working pressure 1,035 kPa (150 psi).
5) Valve interior to be epoxy coated for corrosion protection.
6) Valves shall close by turning clockwise and be a non-rising stem type and be equipped with a 50 mm square operating nut. Valve stem shall be equipped with "O-Ring" type seals.
7) Exterior to be factory coated.
8) All exterior bolts and nuts must be T304 or type 3145.5 stainless steel.
9) Main Valve Casing Detail is shown on Standard Drawing 4.3.

5.2.5. Valve Boxes

Valve boxes shall be Norwood Foundry Type A, or equal. Valve box shall consist of a cast iron bonnet of sufficient size to fit over the valve, and an adjustable cast iron top box with lid.

Valve boxes shall be of suitable length for depth of bury specified for mains with possible adjustment of 300 mm up or down from this length.

Valve box extensions shall be cast iron suitable for use with the valve box to be installed.

All cast iron surfaces to have a bituminous coating for corrosion resistance.

Valve Box Construction Detail is shown on Standard Drawing 4.5.

5.2.6. Hydrants

Hydrants are to be of the post type, dry barrel hydrant with compression shut-off conforming to AWWA Specification C502-80, having the following features:

Working pressure of 1,035 kPa.

Two hose connections at 180 Deg., 63 mm ID with threads to Alberta Mutual Standard.

One pumper connection, 100 mm OD, outlet nozzles to be fastened by a thread connection.

150 mm riser barrel, 125 mm bottom valve.

Minimum distance from flange to bonnet will be 600 mm.

Main connection to be 150 mm ductile iron size rubber gasketed bell end joint.

Self Draining hydrants (or as determined by site condition)

Number 6 operating nut with five sides.

Hydrant to open counter clockwise.

All hydrants will be painted Fire Engine Red.

Ground line breakaway system: 2.75 m from invert to flange, including a 450 mm top extension spool section with hydrant rod coupled at extension.

Minimum 710 mm from top of operating nut to bottom of base flange.

All exposed nuts and bolts to be T304 or type 3145.5 stainless steel.

Interface between removable parts of main valve and hydrant body shall be bronze to bronze.

Hydrants shall be of the same type and make as presently used in the Municipal District of Lesser Slave River (Canada Valve).

Typical Hydrant and Valve Detail is shown on Standard Drawing 4.2.

5.2.7. Watermain Plugs

Watermain plugs shall be of standard manufacture to suit type of pipe and pipe joint specified.

5.2.8. Air Relief Valve & Flushing Chamber

Air Relief Valve and Flushing Chamber is shown on Standard Drawing 5.1.

5.2.9. Bedding Pipes

Excavate trenches to widths not less than 300 mm greater than pipe diameter. Maximum width at top of pipe zone shall not exceed outside pipe diameter plus 600 mm, plus allowance for timbering, if required. Refer to Standard Drawing 5.2 and 5.3.

Excavate below bottom of trench at joints as required to provide working space. Body of pipe to rest on minimum 100 mm firmly compacted sand bedding throughout its length.

Place sand bedding for PVC pipe as per trench bedding and installation and backfill with Class B granular surround as detailed in the Standard Detail Drawing. If site material meets bedding sand specification requirements, it may be used to replace the top 300 mm of bedding sand.

For trench in rock, bed pipe on minimum of 150 mm of compacted sand.

5.2.10. Laying and Jointing Pipe

Carefully lower pipe and specials into trench using proper appliances. While suspended, inspect for defects. Remove foreign materials from inside of pipe. Unless otherwise directed, lay pipe from lower end of line upward.

Lay pipe true to line and establish grade using laser level or measurement rod and sight rails.

Cut pipe accurately to bring valves, fittings and hydrants to correct position.

At all hydrants, plugs, tees, crosses, bends of 22 degrees or more and all other points of concentrated thrust, provide reaction blocking as shown on Standard Drawings 4.6 and 4.7 to prevent movement. Place reaction blocking against solid undisturbed ground. Details are based on soil load values of 7,323 kg per square meter, or more. Where soil will not provide this load value, provide bands and clamps to take reaction. Refer also to special thrust block details. Place blocking to provide access to pipe and fittings for repairs or extensions of line.

Install turned wood or plastic plugs, properly sized, in pipe and fittings to prevent ingress of water, mud, dirt and debris at all times. Do not use rags, clothing or other means.

Install slip type rubber gasket joints to manufacturer's directions. If requested, provide copies of manufacturer's directions on site for reference and obtain technical assistance from manufacturer or representative.

Ensure that valve box can be adjusted up or down at least 300 mm. It is intended that valve boxes installed at this time to finished crushed gravel elevation, will be raised at the time of paving without having to supply a new upper extension.

5.2.11. Setting and Jointing Valves

Check and ensure stuffing glands on valves are properly packed before installation.

Set valves accurately in position, set valve box carefully over hood with shaft vertical and cap at proper level plus or minus 50 mm from finished ground elevation.

Anchor valves to prevent movement under unbalanced pressure conditions when recommended by pipe manufacturer.

Check operation of valves in presence of the Municipal District before and after testing.

5.2.12. Setting and Jointing Hydrants

Set hydrants and hydrant valves on precast sulfate resistant concrete base as shown on Standard Drawing 4.2.

Ensure hydrant stock and valve box are truly vertical.

Locate hydrants and valves as per drawings within the following tolerances: 50 mm horizontal, 15 mm vertical.

Face pumper nozzles to roadway with hose nozzles parallel to roadway. No portion of the hydrant or nozzle cap shall be within 150 mm of the sidewalk.

Concrete thrust blocks will be required at hydrants and hydrant valves as detailed.

Ensure that regular maintenance of hydrants is carried out for the duration of the maintenance period. Pay all costs for maintenance such as repainting, draining prior to freeze-up, etc.

5.2.13. Thrust Blocks

Complete concrete work in accordance with Section 9.0 – Curb, Gutter and Sidewalks.

Cement to be sulfate resistant Portland cement.

Place concrete thrust blocks between undisturbed ground, tees, plugs, caps, bends, reducers, hydrants, and fittings.

Keep joints and couplings free of concrete.

Do not backfill over concrete within 24 hours after placing.

Thrust Block Details are shown on Standard Drawing 4.6 and 4.7.

5.2.14. Testing Watermains

Watermain testing may be carried out when all the following conditions have been met:

1) a section of watermain not exceeding 450 meters in length has been completed.
2) the section has been carefully filled with water and allowed to sit for at least 24 hours.
3) reaction or thrust blocking within the section has reached 15.0 MPa of compressive strength.

If all the conditions have been met, apply a constant pressure of 1,035 KPa (150 psi) for a minimum of two hours to mains, hydrants, valves and services. Correct all defects at no additional cost to Owner. Ensure all water service connections are turned off at curb stops to avoid damage to private plumbing.

Conduct leakage tests after completion of pressure testing. Conduct leakage tests at 1,035 KPa (150 psi) in accordance with AWWA C600-82 procedures. Allowable leakage will be calculated using the following formula:

Allowable leakage: PVC Pipe: $L = N \times D \times \sqrt{P} \div 128{,}320$

Ductile Iron Pipe: $L = N \times D \times \sqrt{P} \div 32{,}046$

Where L= Allowable Leakage (litres per hour); N = Number of joints;

D = nominal diameter of pipe (mm); and P = test pressure (kPa).

Conduct pressure tests on HDPE pipe as follows:

- Pressure pipe to 1.5 times pressure class
- Maintain 1.5 times pressure class for 4 hours (Add water as needed)
- Reduce pressure 70 kPa (10 psi) below 1.5 times pressure class
- Monitor pressure for 1 hour. The pipe is acceptable if the pressure drop is 5% or less over 1 hour

If test leakage in any section is greater than permitted by AWWA Standards, locate and repair defective pipe joints until leakage is within permitted allowance. Test pipelines in sections not exceeding 450 m in length.

Provide all equipment, labor, and material for tests.

5.2.15. Flushing and Disinfecting Watermains

After completing satisfactory hydrostatic tests and before placing into service, flush all mains to remove as much foreign matter as possible from system. Flush at a minimum velocity of 0.8 meters per second as required by AWWA C651-99 procedures (250 mm line requires 2 - 50 mm openings to provide the required flushing velocity).

After flushing, disinfect mains by pumping chlorine solution into mains through a special main cock at beginning of line near the source of water. Do not use hydrants at point of application for disinfectant.

Introduce disinfectant according to AWWA C651-99 and to approval of the Municipal District and Provincial Ministry of Health.

Conform to AWWA C651-99 for quantity of disinfectant, method of distribution throughout system and final flushing.

After final flushing and before placing watermain in service, the Municipal District will collect samples in sterile bottles from an approved sampling point. The sampling is to be witnessed by local authorities as necessary. Samples will be submitted to Provincial Ministry of Health for testing and test results forwarded to Local Authorities. Heterotrophic plate counts will be provided.

If initial disinfection fails to produce satisfactory results, repeat disinfection until satisfactory samples are obtained.

Dechlorination of the chlorinated water will be required prior to discharging the water to the environment in order to meet the regulatory requirements of the Municipal District of Lesser Slave River and Alberta Environment. Dechlorination, if required, is to be performed by adding neutralizing chemicals (AWWA C651-86, Appendix B) to the chlorinated water as it is flushed from the system and before it enters the receiving environment.

5.2.16. Markers

A 50 mm by 100 mm stake, from 1000 mm below ground to 600 mm above ground level shall be placed at each water valve, the top 600 mm to be painted blue.

5.3. Trenching and Backfilling for Utilities

5.3.1. General

Trenching and backfilling to be carried out in accordance with Alberta Occupational Health and Safety Regulations, Part 10. Standards for pipe bedding and typical trench details are located in Section 18, Drawings 5.2 and 5.3.

5.3.2. Work Included

Provide all labor, products and equipment for trenching and backfilling for utilities, including but not limited to:

1) watermains
2) sanitary sewers
3) storm sewers
4) manholes, valve boxes

5) lot service connections

6) shoring, sheet piling

7) dewatering

5.3.3. Excavation

Excavate to lines and to design depth shown or as required by the Municipal District to provide satisfactory bearing. Excavate unsuitable soil from trench bottoms as required by the Municipal District. Backfill with screened rock material specified to the required level and compact to provide uniform bearing.

No additional compensation will be paid for any changes due to deterioration of excavations caused by activities or neglect of the contractor.

Level and clean excavation bottoms free from loose material and debris.

Where excavation is made below depth shown through error, fill to required depth with 20 MPa compressive strength concrete or screened rock at no additional cost to Owner.

Provide firm undisturbed earth or rock bearings for granular bedding below pipelines and structures.

Excavate for structures to widths sufficient for formwork construction. Place no concrete or masonry until the Municipal District has inspected excavation.

Where concrete is to be placed, thaw excavation bottom if frozen, and protect from further freezing.

Maximum lengths for open trenches are 30 meters ahead of pipe laying crew and 200 meters behind, unless otherwise permitted by the Municipal District.

Where trenches are excavated in existing pavements, saw cut the pavement to neat lines.

5.3.4. Horizontal Directional Drilling

This Section specifies the requirements for the installation pipe or conduit utilizing horizontal directional drilling methods.

5.3.4.1 Directional Drilling Method

Definitions

A horizontal directional drill rig is a mechanical drilling device used to create a horizontal borehole through which pipe or conduit is installed.

Returns and spoils are the drilling mud and cutting collected in the entry and exit pits.

Returns and spoils which do not exit the borehole through either the entry or exit location are termed as inadvertent returns or frac-outs.

General Description

Horizontal directional drilling is the installation of a pipe by drilling a pilot bore from the entry pit to a predetermined exit location. The drilling head is then replaced with the reamer and the drilling string is pulled back to the entry hole, enlarging the hole while simultaneously pulling the pipeline product into place.

Design Submittal

Submit methodology, complete with design and construction details for the proposed directional boring operation.

5.3.4.2 Work Content

Include all engineering services, plant, labor, material and services for all of the following:

- Preparation of the site including removal of vegetation, location of all existing utilities along the proposed path, excavation of all utility crossings, excavation of entry and exit pits and any slurry containment pits required.
- Installation of new pipe by directional drilling method.
- Testing of installed section and restoration at all affected surfaces to their pre-construction conditions

5.3.4.3 Constraints

Schedule work to minimize interruption to existing services and local traffic.

Obtain all necessary permits or authorizations to conduct construction activities and to disturb ground near or across all existing buried utilities, pipelines, services and conduits.

Submit for approval proposed methods to control, collect, transport and dispose of drilling fluids and spoils.

5.3.4.4 Submittals

Provide within fifteen (15) working days of the award of the contract:

Complete methodology, specific to each borepath or crossing, including:

- Equipment specifications and capabilities,
- Size of pilot hole,
- Number and sizes of pre-reams,
- Method of support for product during pullback,
- The number of sections in which the product is to be installed,
- Type and capabilities of tracking system, and
- Calculations of the appropriate back ream rate for each pre-ream and pullback based on equipment capabilities and soil conditions.

Schedule of work including installation sequence for projects requiring multiple bore paths.

Drawing of work site, including location and footprints of equipment, and the locations of the entry, exit and slurry containment pits. For each installation, indicate product layout areas during pullback, identify potential conflicts with traffic, and indicate duration of any road closures required.

Drilling fluid management plan, including drilling fluid containment, recycling/transport and approved disposal site.

MSDS and related technical information for all drilling muds, polymers and admixtures that are intended to be used during drilling reaming or pullback. Contractor shall not deviate from the submitted list of materials unless approved by the Engineer.

Emergency procedures for inadvertent utility strikes, including: power, natural gas, water, sewer or telecommunication lines. Procedures must comply with regulations.

Method of dealing with inadvertent returns of surface seepage of drilling fluids and spoils.

Data from the product pipe manufacturer indicating the tensile strength and minimum bend radius.

5.3.4.5 Products

Product Pipe

Product pipe shall be pressure tested above ground prior to insertion. All necessary temporary pipe end termination fittings, restraints and connection points as required to conduct and monitor the filling and testing shall be provided. All required safety provisions shall be determined prior to the commencement of the pressure test.

Pipe to be tested to 100 psi for 1 hour to test for leaks. Test with water – testing with air is strictly prohibited. Only potable water shall be used for the test.

Where possible and unless approved by the Engineer, the product pipe shall be fused, welded or connected into tone string prior to commencement of the pullback operation.

Depending on specific project conditions, alternative product pipe materials may be suggested by the contractor for the Engineer to review. Alternates must meet operational pressure, temperature and chemical resistivity requirements, depth of bury and installation pullback loads.

Equipment

The Contractor is responsible for the directional drilling method and equipment. The Contractor is to confirm that the drill rigs and mud mixing systems will be of sufficient capacity to successfully complete the installation taking into consideration the installation length, product type and diameter, and ground and ground water conditions that can be reasonably foreseen.

Mud mixing and or mud recycling systems should be of sufficient capacity as to not impede the installation process. Contractor should plan installation to take into consideration mud production and pumping rates.

Tracking and locating system should have appropriate operating range and degree of accuracy to meet project conditions. Tracking and steering equipment shall allow for continuous monitoring of the drill head along the entire proposed alignment. If it is anticipated that the drill head may not be tracked along the entire the entire length of the installation, this should be communicated to the Engineer prior to commencement of construction.

Drill rig must be equipped with an electrical strike safety package. Prior to commencement of the pilot bore the rig's electrical strike alert system must be tested. The package should include warning sound alarm, grounding mats and protective gear.

5.3.4.6 Execution

Pre-Commencement

All subsurface utilities within 25 m of the proposed drill path must be identified and located. All subsurface utilities with 5 m of the proposed drill path must be identified and location marked on the surface. Owners of subsurface utilities within 25 m of the proposed borepath must be notified of the impending work through the one-call program or directly if not a member of the service.

All utility crossings shall be exposed using hydro-excavation, or another approved method to confirm depth. Contractor must acquire appropriate permits to cross, expose, and backfill exiting utilities.

The proposed drill path shall be determined and documented, including its horizontal and vertical alignments and the location of buried utilities and subsurface structures along the path.

Prior to commencement of the pilot bore, the proposed borepath shall be "swept" for interference by the Locator. Based on the results of the "sweep" (for electromagnetic interference that may affect the locating system) the Contractor will indicate to the Engineer any concerns regarding the ability to accurately locate and track the drill head. Alternative tracking methods or realignment of the borepath may be required if tracking along the proposed borepath is deemed impractical.

Exit and entry areas should be delineated using traffic cones, barricades, construction taping, flagging, or by some combination of these. If necessary warning signs should be placed to indicate open excavation.

Exit area should be suitable size to accommodate activities related to reamer and product pipe connection.

Location must be identified for product pipe layout, as well as suitable space for pipe fusion or coupling depending on product pipe material. This area may require delineation depending on level of pedestrian and vehicular traffic at the discretion of the Engineer.

Installation Procedures

Only a fully trained and experienced operator shall be permitted to operate the drilling equipment. While operating the drill rig, the manufacturer's operating instructions and safety practices are to be always followed.

Provide any additional anchoring required for the drill rig such that the installation can proceed in a safe and effective manner.

Entry angle of the drill string should range between 8 and 20 degrees, exit angles between 5 and 10 degrees and in accordance with submitted plan. Any deviation from these angles must be approved by the Engineer.

Drilling of the pilot bore should be performed in a manner that maximizes the overstressing and straining of the drill stem as well as the product pipe on the backream. Locations of entry and exit pits are to be of sufficient size and located such to avoid a sudden radius change of the product pipe and the resultant excessive deformation.

Drilling mud pressure in the borehole should not exceed that which is supported by the overburden pressure to prevent surface heave or hydraulic fracturing of the soil (frac-out).

Pilot bore shall have a horizontal alignment/vertical tolerance +/- 150 mm or within the minimum bending radius of the product pipe. Depth must not be less than the minimum

specified depth, and not exceeding 130% of the specified minimum depth unless either specifically indicated on the drawings or approved by the Engineer.

If a drilled hole must be abandoned for whatever reason, the hole must be filled with grout or betonies to prevent future subsidence.

All phases of the installation require the utilization of a properly formulated drilling fluid. Drilling fluid properties, drilling fluid volumes, and rate of penetration must be matched to ground conditions to maintain proper circulation, borehole stability, and increase the chances of a successful installation.

Reaming and Product Installation

The pilot bore shall be reamed to accommodate and permit the free sliding of the product inside the borehole according to these minimum requirements:

Product size < 200 mm (8 inches) then final backream hole diameter should be product diameter plus 100 mm (4 inches).

Product size 200 – 600 mm (8-24 inches) then final backream hole diameter should be 1.5 times product diameter.

Product size > 600 mm (24 inches) then final backream hole diameter should be product diameter plus 300 mm (12 inches).

After fabrication and pre-installation testing of the product is completed, the pulling head may be attached to the product. A swivel must be installed between the pulling head and reamer to prevent rotation of the product during the installation.

The product pipe must be properly positioned and supported to enter the borehole. Pipe roller, skates or other protective devices shall be used for the installation of products 150 mm (6 inches) outside diameter or larger.

Pullback and product installation should be completed without interruption, to reduce the risk of the product from becoming stuck in the borehole.

During pullback or back-reaming the pipe or conduit must be sealed on both ends with a cap or lug to prevent water, drilling fluids and other foreign materials from entering the pipe.

Several reaming passes may be required to achieve the desired minimum borehole diameter for the installation of the product.

During reaming and product installation, drilling fluid must be used, and proper circulation must be maintained.

The Contractor is to avoid excessive reaming and pullback rates. The Contractor is to match pullback and reaming rates with downhole tooling and borehole cleaning ability of their equipment. Excessive backream rates and outrunning hole cleaning ability may result in surface heave and frac-outs. Under no circumstances should the pulling force on the product pipe exceed the maximum recommended by the pipe manufacturer for the specific product and installation conditions.

Drilling Fluids – Collection and Disposal Practices

Precautions shall be taken to keep drilling fluids out of streets, manholes, sanitary and storm sewers and other drainage systems including streams and rivers.

Fluid returns not contained by the entry or exit pits should be promptly cleaned up.

Excess drilling and mud slurry shall be contained in a lined pit or temporary holding container at the exit of entry points until recycled or removed from site. Entrance and exit pits shall be of sufficient size to contain the expected return of drilling mud and spoils.

Recycling of drilling fluids is an acceptable alternative to disposal.

If working in an area of contaminated ground, the circulated drilling fluid shall be tested for contamination and disposed of in a manner that meets government requirements.

The Contractor shall make a diligent effort to minimize the amount of drilling fluids and cutting spilled during the drilling operation and shall clean up all drilling mud overflows and spills.

Contractor shall have in place a suitable emergency response plan to respond to inadvertent returns and frac-outs. This plan shall include a procedure, contact numbers for appropriate regulatory agencies, materials and or equipment to contain the drilling fluid, and materials and or equipment to collect and dispose the drilling fluid. Plan to be discussed with Engineer prior to commencement of the bore, and be scaled according to the risk associated with the installation.

After product is installed, entry and exit pits shall be cleaned of drilling fluids and cuttings, and backfilled with native material or select backfill in accordance with the Contract Documents.

Record Construction

Contractor shall indicate any horizontal or vertical deviations between the designed bore path and the actual bore installation. Contractor to provide a set of as built drawings including both alignment and profile constructed from actual field readings.

A log book must be kept for all installations. Log book shall include pipe number, depth, pitch and steering commands. For more complicated or high risk installations log book shall also include rig performance parameters (thrust, pullback, rotational torque), drilling fluid circulation, drilling fluid composition, ground conditions and objects encountered during the bore, start and end of production shifts, as well as shift productivity. Logs must be legible and accurate, and copies submitted to the Engineer with the as-built drawings.

Acceptance

Pipeline product shall be installed within the pre-specified alignment and grade tolerance as shown on the drawings and provided in the project specifications.

Pipeline product must pass post-installation pressure test in accordance with Product Pipe Specifications outlined in the section.

5.3.5. Rocks and Boulders

Remove boulders to provide 150 mm minimum clearance under pipes. Backfill with granular and compact at required level to provide suitable bearing, if boulders are less than 0.4 cubic meters.

Boulders larger than 0.4 cubic meters and material which cannot be removed with pick and bar will be classified as rock by the Municipal District. Notify the Municipal District when rock is encountered for classification and measurement.

Excavate rock to provide 150 mm minimum clearance on each side and under pipes. Backfill with granular and compact at required level to provide suitable bearing.

Prior to commencing blasting operations, obtain written approval from authorities having jurisdiction and from the Municipal District. Employ qualified and licensed workers only.

5.3.6. Shoring, Bracing and Sheet Piling

Provide all shoring, bracing and sheet piling required for support and protection of earth banks at excavations.

Erect all shoring, bracing and sheet piling independent of utilities and structures.

Shore and brace sides of trenches and excavations in accordance with Workers' Compensation Board Regulations.

Maintain during backfilling and remove in stages as backfilling progresses or as approved by the Municipal District.

Remove all shoring, bracing and sheet piling unless otherwise permitted by the Municipal District. If shoring is allowed to remain, cut off to a level at least 600 mm below finish grade.

Pre-fabricated cages or shields may be used, at the discretion of the Municipal District, to supplement or replace conventional shoring provided they conform to all applicable safety regulations, and permit the proper placing and tamping of bedding material under and around utility pipes.

5.3.7. Backfilling - General Requirements

Bedding of pipes and utilities and backfill to 300 mm above top of pipes and utilities is included in other sections.

Backfill trenches and excavations with excavated earth material. Remove all rocks larger than 200 mm in diameter from earth backfill.

Place and compact all backfill in maximum 300 mm deep loose layers, prior to compaction.

Compact site material used as trench backfill in all areas from 300 mm above top of pipe to 300 mm below bottom of granular base for roads to a density not less than 98% of Standard Proctor Density, as defined herein, and carried out at moisture content within 3% of optimum moisture content. Remove any free water in the trench prior to placing additional lifts. Note that if moisture content is too high and densities not initially attainable the contractor will make every reasonable attempt to dry the material by whatever means available (i.e. discing, spreading, etc.) should the Municipal District deem the material to be "unworkable" the use of imported granular backfill may be required. Compact the final 300 mm below road or lane granular base to not less than 100% of Standard Proctor Density.

Compaction results will be based on a minimum of one density test per 150 lineal metres of trench for each 1.5 metres of depth. If a density test indicates insufficient compaction at any depth, then two more densities, which are proportionally representative of trench length will be taken at that depth. Then, if the average of the three tests is below the required density, the contractor will re-excavate and re-compact to meet the specified density.

Place and compact evenly around structures to prevent damage or displacement. Grade surface to direct water away.

Stockpile, spread or remove excess excavated earth material where directed by the Municipal District.

Remove and dispose of boulders off site at no additional cost.

Where additional pipes are to be, or have been laid, crossing the trench being backfilled and at a higher elevation, take special care to ensure the backfill is compacted to a minimum of 98% of Standard Proctor Density from the lower pipeline up to the obvert elevation of the higher pipeline.

Where imported material is called for by written direction of the Municipal District, place the specified depth of granular material to the elevations provided and compact to specified Standard Proctor Densities.

Where filter fabric is called for by written direction of the Municipal District, place fabric to the overall dimensions specified.

5.3.8. Settlement

The Contractor shall be responsible for all settlement of backfill that may take place during a period of two (2) years after date of completion certificate.

When notified of any such settlement, promptly repair same, or make arrangements for others to do so at the Contractor's expense. Failure to do so will result in the Owner making appropriate arrangements at the Contractor's expense and at no cost to the Owner.

Pay the cost of all damages that may be caused by such settlements, including but not limited to repair and/or replacement of concrete sidewalks, curb and gutter and asphalt concrete pavement.

5.4. Adjustment of Appurtenances

5.4.1. Work Included

The work described in this section pertains to the adjustments of all appurtenances.

5.4.2. Execution

5.4.2.1 Valve and Curb Boxes Adjustments

Valve box tops and curb box tops shall be adjusted so that the top of the box is set exactly to the required elevation. The Contractor shall shorten or lengthen the boxes and stems as required and block the boxes to prevent any settlement. The adjustments shall be made so that the boxes are plumb and the valves operate effectively. The rock guard and operating nut are to be located no closer than 300mm below the proposed finished grade.

5.4.2.2 Manhole and Catch Basin Adjustments

Manhole and catch basin frames shall be adjusted so that the top of the cover is set exactly to the required elevation. Where it is necessary to raise manhole frames it shall be done with approved precast rings or blocks, meeting the requirements of the current issue of ASTM C478. Joints between slab top blocks, and frame shall be mortared, and the joints finished flush and smooth. Joints between slab top, precast rings, and frame shall be made watertight utilizing preformed bituminous gaskets or other approved sealant. Under no circumstances shall the depth from the rim of the manhole to the first ladder rung be more than 800mm.

5.4.2.3 Damaged Appurtenances

The Contractor shall replace any appurtenances damaged by his work or forces. Any existing damaged appurtenances found within the proposed work zone shall be replaced by the Contractor, as approved by the Municipal District, at an agreed lump sum price.

5.4.2.4 Final Adjustment Elevations

The tops of valve boxes, manholes, and catch basins shall be set to the design elevations, or as approved by the Municipal District. Generally, the following shall apply for setting the final elevations of the tops of the appurtenances.

1) In asphaltic pavement, 5 mm below the finished surface elevation for manhole frames.
2) In concrete curb gutter, 10 mm below gutter elevation for catch basin frames.
3) In gravel roadways/lanes, 50 mm below the surface.
4) In landscape areas, 50 mm above the final surface, providing a smooth transition to match the surrounding areas.

6.0 Sanitary Sewage System

6.1. Design Factors

The sanitary sewerage system shall be of sufficient capacity to carry peak flows plus infiltration. Foundation weeping tile and roof leaders shall not be connected for discharge into the sanitary sewer system. The following factors shall be used in design of sanitary sewerage systems:

6.1.1. Residential

Population estimates for the purpose of system design shall be based upon the actual lot proposed for the development and a persons/dwelling estimate of not less than 4.0.

The Municipal District reserves the right to require additional system capacity to accommodate potential future subdividing of larger lots.

1) Average Sewage Flow 340 lpd
2) Peaking Factor 1 + 14/ (4 + P x 0.5) (the Harmon Formula)

Where P equals the design contributing population in 1,000's

3) Infiltration 0.28 L/s/ha

6.1.2. Commercial, Industrial and Institutional

1) Average Sewage Flow Commercial: 40,000 l/ha/d
2) Industrial 30,000 l/ha/d
3) Peak Flow 3.0 x Average Flow
4) Infiltration 0.28 l/s/ha (24,000 l/ha/d)
5) Minimum Velocity 0.61 m/s

Pipe sizing shall be determined by using the Manning's Formula with an "N" value of 0.013.

The minimum size for sanitary sewer mains shall be 200 mm diameter for residential and 250 mm for industrial/commercial areas.

Minimum pipe slopes shall be as recommended by Alberta Environment.

Sanitary sewers may have to be oversized to conform to the Municipal District's Sanitary Sewer planning.

6.1.3. Sewer Main Installation and Location

Mains shall be installed to provide a minimum depth of 3.0 m from top of pipe to final finished grade at the surface.

Mains shall be installed to provide adequate sewer service connection depth at the property line

Mains shall be located within the road right-of-way in accordance with the Roadway Cross-Section Standard Drawings.

Pipe bedding shall be provided for all mains in accordance with the Standard Drawings.

6.1.4. Manhole Installation and Location

Manholes shall be located at the end of each line, at all changes in pipe size, grade or alignment, at all junctions, and at intervals no greater than 120 m along the length of the sewer.

Inverts in manholes at changes in direction shall have at least 50 mm fall across manhole. To maintain a continuous energy gradient through manholes, the obvert (crown) elevation of the lowest upstream pipe shall be equal to, or higher than, the obvert of the downstream pipe.

Manholes shall be installed as shown on Standard Drawings. Manhole bases shall be pre-cast slabs, concrete poured bases, vaults or pre-cast tees. Pre-benched manholes shall be used when possible. All manholes shall be 1200 mm inside diameter for all pipe 900 mm diameter and less. For pipe exceeding 900 mm diameter, manhole diameter shall be pipe diameter plus 600 mm, or a Tee-Riser shall be used.

Manhole frames and covers to be Type F-39 in landscaped areas, Type NF-80 in paved areas and Type NF-90 gasketed in sags. All manhole covers are to be clearly stamped "Sanitary Sewer".

An interior drop manhole shall be used where invert levels of inlet and outlet pipes differ by more than 750 mm.

All joints shall be watertight.

Safety platforms at intermediate levels are required for manholes greater than 5.0 m in depth when measured from the top of the frame to the lowest invert. Refer to Standard Drawing 6.1.

Other Standard Drawings for manholes are:

1) 6.2 Manhole Detail Type 5A Pre-Cast;
2) 6.3 Interior Drop Manhole Detail
3) 6.4 Exterior Drop Manhole Detail;
4) 6.5 Typical Perched Manhole for 600 to 1050 mm Diameter Pipes;
5) 6.6 T-Riser Manhole for Pipes 1200 mm and Larger;
6) 6.7 PreBenched Manhole Base.

6.1.5. Curved Sewers

Curved sewers will be permitted, with the following restrictions:

1) The sewer shall be laid as a simple curve, with a radius equal to or greater than 90 m or the manufacturer's minimum recommended radius, whichever is larger.
2) Manholes shall be located at the beginning and end of the curve.
3) Manholes shall be located at intervals not greater than 90 m along the curve.
4) The main shall run parallel to the curb or street centerline.
5) The minimum grade for sewers on curve shall be 50% greater than the minimum grade required for straight runs of sewers.

6.1.6. Inspection and Testing

Prior to issuance of the Construction Completion Certificate of the project, all sewer mains shall be tested as follows:

6.1.7. Closed Circuit Television Inspection

All sections of sanitary sewers shall be inspected with closed circuit television camera equipment prior to Final Acceptance Certificate (F.A.C.). A written report and a colour video tape, in VHS format, shall be submitted to the Municipal District for their approval and records.

6.1.8. Leakage Test

The Director of Field Services may require each section of sewer main and service connections to be tested for water tightness by an exfiltration test and/or infiltration test. In areas where the water table rises up to the sewer pipe invert or higher, each section of the sewer main and service connections shall be tested for water tightness by an infiltration test. In all other situations, an exfiltration test shall be conducted. The test results shall be recorded for each section of the main tested and the results forwarded to the Director of Field Services.

6.2. Low Pressure Sewage Systems

6.2.1. Design Factors

System design shall comply with all environmental legislations, including but not limited to safety, odour control, accidental line break, spillage control, health issues, zoning development standards and its impact on existing and proposed downstream treatment facilities.

System and pump configuration will need to be designed for increased future sewage flows, based on greater "per capita" sewage generation and/or staged low-pressure system expansions to existing networks, as presented in area structure and long range development plans. Accessibility and maintenance provision shall be considered when locating the units.

All materials incorporated in the system shall meet Municipal District approval and be installed as per manufacturer's instructions. Unapproved materials shall be replaced at the contractor's or developer's expense.

All systems shall be designed for a minimum 20 year operating life span.

Pipe sizing shall meet all the requirements of the design flow rate(s). The total dynamic head (TDH) at each pump location during peak flow conditions shall not exceed the recommended pump operating parameters on any flow path. Minimum inside diameter shall be 50 mm.

Low pressure sewage systems shall be laid out in a branched or tree configuration. The end of a branch is determined by the joining of 2 or more main sections and/or when the outfall is reached. There shall be no looping of collection mains.

A minimum of 1.0 metres/sec scouring velocity shall be achieved in each sub-system at least once per day, based on design flows.

Where systems require the retrofitting of existing sewage holding tanks, inspection and re-certification of the structure is required.

The low pressure system can utilize either centrifugal or semi-positive displacement pumps; whichever is deemed more applicable for the particular application. In no case shall both pump styles be utilized within the same system.

Design flows for low-pressure residential collection main systems shall be designed as follows:

6.3. Centrifugal Pump System

Q=1.2611 + (0.0316 x R) where

R=The accumulative number of residences contributing sewage flows to each system segment.

Q=Equivalent design flows for each segment in litres/second (l/s).

6.4. Semi-Positive Displacement

Q=N x PR where

N=The maximum number of households contributing sewage flows to each system segment at any one time. Where pumping rates range between 0.38 l/s and 0.95 l/s, the maximum number of households shall be based on statistical evidence listed below.

PR=Pump Pumping Rate.

Number of Contributing Pumps	Max. Daily Simultaneous Pump Operations
1	1
2-3	2
4-9	3
10-18	4
19-30	5
31-50	6
51-80	7
81-113	8
114-146	9
147-179	10
180-212	11
213-245	12
246-278	13
279-311	14
312-344	15

Note: Where pumping rates are outside the 0.38 l/s to 0.95 l/s range, verify the number of simultaneous pump operations with the pump supplier and adjust accordingly.

All minor losses at bends and valves according to the supplier specifications must be taken into consideration in the system design.

Elevation changes shall be taken into consideration in the system design.

The system shall contain provisions against any possibility of flow reversal due to back siphoning.

System operating pressures shall normally be in the range of 200 kPa to 415 kPa (30 psi to 60 psi). The network shall be designed to prevent any long-term high-pressure situations.

Piping material shall be either, PVC DR26 (series 160) gasketed joints or HDPE DR11 (series 160) butt fused, electro-fused; or better. Pipe network shall be designed to operate at a sustained system pressure of 885 kPa (128 psi).

Final plastic sewer pipe selection shall be the consulting engineer's responsibility, and shall take availability, cost, local code, soil conditions and system design requirements into consideration. Material selection must be shown to adequately meet structural and chemical conditions.

Piping from sewage generating facilities to grinder pump units shall meet all applicable code requirements.

An analysis is required to determine if a grinder pump (GP) or septic tank effluent pump out (STEP) low-pressure system is best suited for the particular application.

6.5. Grinder Pump Station

6.5.1. General

The following grinder pump station and service installation requirements are provided as a guideline for property owners who choose to complete the on-property installation and service tie-in components of new sewer systems independently. Any work completed on private property by the owners is the sole responsibility of the property owners.

Grinder pump station equipment installation and service tie-ins required on private property to connect to the low pressure sewer main are as follows:

1) Installation of the pump station.
2) Connection to the buildings existing gravity service and extension to the pump station. Refer to Standard Detail Drawing 6.8.
3) Installation and connection to the pump discharge line to the low pressure sewer system service at the property line. Refer to Standard Detail drawing 6.9.
4) Installation of the control cable and panel.
5) Power supply connection to the pump station control panel.

The following materials and methodology are required to meet the project minimum installation requirements.

6.5.2. Materials

Pressure service line from the pump station to the municipal service, at the property line, shall be 38 mm DR 11 polyethylene pipe manufactured in accordance with AWWA 906 and CAN/CSA B1237.1 based on IPS outside diameter sizing. Pipe joints shall be completed by thermal butt-fusion or suitable compression fittings complete with stainless steel inserts.

Gravity service line from the building service pipe to the pump station inlet shall be 100 mm SDR 28 PVC pipe to CSA B182.1, or equivalent.

Valves installed on the residences gravity service pipe to isolate the existing septic tanks and new pump stations shall be PVC compact ball valves (Cepex or equivalent). These valves are only required if the pump station and tie-in is complete prior to system commissioning.

The Municipal District will provide previously purchased pump stations for independent installation at cost. Pump stations, as supplied by E/One Sewers include:

1) Pump access way and pump chamber;
2) Grinder pump (single phase 230V);
3) Control cable and panel (10 m length of cable); and
4) Remote sentry panel.

6.5.3. Execution

The pressure service line from the pump station to the service connection shall be buried a minimum depth of 2.5 m.

Lay pipes on a prepared bed and hand place sand bedding material around and up to 300 mm above the pipe. Do not place frozen or other unsuitable material above the pipe. Do not place backfill directly on the pipe. Ensure the pipe does not "kink" during installation.

Support valves by means of either concrete or wood blocks, located between valve and solid ground, bedding same as adjacent pipe. Valves shall not be supported by pipe. Valves operating handles should be accessible.

Pump station should be installed in accordance with the E/One Sewers Typical Installation Instructions. Pump stations are available for pick-up at the Canyon Creek Water Treatment Plant. Pump stations shall be loaded, transported and unloaded at the property owner's expense.

All electrical work shall be completed, or supervised and approved, by licensed master electrician as per the conditions of the Provincial Act respecting manpower vocational training and qualification.

6.6. System Requirements

Where possible, all sewer piping shall be installed at sufficient depths to prevent freezing. Where pipe sections and appurtenances have less than 3.0 metre cover, necessary rigid insulation shall be used to prevent freezing.

Air release / vacuum break valves will be installed at all locations where trapped air affects system functionality.

Standard water / sewer clearances shall be maintained at 30 metres horizontal and 0.5 metres vertical.

Clean outs shall be installed at the upstream of each line segment and major directional changes. Maximum spacing for cleanouts and isolation valves shall be 150 metres. Units shall include a quick coupler system for system flushing compatible with Municipal District maintenance requirements.

All forcemain lines will be installed with metallic tape or insulated 14 gauge copper wire for locating purposes c/w the required surface detection unit connection points. All cleanouts shall include an isolating valve. An additional check valve shall be located between the isolating valve and the cleanout assembly.

Fitting connections shall be butt fused, socket weld, mechanical flange or electro – fused. All joints shall be equal to or greater than the pipe pressure ratings, be approved for use in the particular application, and be full bore with smooth interior surfaces.

Service line sizes shall be as per the grinder pump manufacturer's instructions and will have the same or better pressure rating as the collection mains.

Low-Pressure collection lines can be installed using trenching, ploughing, or directional drilling. Prior to installation, all utilities need to be located and identified.

Use of repair clamps will not be permitted.

6.7. Property Shut-off and Main Line Isolation Valves

Isolation valves shall be located at key points, and major directional changes for maintenance and repair requirements, to a maximum of 150 metres between each other.

Valves on lines less than 75mm diameter shall be fully ported ball valves, true union type or flanged connection to allow for removal without cutting the line.

Isolation valves on lines 75mm diameter or greater shall be eccentric plug type, suited for operation in sewage systems.

Isolation valves shall remain accessible via a service box or access chamber assembly. Where a chamber unit is utilized, it will be insulated to prevent freezing.

All service lines to individual lots shall incorporate a shut-off valve. Lot shut off valves shall be located at least 300 mm outside the property limits. Accessibility shall be the same as for isolation valve units. The maximum number of shut-off valves clustered together shall be dependent on Municipal District policy and the access chamber size.

Cast valve boxes shall be epoxy coated. Other materials shall be suited for direct bury applications and approved for use by the Municipal District. Valve open/closing rotation shall be as per water valve requirements.

6.8. Pump Requirements

Pump operating parameters shall be based on the present and future system requirements as determined by the Engineer. The required individual grinder pumping rates shall be determined according to daily inflow rates as indicated in "Section 6 Sanitary Sewage System".

Pump units shall be submersible types, either semi-positive displacement or centrifugal, with integrally built grinder assembly and isolation valves. Pump units shall pump directly into low-pressure mains. Pumping equipment shall meet all applicable safety, fire and health requirements for the intended application and location.

Grinder assemblies shall be capable of macerating all material in domestic sewage, including reasonable amounts of glass, wood, plastic, rubber, light metal objects, disposable diapers, sanitary napkins, and be specifically designed for the purpose intended. Processed material must have a consistency that will not clog any part of the discharging system.

While outside below ground installations are preferred, inside installations meeting all code and collection system requirements may be allowed subject to Municipal District approval. Pump operating parameters shall be based on the present and future system requirements as

determined by the Engineer. The required individual grinder pumping rates shall be determined according to daily inflow rates as indicated in "Section 6 Sanitary Sewage System".

Grinder pump assembly to consist of 440-C stainless steel hardened to C-58-60 Rockwell. Remaining parts exposed to sewage shall be manufactured to prevent corrosion.

The unit shall operate at 120 or 240 volts, single phase, and be able to provide the required flows at the design total dynamic head. All complete grinder pump installation manuals including but not limited to electrical wiring, piping installations and detailed installations, shall be provided to the installer and Municipal District personnel prior to construction.

The pump unit shall be constructed such that open shafts are not exposed inside the raw sewage passageways where they can become clogged.

The sewage tank shall be of sufficient built-in storage to accommodate peak flow and power outage situations. Provision for mobile power generating units should be considered, where applicable.

Semi-positive grinder pump unit will have a built-in automatic shut off mechanism when system back pressures cause thermal overload. Units shall be able to automatically restart after cooling.

Grinder pump rated maximum pumping pressures shall not exceed 85% of low-pressure collection pump systems, designed maximum working pressures.

Pumps shall be of the flooded suction type to ensure positive priming.

Where high ground water levels exist, grinder pump and tank assemblies shall need to be securely anchored to avoid floating.

Pump holding tanks shall be vented such that the airspace above the wastewater level is always at atmospheric pressure.

Tank interior geometry and generated pump suction currents during operation must be adequate to provide scouring velocities to prevent build-up of solids.

Grinder pump assembly shall include all level controls to turn unit on/off at set levels. In addition high level / pump operation alarms shall be provided.

Maintenance replacement and power consumption evaluations shall be preformed as part of the final system design. Where required, provide a minimum of two manuals to Municipal District maintenance personnel. Literature shall include but not be limited to:

1) parts listing
2) parts supplier
3) maintenance schedule

6.9. System Testing

The low-pressure collection system shall be pressure tested prior to commissioning, after backfilling operations are complete and at least 36 hours after the casting of concrete thrust blocks.

Zero infiltration/exfiltration is permitted.

Components to be tested shall include the entire collection system, up to the grinder pump assembly. Test duration shall be a minimum of 2 hours, or if the pipe network is buried, 8 hours.

The test pressure shall be 1.5 times the maximum operating pressure, but not less than 350 kPa.

6.10. Private Sewer Systems

The design, installation, and use of all private sewage systems must comply in full to the standards outlined in the current edition of the Alberta Private Sewage Systems Standard of Practice.

6.11. Sanitary Sewer Mains

6.11.1. Work Included

Provide all labor, products and equipment required for the work, including but not limited to:

1) bedding under and over piping
2) sanitary sewers and appurtenances
3) manholes and appurtenances
4) cleaning sewers
5) testing sewers
6) connection to existing systems

6.11.2. Quality Standards and Assurances

Products, workmanship and testing shall conform to standards specified in this section.

All products and workmanship are subject to inspection by the Municipal District.

Perform all tests required by the specifications and by authorities having jurisdiction.

Notify the Municipal District and authorities in ample time before testing to permit inspection and to allow tests to be witnessed.

Do not cover any work before inspection and testing unless authorized by the Municipal District in writing.

Remove or repair defective products or work which fails to meet specified requirements as directed by the Municipal District.

6.12. Products

6.12.1. Sewer Pipe

To be type called for in the schedule of quantities or shown on drawings and meet the requirements noted in subsequent clauses of this section.

Non-reinforced pipe and fittings to meet requirements of CAN/CSA-A259.1 Class 3, designated for flexible rubber gasket joints to CAN/CSA-A257.3.

Reinforced concrete pipe to meet requirements of ASTM Specification C76- CSA-A257.2-M92.

PVC pipe and fittings - DR 35 meeting ASTM Specification D3034 and CSA-B182.2 and CSA-B182.1 may be utilized for mains up to and including 375 mm diameter with prior approval of the Municipal District.

Cement - sulphate resisting Portland for all concrete pipe, meeting Type 50 CSA-A5.

6.12.2. Pipe Joints

For all sewers - as recommended by pipe manufacturer, to produce watertight joints with infiltration within specified limits.

Concrete pipe - rubber gasket to meet requirements of ASTM C443, and CAN/CSA A257.3-M92

PVC - rubber gasket to meet requirements of ASTM 03212 or ASTM F477.

6.12.3. Pre-Cast Concrete Manhole Units

To meet requirements of ASTM C478 and CSA A257.4 to dimensions shown on drawings.

Cement - sulphate resisting Portland, CSA A5, Type 50.

Manhole steps shall be 19 mm diameter, galvanized iron safety rungs spaced at a maximum distance of 400 mm centre to centre for full height.

Pre-cast bases to be minimum 20.7 MPa concrete.

6.12.4. Concrete Blocks and Bricks

Solid concrete, conforming to CSA A165.1 and 165.2 and ASTM C139, not less than 128 mm thick for block, standard dimensions for brick, true to shape, free from cracks and surface defects, compressive strength not less than 17.2 MPa, absorbing not more than 8% water by weight during 24 hours immersion test performed after drying.

Cement - sulphate resisting Portland CSA A5, Type 50.

6.12.5. Mortar

For pipe joints and all other parts of the work, one part sulphate resisting Portland cement to two parts clean sand, by volume.

6.12.6. Cast Iron Frame, Covers and Grates

For manholes and catch basins, close-grained grey cast iron, meeting ASTM A48, Class 20, true in form and dimension, free from faults, sponginess, cracks, blowholes and other defects. Cast steel to conform to ASTM A27, grade 70-36. Substitution of ductile iron meeting ASTM A445 for cast iron or cast steel shall be subject to approval of Municipal District.

Machine or grind frames, covers and grates to even non-rocking bearing surfaces.

Hot dip in asphaltic varnish.

Manhole covers and frames:

Sanitary - Norwood Foundry Model F-39, or approved equal

6.12.7. Manhole Steps

Safety type, 19 mm diameter solid steel bar, hot dip galvanized after fabrication.

6.12.8. Safety Platforms

Safety platforms shall be aluminium grates to MSU Mississauga or approved equal.

To be installed according to manufacturer's recommendations.

To be installed on manholes greater than 5.0 meters in depth when measured from the top of the frame to the lowest invert.

Refer to Standard detail Drawing 6.1.

6.12.9. Concrete

Ready-mixed concrete, sulphate resisting, Portland cement CSA A5, Type 50, 20 MPa compressive strength at 28 days, to CSA A23.1

6.12.10. Reinforcing Steel

CSA G30.12 or G30.13, 34.5 MPa minimum yield, Grade 50 all deformed except where noted otherwise. Use Grade 40 for ties.

6.12.11. Sewer Pipe Tests and Rejection

Include all costs for testing, supply and delivery of specimens to testing laboratory and replacing defective material.

The Municipal District reserves the right to select, either on site or at the manufacturer's stockpile, 0.5% of total length of each category of pipe for testing, minimum number of lengths as follows:

1) for each category of over 100 lineal meters - 4 lengths
2) for each category of over 50 lineal meters and less than 100 lineal meters - 2 lengths
3) for each category of less than 50 lineal meters - 1 length.

Where the Municipal District has selected full sized pipe specimens for load tests, deliver these specimens to an approved testing laboratory. Results of the tests shall be mailed directly to the Municipal District in triplicate. Pipe will be accepted, based on certified factory tests, provided they are done under supervision of an independent testing agency. All pipe tests shall be performed in accordance with ASTM Specifications.

Should any specimens fail to meet test requirements, test two additional selected specimens for each failure. Pipe will be acceptable only if all re-test specimens meet requirements. Should test results be unsatisfactory, all or part of pipe supplied may be rejected and acceptance withheld until satisfactory tests of pipe in place are conducted.

Inspect pipe on delivery and reject any that fails to meet specified requirements. Replace rejected pipe with satisfactory pipe without delay. Mark all rejected pipe plainly as "Rejected" and immediately remove from site.

The Municipal District may require submission of a manufacturer's report verifying satisfactory random testing of the pipe designated for this project.

6.13. Execution

6.13.1. Bedding Sewers

Excavate trenches to widths not less than 300 mm greater than pipe diameter. Maximum width at top shall not exceed outside pipe diameter plus 600 mm.

Bed pipe per trench bedding and initial backfill Class "B" granular surround conditions for plastic pipe and Granular Foundation for concrete pipe, as detailed in the standard drawings.

Obtain Municipal District approval for all materials to be used in the pipe bedding zone.

6.13.2. Laying and Jointing Pipe

Commence laying at lower end of line, lay pipes and specials true to line and grade, socket ends up grade, joints close and evenly butted all around pipe. Take special care to prevent sagging of spigot end in hub and provide true, even invert surface throughout entire length of sewer. Excavate at end of each pipe to provide rest for socket, sufficient to permit proper jointing. Clean pipe interior, remove all dirt, mud and other extraneous materials.

6.13.3. Infiltration / Exfiltration Testing

Total infiltration of groundwater into whole of system or exfiltration, shall not exceed 5.0 litres per mm of internal pipe diameter per kilometre per day including manholes, for PVC pipe, and 20 litres per mm of internal pipe diameter per km per day including manholes for concrete and clay tile pipe. Where such leakage is exceeded, repair sewer mains so total infiltration is within specified limits.

During construction and immediately on completion of a manhole, measure infiltration at new manhole. If amount exceeds specified limit, make necessary repairs immediately to reduce infiltration to allowable limit. Failure to comply with this requirement will be sufficient cause for the Municipal District to stop sewer laying work until repairs have been made.

6.13.4. Cleaning Sewer Mains

On completion of construction of mains and services, flush and string, (in readiness for TV inspection) all mains until all deposits of earth or other material are removed. If new system connects to an existing system, plug outgoing line at manhole at junction and remove dirt and debris at that manhole. Do not permit debris from new construction to enter existing system. Pay all costs for repairs where damages occur due to negligence. Pay all costs of water from the municipal authority.

During flushing operations, check all manholes. If depth of flow in any manhole is greater than should be anticipated, bucket main and remove obstructions in pipe line. Pay all costs for required repairs.

Whenever practicable, flush out in runs not over 250 meters. Remove all foreign material from each run before proceeding with next.

6.13.5. Testing

If required by the Municipal District, perform Pig test after cleaning sewer mains. Through each section of main, pull wood or metal ball with diameter 50 mm less than inside pipe diameter. If the Pig does not readily pull through, uncover pipe and repair defective section.

Pig test is not required on lines 216 mm diameter and larger if they are visually inspected in a satisfactory manner.

TV Testing - the Contractor, at their cost will carry out a TV inspection of all sanitary and storm water mains. All defects identified by the TV inspection shall be corrected by the contractor at the contractor's expense. The contractor shall be responsible for the cost of flushing and stringing the mains prior to TV inspection. If additional TV inspection is required to verify correction of defective work, it will be at the contractor's cost. The Contractor shall provide a copy of the video recordings and a written report to the Municipal District for record purposes.

6.13.6. Manholes

Construct manholes as shown on drawings, unless otherwise permitted in writing by the Municipal District. Submit full details of any proposed alternative construction with bid.

For cast-in-place concrete for manholes, conform to CSA A23.1.

Place manholes accurately, plumb, in alignment and at exact plan location.

Construct manholes watertight and complete, including finishing flow bottoms, as work proceeds. Do not lay pipe in advance more than two manholes ahead of last completed manholes.

Shape bottoms accurately for necessary flows as shown on drawings or as directed by the Municipal District. In manholes with sewers 610 mm in diameter and smaller, form invert through manhole with half-round pipe. In manholes containing lot services, shape bottoms to provide slopes required to ensure no build up of sewage occurs in manholes.

Place stubs for future lines accurately and plug watertight. Shape flow bottoms to suit future lines.

At all bends through manholes, provide 50 mm drop in invert from inlet to outlet.

Support pipes at manholes to prevent shearing or settlement. Where not detailed use concrete fills, concrete or timber beam, or suitably compacted gravel.

During construction, plug pipes at manholes to prevent entry of concrete and mortar. Remove plugs immediately after construction is completed.

Set covers accurately within 15 mm of correct grade. On sloping streets, set covers to match slopes.

Set all precast concrete sections, bricks, blocks and frames in mortar. Tool joints smooth and point all voids after setting.

All sanitary manhole barrels are to be sealed with rubber neck to prevent infiltration.

7.0 Storm Drainage System

7.1. Design Factors

The storm sewers or storm drainage system shall be designed as a separate system and shall be of sufficient capacity to carry storm runoff from the ultimate development the area is zoned for. The storm system should be designed considering both the minor and major drainage systems.

The minor system comprises of piping, manholes, catch basins and outfall structures. The minor system shall convey runoff from snowmelt and rainfall events to adequate receiving water (river, stream, lake or pond) without sustaining any surface ponding or excessive surface flows for events up to and including a 1-in-5-year return period. Where required by the Director of Field Services, high value commercial areas shall have their minor systems designed to accommodate a 1-in-10-year return period event.

The major system comprises the street system, detention facilities, parkland and any other land required to convey runoff from events up to and including a 1-in-100 year return period to the receiving water. The major system shall be evaluated in a manner sufficient to determine that no flooding may cause significant property damage (e.g. flooding of buildings) occurs during the 100 year event.

Effluent from sanitary sewers and any drainage from industrial, agricultural or commercial operations that may potentially be contaminated shall not be discharged to the storm sewers.

Roof leaders of residential buildings shall be splashed on the surface and shall not be connected to the storm sewer system. Roof drainage from one-family and two-family dwellings shall discharge to grassed or pervious areas. The point of discharge shall be a sufficient distance (i.e. at least 1.0 m) to ensure the water flows away from the building. Roof drainage from apartment buildings, commercial areas, and industrial areas may discharge to the storm sewer, without the drainage crossing a sidewalk, if approved in writing by the Director of Field Services.

The post development runoffs rates from properties shall not exceed the existing pre-development runoff rates being discharged to the storm drainage system, thus resulting in a no net increase to the storm drainage system.

Where pre-development runoff rates are considered excessive for the existing drainage system, the developer shall consider alternatives to reduce the existing runoff to a level acceptable by the Director of Field Services.

The developer shall provide these designs and calculations to the Municipal District for approval.

Ponding of runoff on roofs, parking lots or landscaped areas to reduce runoff rates must be considered.

All development shall provide sump pumps to discharge weeping tile water to grassed surface areas or splash pad. Splash pads are required to insure positive drainage away from the building. Should the Geotechnical Report indicate a high water table, the Municipal District may request other alternatives to surface discharge of weeping tile.

No sump pump connections to the storm system are allowed unless approved in writing by the Director of Field Services.

Control shall be provided to minimize sediment discharge to the storm sewers. This shall be in the form of properly graded and surfaced streets and lanes, landscaping, sediment control structures at pond and lake inlets, or other means where appropriate.

The following criteria shall be used in the design of the minor storm sewer system:

7.1.1. For Areas Less Than 65 Hectares

The Rational Method shall be used to design the storm sewer system: Q=CIA/360

- Where Q = the design peak flow rate in cubic metres per second
- I = the intensity of rainfall in millimetres per hour, corresponding to the time of concentration
- A = The contributing area in hectares
- C = The runoff coefficient

The five year rainfall intensity table shall be used as shown on Table 7.1 and Table 7.2.

The following runoff coefficients shall be used for the 1-in-5 year analysis:

1) Parks = 0.15
2) Residential = 0.40
3) Industrial = Must be Calculated
4) Commercial = Must be Calculated
5) Multiple Family = 0.70
6) The weighted average of pervious and impervious area runoff coefficients shall be estimated from the following equation:

   - $C = \frac{(0.95 \times \text{Impervious Area}) + 0.10(\text{Total Area} - \text{Impervious Area})}{\text{Total Area}}$

7) The weighted average of pervious and impervious area runoff coefficients shall be estimated from the following equation. The duration of rainfall used to determine the intensity is equal to the time of concentration. The time of concentration is comprised of the overland time to the storm sewer inlet and the time of travel in the conduit. The overland flow time to curbside in residential areas shall not exceed 15 minutes in duration (specific overland flow times shall be computed separately for commercial, industrial and undeveloped areas). Gutter flow time shall not exceed 5 minutes and shall be estimated based on methods outlined in "Modern Sewer Design" (AISI, 1980). The time of travel in the conduit shall be based on the pipe flow velocity.

7.1.2. For Areas Greater Than 65 Hectares

Computer models shall be used to determine design flows and the sizing of systems that contain non-pipe storm water management facilities (e.g. detention ponds) or systems that include a significant amount of undeveloped land.

The selection of an appropriate computer model shall be based on an understanding of the principles, assumptions and limitations in relation to the system being designed.

Wherever possible, the computer model shall be calibrated. In all analyses, the parameters used, the drainage boundaries, the pipe network and its connectivity shall be clearly identified on an overall drawing, computer printouts and a design summary report.

The critical design rainfall hyetograph shall be selected. Both the AES Distribution (for long duration) and the Chicago Distribution (for short duration) will be evaluated.

The storm duration of an event is critical for the system being designed and shall be used to determine pipe sizes. The 5 year 4-hour Chicago Distribution event shall be selected. For systems involving storage design, both short duration and longer duration events such as the AES 24 hour event should be evaluated.

TABLE 7.1 **RAINFALL INTENSITIES FOR ROCKY MOUNTAIN HOUSE**

Duration (minutes)	Rainfall Intensity (mm/hr.)		
	5 Year	10 Year	100 Year
5	9.0	11.2	18.2
10	12.9	15.8	24.8
15	16.2	19.9	31.5
30	20.2	24.4	37.7
60	23.1	27.6	41.7
120	26.1	30.4	43.9
360	34.5	39.2	53.9
720	49.0	57.8	85.0
1440	62.8	74.2	110.1

Notes:

1) Based on AES data at Rocky Mountain House Airport for period 1964 to 1990 (66 years).
2) Maximum Initial time of Concentration is 15 minutes.

TABLE 7.2 RAINFALL INTENSITIES FOR EDMONTON

Duration (minutes)	Rainfall Intensity (mm/hr.)		
	5 Year	10 Year	100 Year
10	66.0	79.0	120
11	62.0	74.1	112
12	58.5	69.9	106
13	55.5	66.3	100
14	52.9	63.1	95.5
15	50.5	60.3	91.1
16	48.4	57.4	87.2
17	46.5	55.4	83.7
18	44.8	53.4	80.5
19	43.2	51.5	77.6
20	41.8	49.7	75.0
21	40.4	48.1	72.5
22	39.2	46.7	70.3
23	38.1	45.3	68.2
24	37.0	44.0	66.3
25	36.0	42.9	64.5
26	35.1	41.7	62.8
27	34.2	40.7	61.2
28	33.4	39.7	59.7
29	32.7	38.8	58.3
30	31.9	37.9	57
60	20.2	12.9	35.6
120	12.8	15.1	22.3
360	6.18	7.23	10.6
720	3.91	4.56	6.60
1440	2.47	2.87	4.13

Notes:

Based on AES data at Edmonton Municipal Airport for period 1914 to 1980 (66 years).

Maximum Initial time of Concentration is 15 minutes.

The maximum velocity within a piped system shall be 3 m/s. If sewer flow velocities exceed 3 m/s, special consideration shall be given to prevent scouring.

Pipe sizing shall be determined by utilizing the Manning's Formula, using an "N" value of 0.013.

Storm sewer pipe shall be designed to convey the design flow when flowing full, with the hydraulic grade line at the pipe crown. All pipe crown elevations shall match at manhole junctions.

Surface water shall not be permitted to run a distance greater than 250 m in lanes and swales without provision of interception by the first catch basin. Within the piped drainage system, or on Collector or Arterial roadways, surface runoff shall not run a distance greater than 120 m without interception.

Surface water shall be intercepted with a sufficient number of catch basins such that the inlet capacity is sufficient to receive the design storm water flow. Catch basin capacity shall be considered, as shown on Table 7.3, where values are given for sag conditions and on slope conditions based upon inlet grate type.

TABLE 7.3 CATCH BASIN CAPACITIES (l/s)

For design purposes, catch basin capacities in litres/second, are approximately as follows:

Norwood Model	Sump Condition*	Continuous Slope**	
		Capture	Overflow
F-51 (with side inlet)	190	30	95
F-51-G (grate only)	155	35	85
F-33	75	10	30
F-35	40	-	-
F-38	85	15	45
F-39	80	15	40
F-49	105	20	50

*based on 100mm depth of ponding

**based on 50mm depth on 1% slope

Minimum gutter grade shall be 0.50%.

Cul-de-sacs and curb returns are minimum 0.6%.

Roadway ditches and swales will efficiently convey run-off through the storm drainage system. Roadway ditches and swales will not be used for storm water detention or retention.

Refer to Drawing 7.1 Concrete Drainage Swales.

7.1.3. Storm Sewer Mains

The minimum size of storm sewer mains shall be 300 mm diameter.

Pipe classes shall be determined to withstand subsequent superimposed loadings.

Various factors affecting the pipe class shall be taken into account, and pipe class shall be evaluated as per standard engineering practice.

7.1.4. Catch Basin Manholes

Catch basin manhole barrels with pre-cast base and pre-cast slab top shall be:

1) 900mm I.D. pipe barrel conforming to CSA-A257 2. Joints to be confined O-ring to CSA-A 257.3 and ASTM C443 using rubber gasket.
2) Catch basin manholes shall be 1200 mm inside diameter in accordance with Standard Drawing 7.2.

Catch Basins:

1) Catch basin manholes shall be used in place of a catch basin when the lead exceeds 30 m in length or one catch basin discharges into another.
2) Catch basins are to have 600 mm deep sumps.

Catch basin frames and covers shall be:

1) Standard frame, grate and 2 piece side inlet curb component for use with 900 mm barrel equal to Norwood F-51 or F-36A for straight faced curb and gutter.
2) Top inlet standard round top equal to Norwood F-38 or F-39, Open Grate, for swales or lanes.
3) Side inlets for rolled curb and gutter shall be Norwood F-33, K-2, DK-7 (for low profile curb) or equivalent.
4) Other types shall be subject to acceptance by the Director of Field Services.

Catch basin leads:

1) The minimum size of catch basin leads shall be 250 mm diameter with a minimum grade of 1.0%.
2) Two catch basins may be connected in series. The catch basin lead connecting to the storm sewer manhole shall be 300 mm at a minimum slope of 1.0%.
3) The maximum length of a catch basin lead shall be 30 m.
4) If a lead of over 30 m in length is required, a catch basin manhole shall be installed at the upper end.
5) Catch basin leads shall have a minimum cover of 1.2 m to obvert.

Refer to Standard Drawings 7.2 Catch Basin Manhole, 7.3 Catch Basin Typical 900 mm and Standard Drawing 7.4, Storm Catch Basin Assembly c/w 300 mm Sump.

7.1.5. Storm Sewer Installation and Location

Mains shall be installed to provide a minimum depth to top of pipe of 1.50 m below final finished grade.

Pipe bedding shall be provided for all mains in accordance with the Standard Drawings.

7.1.6. Manhole Installation and Location

Manhole spacing on storm sewers greater than 750 mm in diameter should not exceed 120 m unless approved by the Director of Field Services.

Benching in manholes shall be provided to minimize hydraulic losses. The downstream invert in a manhole shall be a minimum of 25 mm lower than the lowest upstream invert. At a change in direction, the drop shall be at least 50 mm. If an influent pipe diameter is greater than 525 mm and the bend is greater than 45 degrees or if the outflow pipe velocity exceeds 1.5 m/s, then minor losses shall be considered (see AISI, 1980).

Tee riser manholes may be utilized on lines 900 mm diameter and larger. Tee riser manholes must be bedded in concrete to the spring line of the pipe.

7.1.7. Connections to Storm Sewers

Only catch basins and site surface drains shall be connected to a storm sewer.

7.1.8. Curved Sewers

Refer to Section 6, Sanitary Sewer System

7.1.9. Inspection and Testing

Refer to Section 6, Sanitary Sewer System

7.2. Design Requirements for Stormwater Storage Facilities

7.2.1. General

The use of storm water facilities may be required to reduce peak flow rates to downstream sewer systems and/or watercourses, or to provide a temporary receiving area for peak major drainage flows. Their approximate location and size must be identified at the time of the Subdivision Outline Plan approval to avoid conflicts with adjacent land uses. The effects of the maximum pond water levels shall be considered in the design of the minor system and lot grading. If possible, the crown elevations of the pipes in the first manhole upstream of a pond shall be at or above the maximum pond level during the five-year storm event.

7.2.2. Geotechnical Considerations

Soils investigation specific to the detention facility shall be undertaken to determine the soil's permeability and salinity (or other potential contaminants), and the height of the groundwater table. Where the facility is sited above a shallow aquifer the potential for groundwater contamination must be minimized. Where the pond bottom is below the water table, weeping tile systems may be required to keep the pond bottom dry enough to support grass growth and maintenance equipment traffic.

7.2.3. Sediment Control

A sediment control plan is required as a part of the Stormwater Management Study to define measures that must be taken for the control of sediment into the pond and into the receiving stream.

7.2.4. Master Drainage Plan

The Master Drainage Plan shall be prepared and used in developing and comparing alternatives, and to select the optimum storage and drainage solution for a development area. This Master Plan should provide, as a minimum, the following information:

1) Detailed description of the development area, including proposed street layout, locations of parks, direction of overland flow, natural storage and drainage sub-catchments' boundaries, etc.
2) Identify and quantify the amount of upstream drainage entering onto the proposed development lands, including all points of entry.
3) Identify the impact of the proposed development on the watershed.
4) Identify all existing flow channels, drainage patterns or routes, and containment areas.
5) Identify the point(s) of discharge from the lands, as well as the type and calculated capacity of the receiving drainage facility(s), whether natural, man-made, or a combination of both.
6) Provide details of water quality enhancement facilities.
7) Identify all licensing requirements that may be required by Alberta Environment.
8) Post-development hydrographs for the 5-year and 100-year events to be determined at key points in the system.
9) Delineation of flood lines for the 100-year design storm for creeks or watercourses.
10) Description and discussion of storage alternatives. All alternative storage and runoff control methods shall be reviewed and shall include, but not be limited to:
    - retention storage
    - detention storage
    - off-line stream storage
    - channel storage
    - on-line storage
    - wet ponds (retention storage) or dry ponds (detention storage).

In reviewing the alternatives, the optimum number and location of the storm water facilities shall be determined, bearing in mind the total system.

7.2.5. Ponds and Spillways.

7.2.5.1 Design Standards for Wet Ponds

Land that is adjacent to a lake that is subject to flooding, as per the design standard established, but is part of the development parcel, will carry easements to allow Municipal

District forces right of access though the lands to the waters edge to carry out normal maintenance operations.

Public land that is permanently under water shall be designated P.U.L. (Public Utility Lot). Private land that is subject to flooding due to the operation of the lake shall carry a flooding easement up to the 1:100 year storm level.

The storage capacity shall be determined at the Master Drainage Plan stage along with the hydraulic performance criteria.

The minimum surface area of any lake or combination thereof shall be 2.0 hectares.

The annual volume exchange shall be twice per year.

Side slopes shall be constructed as shown on Standard Drawing 7.6.

Maximum water fluctuation for a one-in-five year storm event should not exceed one metre.

The minimum depth from normal water level to lake bottom should be 2.5 metres.

The inlets and outlets are to be fully submerged at least 1.0 m below normal water level to crown of pipe.

The lake bed is to be composed of impervious material.

No dead bay areas shall be permitted unless special circulatory provisions are made.

The first manhole in the minor system, the connecting or interconnecting pipe system, shall have an invert that is at or above the normal water level.

The lake design shall include an approved sedimentation removal process for control of heavy solids to the lake during the development of the basin.

A sedimentation measurement system shall be included for control and recording of siltation during long term performance of the lake.

The edge treatment or shore protection required shall be compatible with adjacent land use. The standard used shall meet the criteria of low maintenance, safety and ease of access to the water edge. The recommended guideline is approved rip-rap material varying in size from 50 mm to 100 mm, for a thickness of 0.3 metres and extending in a vertical distance of 0.6 metres below and above the normal water level, and encased in Gabion baskets.

Lake design must provide for vehicular access for maintenance and emergency purposes.

Approved lighting shall be provided at the interface between the lake high water levels and any adjacent public lands.

Approved fencing will be required where necessary for safety purposes.

Approved signage shall be installed to warn of anticipated water level fluctuations, with demarcation of maximum water levels to be expected for design conditions. Warning signs will be designed by the Developer and approved by the Director of Field Services.

An approved fresh water well system is required to maintain the lake water levels during extended dry hot periods.

7.2.5.2 Emergency Spillway Provisions

The feasibility of an emergency overflow spillway is to be evaluated for each storage facility (wet or dry) design, and, where feasible, such provisions are to be incorporated in the pond design.

As part of the pond design process, the probable frequency of operation of the spillway should be determined. Where it is not possible to provide an emergency spillway route, the design is to include an analysis of the impact of over-topping the pond and a significant freeboard above the 100-year level.

The functional requirements of the spillway, and the impact analysis for the absence of one, are to consider the possible consequences of blockage of the system outlet or overloading due to the run-off events, such that the storage capacity of the facility may be partially or completely unavailable at the beginning of a run-off event.

7.2.5.3 Dry Detention Ponds

Dry pond (detention) storage is the storm water management method where the storm run-off is collected and the excess run-off is temporarily detained for a short period of time, and released after the storm run-off from the contributing area has ended. Generally, low flows do not enter the pond.

Dry ponds should have gentle side slopes and be aesthetically contoured and landscaped to provide an attractive feature for the subdivision. Where possible, and as agreed by the Director of Field Services, they should be associated with municipal reserve areas to take advantage of the joint use ability of the facilities (e.g. extension of sport fields or passive park uses into the detention pond).

Active park uses should not be located adjacent to the inlet/outlet facilities nor in areas that flood frequently (more than twice per year on average). The Municipal District should be contacted to provide input to the design of detention facilities from the concept stage through to detailed design and construction.

7.2.5.4 Safety Provisions at Inlets and Outlets

All inlet and outlet structures associated with dry ponds shall have grates provided over their openings to restrict access and prevent entry into the sewers by unauthorized persons. A maximum clear bar space of 150 mm shall be used for gratings.

Grated outlet structures are to be designed with a hydraulic capacity of at least twice the required capacity to allow for possible plugging. Further, the velocity of the flow passing through the grating should not exceed 1.0 m/sec. Appropriate fencing and guard rails are to be provided to restrict access and reduce the hazard presented by the structure head and wing walls.

Trash Grate Inlet details are shown on Standard Drawing 7.5.

7.2.5.5 Design Parameters for Dry Ponds

The following general design parameters should be considered for a dry pond in a residential subdivision:

1) Storage capacity for up to the 100-year storm event.
2) Detention time to be determined based on downstream capacity; recommended maximum detention time is 24 hours.

3) Maximum active retention storage depth of 1.5m. The maximum water level should be below adjacent house basement footings (a greater freeboard may be required if an emergency overflow route cannot be provided).
4) Maximum interior side slopes of 5:1 (7:1 is recommended).
5) Maximum exterior side slopes of 3.5:1.
6) Minimum freeboard of 0.6m above 1:100 year high water level (a greater freeboard may be required if an emergency overflow route cannot be provided).
7) Maximum 4:1 ratio of effective length to effective width measured at 100 year high water level.
8) Dimensions must be acceptable to the Municipal District when the bottom of the pond is to be used for recreational facilities.
9) Minimum lateral slope in the bottom of the pond of 1.0% (2.0% is preferred) and a minimum longitudinal slope of 0.5% (1.0% is preferred),
10) Low flow bypass for flows from minor events to be provided.
11) French drains are to be provided within pond bottom where water table is near pond bottom.
12) Address all safety issues (particularly during operation).

Refer to Standard Drawing 7.6, Typical Dry Pond Detail.

7.2.5.6 Design Parameters for Wet Detention Ponds (Residential Subdivision)

Wet pond (retention) storage functions the same as dry pond detention except that a portion of the storm water is permanently retained.

If approved, the developer will be responsible for all construction costs in excess of the cost to construct the original dry pond facility. The Developer will also be required to establish maintenance of the pond.

Design of a wet pond is to be in accordance with the Alberta Environment publication entitled "Storm water Management Guidelines for The Province of Alberta". Some general design parameters to consider are:

1) 2.0 ha minimum water surface area.
2) Maximum side slopes of 7:1 between the high water level and 1.0 m below normal water level.
3) Minimum permanent pool depth of 2.0 m
4) Maximum 1:100 year storage depth of 1.5 m
5) Sediment fore bays required at each inlet.
6) Hard edge treatment required along lake perimeter.
7) Minimum freeboard depth of 0.6 m. House footings must be above freeboard elevation.
8) Water recirculation and make-up system required.
9) Provide access for maintenance and emergency equipment.

10) Design of outlet control structure to be capable of maintaining permanent pool depth and capable of draining the permanent pool for maintenance purposes.

7.2.6. Outfalls

Outfall structures shall be placed at the end of all storm sewers discharging to an open channel, watercourse, river or other receiving water body such as a lake. The purpose of the structure is to reduce velocities and prevent erosion. All outfall structures must be approved by Alberta Environment. It is the responsibility of the Developer to obtain the necessary approvals and permits from the above mentioned Authorities.

The outfall structure may be a chute, spillway drop structures and energy dissipaters, stilling basin or plunge pool with head wall. A cut off wall is required at the end of the outfall apron to prevent undermining of the structure.

Obverts of outfall pipes shall be at least 150 mm above the 5-year flood level in the receiving stream. Inverts of outfall pipes shall be above winter ice level, otherwise outfall pipes shall be submerged below the bottom of ice level. In addition, outfalls shall be located to avoid damage from moving ice during breakup.

If the downstream channel is relatively flat, the apron shall be 150 mm to 225 mm above the channel invert to prevent collection of debris on the apron.

Rip-rap and a filter layer shall be placed downstream of the outfall structure, where required to prevent erosion. Where erosion control or bank stability work must be done, preservation of watercourse aesthetics and wildlife habitat must be considered.

Weeping tile shall be placed under the structure to reduce any water pressure behind the head wall.

Grills or trash bars shall be placed over all storm sewer outlets to prevent access.

Railings shall be placed along the head wall and wing walls of the outfall structure.

Outfalls shall be landscaped designed with low maintenance, to aesthetically blend in with surrounding areas.

Measures, such as detention ponds, should be incorporated in new developments to prevent any increase in the amount of erosion and downstream flooding to existing receiving streams.

7.3. Geotextile

7.3.1. General

This Section specifies requirements for the supply and installation of non-woven and woven geotextile filter fabric.

Non-woven geotextile filter fabric shall be used as a separate membrane for rip-rap or hydraulic filter for drainage systems.

Woven geotextile filter fabric shall be used when in the opinion of the Municipal District the foundation conditions are considered soft and unstable.

7.3.2. Mill Certificates

At least one week prior to the commencement of Work the Contractor shall submit a sample of the geotextile filter fabric to be used in the Work. Copies of mill test data shall be submitted with

the sample along with a Manufacturers Certificate of Compliance that the geotextile filter material delivered to the job site meets the requirements of this section.

7.3.3. Approval

The Contractor shall obtain written approval of the Municipal District for the geotextile filter fabric material to be used in the Work.

7.3.4. Delivery and Storage

During delivery and storage, protect the geotextile filter fabric from direct sunlight, ultraviolet rays, mud, dirt, dust, moisture, debris and rodents.

7.4. Products

7.4.1. Material

The geotextile filter fabric shall be rot-proof, unaffected by the actions of oil or salt water and not subject to attacks by insects or rodents.

The geotextile filter fabric shall be supplied in rolls of minimum width of 3.0m and minimum 50m lengths.

7.4.2. Physical Properties

The non-woven and woven geotextile filter fabric shall meet the specifications and physical properties in accordance with the following table of minimum average roll value properties (MARV's) for each.

Specifications and Physical Properties		
	Non-woven	Woven
Grab Strength	650 N	1275 N
Elongation (Failure)	50%	15%
Puncture Strength	275 N	275 N
Burst Strength	2.1 MPa	3.6 MPa
Trapezoidal Tear	250 N	475 N
Minimum Fabric Lap to be	300 mm	1000 mm

7.5. Execution

Where geotextile fabric is specified, the sloped or horizontal surface shall be graded to provide a smooth, uniform surface. All stumps, large rocks, brush or other debris that could damage the fabric shall be removed. All holes and depressions shall be filled so that the fabric does not bridge them. Loose soils shall be replaced.

The fabric shall be laid parallel to the slope direction in one continuous length from toe of slope to upper extent of fabric. It shall be placed in a loose fashion; however creases, folds, wrinkles and tensile stresses shall be avoided. Adjacent strips of fabric shall be overlapped as specified, except

where placed underwater, the minimum lap width shall be 1m. Overlaps shall be pinned using 6mm diameter steel pins fitted with washers and spaced at 1m intervals along the overlaps.

The top edge of the filter fabric shall be anchored by digging a 300mm deep trench, inserting the top edge of the fabric and backfilling with compacted soil.

Rip-rap placement shall commence at the base of the filter fabric area and proceed up the slope. The height of drop of rip-rap shall be limited to 1.0m or less, and the rip-rap shall not be allowed to roll down the slope. Heavy equipment will not be permitted to operate directly on the geotextile.

7.6. Protection

After installation, the filter fabric shall be covered with an overlying layer within 3 days of placement.

Do not permit passage of any vehicle or equipment directly on geotextile at any time.

Protect geotextile material from displacement and damage until and during placement of the rip-rap, granular material or the gabion mat.

Care shall be taken to prevent puncturing or tearing the geotextile. Any damage shall be repaired by use of patches that extend at least 1m beyond the perimeter of the tear or puncture.

Remove and replace damaged or deteriorated geotextile, as directed by the Municipal District.

7.7. RIP – RAP

7.7.1. Definition

Rip-rap is a protective covering consisting of hand-laid or randomly deposited rock, sacked concrete or sacked cement stabilized material which is placed on exposed surfaces for protection against erosion and wave action.

7.7.2. Work Included

Work of this Section consists of supplying, hauling, and placing of rip-rap as specified and as shown on Drawings.

7.7.3. Approval

The Contractor shall have the rip-rap material approved by the Municipal District in writing prior to delivery to the site. The approval of rock samples from a particular source or quarry site shall not necessarily be construed as approval of all material from that location.

Delivery and handling of rip-rap shall be subject to the Municipal District's approval and shall be as such as to minimize segregation and breakage and damage.

Material which has deteriorated or does not meet specified requirements shall be removed from site.

7.7.4. Quality Assurance

Sampling and testing of materials, as required by the Municipal District for testing the quality of rip-rap.

7.7.5. Job Conditions

Suspend placement operations whenever climatic conditions, as determined by the Municipal District, are unsatisfactory for placing rip-rap fill.

Do not permit or cause material to slide or roll down slopes.

When placing rip-rap do not disturb satisfactorily placed material or structures already in place.

Sequence delivery of material to site in a manner to minimize stockpiling and in any event, obtain approval from Municipal District to stockpile.

7.7.6. General

The rock supplied shall be hard, durable and angular in shape, resistant to weathering and water action, free of overburden, spoil, shale seams and organic material. No sandstone will be permitted. The minimum dimension of any single rock shall not be less than one third of its maximum dimension. The minimum acceptable unit weight of the rock is 2.5t/m^3 or as specified for the intended use.

The rip-rap shall be free from seams, cracks or other structural defects to meet the following specified size distribution:

		Class 1
Nominal Mass	Kg	40
Nominal Diameter	mm	300
None heavier than:	kg	130
	mm	450
No less than 20% or	kg	70
than 50% heavier than:	mm	350
No less than 50% or	kg	40
than 80% heavier than:	mm	300
100% heavier than:	kg	10
	mm	200

Percentages are by mass. Sizes are equivalent spherical diameters, and are for guidance only.

7.8. Execution

7.8.1. Preparation

Prepare surfaces to receive rip-rap to lines and grades as shown on the Drawings.

7.8.2. Inspection

Do not place rip-rap until the foundation has been approved by the Municipal District.

7.8.3. Installation

The rip-rap shall be placed on a non woven geotextile filter fabric unless otherwise noted on the drawings or in the specifications.

The hand laid rip-rap erosion protection shall be placed in the areas indicated on the drawings or as designated by the Municipal District.

Place rip-rap by suitable mechanical equipment so that no intermixing of foundation material and rip-rap occurs, minimizing breakage of rock fragments and assuring that the mass is stable.

Rip-rap shall not be compacted but shall be dumped and graded off to same regular surface in such a manner that larger rock fragments are uniformly distributed and smaller rock fragments fill voids between larger pieces.

Hand placing will be required only to the extent to secure results specified above in the areas where mechanical equipment cannot operate adequately.

Do not place rip-rap against structures until permission is obtained from the Municipal District.

The rip-rap shall be placed on the surface to be covered as shown on the plans or as directed by the Municipal District, on slopes not exceeding 1½ H:1V starting with the larger stones on the bottom row. Rip-rap shall be placed on the prepared surface such that the weight of the stone is carried by the subgrade and not by the underlying stones. Rip-rap shall be placed proceeding upward from the bottom. Voids between rip-rap shall be filled with broken rock fragments.

Care shall be taken not to puncture the geotextile filter fabric when placing the rip-rap. Any damaged filter fabric shall be repaired or replaced as requested by the Municipal District.

7.9. Storm Water Mains

7.9.1. Work Included

Provide all labor, products and equipment required for the work, including but not limited to:

1) excavation
2) bedding under and over piping
3) storm water mains and appurtenances
4) manholes, catch basins and appurtenances
5) cleaning sewers
6) testing sewers
7) connection to existing systems

7.9.2. Quality Standards and Assurances

Products, workmanship and testing shall conform to standards specified in this section.

All products and workmanship are subject to inspection by the Municipal District.

Perform all tests required by the specifications and by authorities having jurisdiction.

Notify the Municipal District and authorities having jurisdiction in ample time before testing to permit inspection and to allow tests to be witnessed.

Do not cover any work before inspection and testing unless authorized by the Municipal District in writing.

Remove or repair defective products or work which fails to meet specified requirements as directed by the Municipal District.

7.10. Products

7.10.1. Storm Sewer Pipe

Storm Sewer pipe is to be the type called for in the schedule of quantities or shown on drawings and meet the requirements noted in subsequent clauses of this section.

Non-reinforced pipe and fittings to CAN/CSA-A257.1 and ASTM C14 Class 3, designated for flexible rubber gasket joints to CAN/CSA-A257.3 and ASTM C443.

Reinforced concrete pipe meeting ASTM Specification C76 and CSA-A257.2.

PVC pipe and fittings - DR 35 meeting ASTM D3034 and F679, CSA-B182.2 may be utilized for mains ranging from 200mm to 900mm in diameter with prior approval of the Municipal District.

Ribbed PVC pipe and fittings to meet CSA B182.4, ASTM F794 with pipe stiffness of 320 kPa as measured in accordance with ASTM D2412. Maximum long term deflection is less than 7.5%.

Cement - sulphate resisting Portland for all concrete pipe, meeting Type 50 CSA-A5.

7.10.2. Pipe Joints

For all sewers - as recommended by pipe manufacturer, to produce watertight joints with infiltration within specified limits.

Concrete pipe - rubber gasket to ASTM C443 and CSA A257.3.

PVC - rubber gasket to CSA B182.2, ASTM 03212 and ASTM F477.

7.10.3. Pre-Cast Concrete Manhole Units

To meet requirements of ASTM C478 and CSA A257.4 to dimensions shown on drawings.

Cement - sulphate resisting Portland, CSA A5, Type 50.

Manhole steps shall be 19 mm diameter, galvanized iron safety rungs spaced at a maximum distance of 400 mm centre to centre for full height.

Pre-cast bases to be minimum 20.7 MPa concrete.

7.10.4. Concrete Blocks and Bricks

Solid concrete, conforming to CSA A165.1 and 165.2 and ASTM C139, not less than 128 mm thick for block, standard dimensions for brick, true to shape, free from cracks and surface defects, compressive strength not less than 17.2 MPa, absorbing not more than 8% water by weight during 24 hours immersion test performed after drying.

Cement - sulphate resisting Portland CSA A5, Type 50.

7.10.5. Catch Basins

To meet requirements of ASTM C478 and CSA A257.2, 910 mm diameter reinforced concrete riser, reinforced pre-cast concrete base slab, to details shown on drawings.

Cement - sulphate resisting Portland CSA A5, Type 50.

7.10.6. Catch Basin Lead Pipes

Catch basin lead pipes shall be:

1) Non-reinforced concrete pipe to meet CSA A257.1 and ASTM C14.
2) PVC pipe DR 35 to meet ASTM D3034 or approved equivalent.

Pipe diameter shall be 250mm diameter for single catch basins and 300mm diameter for twinned catch basins with a minimum grade of 2%.

7.10.7. Mortar

For pipe joints and all other parts of the work, one part sulphate resisting Portland cement to two parts clean sand, by volume.

7.10.8. Cast Iron Frame, Covers and Grates

For manholes and catch basins, close-grained grey cast iron, meeting ASTM A48, Class 20, true in form and dimension, free from faults, sponginess, cracks, blowholes and other defects. Cast steel to conform to ASTM A27, grade 70-36. Substitution of ductile iron meeting ASTM A445 for cast iron or cast steel shall be subject to approval of the Municipal District.

Machine or grind frames, covers and grates to even non-rocking bearing surfaces.

Hot dip in asphaltic varnish.

Manhole covers and frames:

1) Storm - Norwood Foundry Model F-39, or approved equal
2) Catch basin covers and frames:
3) Rolled monolithic curb and gutter - Norwood Foundry Model F-33
4) Round Top Catch Basin - Norwood Foundry Model F-49
5) Side inlet - Norwood Foundry Model F-51.

7.10.9. Manhole Steps

Safety type, 19 mm diameter solid steel bar, hot dip galvanized after fabrication.

7.10.10. Safety Platforms

Safety platforms shall be aluminium grates to MSU Mississauga or approved equal.

To be installed according to manufacturer's recommendations.

To be installed on manholes greater than 7.0 meters in depth when measured from the top of the frame to the lowest invert.

7.10.11. Concrete

Ready-mixed concrete, sulphate resisting, Portland cement CSA A5, Type 50, 20 MPa compressive strength at 28 days of age, to CSA A23.1

7.10.12. Reinforcing Steel

CSA G30.12 or G30.13, 34.5 MPa minimum yield, Grade 50 all deformed except where noted otherwise. Use Grade 40 for ties.

7.11. Sewer Pipe Tests and Rejection

Include all costs for testing, supply and delivery of specimens to testing laboratory and replacing defective material.

The Municipal District reserves the right to select, either on site or at the manufacturer's stockpile, 0.5% of total length of each category of pipe for testing, minimum number of lengths as follows:

1) for each category of over 100 lineal meters - 4 lengths
2) for each category of over 50 lineal meters and less than 100 lineal meters - 2 lengths
3) for each category of less than 50 lineal meters - 1 length.

Where the Municipal District has selected full sized pipe specimens for load tests, deliver these specimens to an approved testing laboratory. Results of the tests shall be mailed directly to the Municipal District in triplicate. Pipe will be accepted, based on certified factory tests, provided they are done under supervision of an independent testing agency. All pipe tests shall be performed in accordance with ASTM Specifications.

Should any specimens fail to meet test requirements, test two additional selected specimens for each failure. Pipe will be acceptable only if all re-test specimens meet requirements. Should test results be unsatisfactory, all or part of pipe supplied may be rejected and acceptance withheld until satisfactory tests of pipe in place are conducted.

Inspect pipe on delivery and reject any that fails to meet specified requirements. Replace rejected pipe with satisfactory pipe without delay. Mark all rejected pipe plainly as "Rejected" and immediately remove from site.

The Municipal District may require submission of a manufacturer's report verifying satisfactory random testing of the pipe designated for this project.

7.12. Execution

7.12.1. Bedding Sewers

Excavate trenches to widths not less than 300 mm greater than pipe diameter. Maximum width at top shall not exceed outside pipe diameter plus 600 mm.

Bed pipe per trench bedding and initial backfill Class "B" granular surround conditions for plastic pipe and granular foundation for concrete pipe, as shown in standard detail drawings.

Obtain the Municipal District's approval for all materials used in the pipe bedding zone.

7.12.2. Laying and Jointing Pipe

Commence laying at lower end of line, lay pipes and specials true to line and grade, socket ends up grade, joints close and evenly butted all around pipe. Take special care to prevent sagging of spigot end in hub and provide true, even invert surface throughout entire length of sewer. Excavate at end of each pipe to provide rest for socket, sufficient to permit proper jointing. Clean pipe interior, remove all dirt, mud and other extraneous materials.

7.12.3. Infiltration / Exfiltration Testing

Total infiltration of groundwater into whole of system or exfiltration, shall not exceed 5.0 litres per mm of internal pipe diameter per kilometre per day including manholes, for PVC pipe, and 20 litres per mm of internal pipe diameter per km per day including manholes for concrete and clay tile pipe. Where such leakage is exceeded, repair sewer mains so total infiltration is within specified limits.

During construction and immediately on completion of a manhole, measure infiltration at new manhole. If amount exceeds specified limit, make necessary repairs immediately to reduce infiltration to allowable limit. Failure to comply with this requirement will be sufficient cause for the Municipal District to stop sewer laying work until repairs have been made.

7.12.4. Cleaning Sewer Mains

On completion of construction of mains and services, flush and string, in readiness for TV inspection, all mains until all deposits of earth or other material are removed. If new system connects to an existing system, plug outgoing line at manhole junction and remove dirt and debris at that manhole. Do not permit debris from new construction to enter existing system. Pay all costs for repairs where damages occur due to negligence. Pay all costs of water from the Municipal District Authorities.

During flushing operations, check all manholes. If depth of flow in any manhole is greater than should be anticipated, bucket main and remove obstructions in pipe line. Pay all costs for required repairs.

Whenever practicable, flush out in runs not over 250 meters. Remove all foreign material from each run before proceeding with next.

7.12.5. Testing

If required by the Municipal District, perform Pig test after cleaning sewer mains. Through each section of main, pull wood or metal ball with diameter 50 mm less than inside pipe diameter. If Pig does not readily pull through, uncover pipe and make good, defects at no cost to Owner.

Pig test is not required on lines 216 mm diameter and larger if they are visually inspected in a satisfactory manner.

TV Testing - the Contractor, at his cost will carry out a TV inspection of all sanitary and storm water mains. All defects identified by the TV inspection shall be corrected by the contractor at the contractor's expense. The contractor shall be responsible for the cost of flushing and stringing the mains prior to TV inspection. If additional TV inspection is required to verify correction of defective work, it will be at the Contractor's cost. The Contractor shall provide a copy of the video recordings or CD Disc and a written report to the Municipal District for record purposes.

7.12.6. Manholes

Construct manholes as shown on drawings, unless otherwise permitted in writing by the Municipal District. Submit full details of any proposed alternative construction with bid.

For cast-in-place concrete for manholes, conform to CSA A23.1.

Place manholes accurately, plumb, in alignment and at exact plan location.

Construct manholes watertight and complete, including finishing flow bottoms, as work proceeds. Do not lay pipe in advance more than two manholes ahead of last completed manholes.

Shape bottoms accurately for necessary flows as shown on drawings or as directed by the Municipal District. On manholes with sewers 610 mm diameter and smaller, form invert through manhole with half-round pipe. At manholes containing lot services shape bottoms to provide slopes required to ensure no build up of sewage occurs in manholes.

Place stubs for future lines accurately and plug watertight. Shape flow bottoms to suit future lines.

At all bends through manholes, provide a 50 mm drop in invert from inlet to outlet.

Support pipes at manholes to prevent shearing or settlement. Where not detailed use concrete fills, concrete or timber beam, or suitably compacted gravel.

During construction, plug pipes at manholes to prevent entry of concrete and mortar. Remove plugs immediately after construction is completed.

Set covers accurately within 15 mm of correct grade. On sloping streets, set covers to match slopes.

Set all precast concrete sections, bricks, blocks and frames in mortar. Tool joints smooth and point all voids after setting.

All sanitary manhole barrels are to be sealed with a rubber neck to prevent infiltration. Gaskets for storm manholes only may be omitted at the discretion of the Municipal District.

7.13. Culverts

7.13.1. Definition

Culverts shall mean galvanized corrugated steel pipes acting as drainage conduits to conduct the flow of surface drainage water.

7.13.2. Terminology

CSP shall mean Corrugated Steel Pipe.

CSP Arch means Corrugated Steel Pipe Arch.

SPCSP means Structural Plate Corrugated Steel Pipe

7.13.3. References

The latest version of the publications listed below form part of this Specification to the extent specified in this Section:

CSA Standard G401

Corrugated Steel Pipe Institute (CSPI)

501-78 Metric Specification for Corrugated Steel Pipe Products.

7.13.4. Quality Assurance

Supply, fabricate and install CSP culverts strictly in accordance with manufacturer's instructions and recommendations and as specified.

7.13.5. Product Delivery and Handling

Deliver to site, handle and store pipes, sections, fittings and hardware in a manner to prevent distortion or bending and damage to metal or galvanized coating.

7.13.6. Job Conditions

Protect CSP pipes before, during and after installation and protect installed work and materials.

In the event of damage, make repairs or replacements necessary to the Municipal District's approval.

7.14. Products

7.14.1. Materials

Culvert pipe shall be galvanized corrugated steel pipe complying with CSA Standard G401.

Culvert pipes up to 600 mm diameter shall have a wall thickness of 1.6 mm and larger pipe up to and including 900 mm diameter, shall have minimum 2.0 mm wall thickness.

Specified wall thicknesses shall not include the thickness of galvanized coating.

The zinc coating mass shall be not less than 1,100 g/m^2 when tested by the single spot test.

Corrugation profile for the pipes shall be 68 x 13 mm.

End sections (square or bevelled as indicated), couplers, fittings and hardware shall match the culvert pipe.

7.15. Execution

Trench shall be properly drained and free of unsuitable material prior to placing and compaction of bedding material.

7.15.1. Trenching and Excavation

The excavation for the culvert base shall be carried to a depth of not less than 150 mm below the invert grade, as established by the Municipal District and shall be of sufficient width to permit pipe assembly and to accommodate operation of compaction equipment on either side of the culvert. Refer to Standard Detail Drawing 7.7.

7.15.2. Culvert Bedding

Place minimum 150 mm thick layer of compacted granular material on bottom of excavation. Place material in uniform layers not exceeding 150 mm thickness, and compact each layer to at least 95% Standard Proctor Density before placing succeeding layer. Any soft and yielding or other unsuitable material below this level shall be removed to the depth required by the Municipal District and backfilled with approved granular material compacted to a uniform density of 95% of Standard Proctor Density throughout the entire length of the culvert.

The base for culverts installed along main water courses or through yielding areas shall consist of gravel bedding compacted to the excavated depth and extending over a width of three (3) times the diameter of the pipe. The depth of this base shall be not less than 300 mm. An impervious compacted bedding material shall be provided for a minimum length of 3 m or three

(3) times the diameter of the pipe, whichever is greater, at the inlet end of the culvert to achieve a seal against seepage.

Trench line and grade requires the Municipal District's approval prior to placing bedding material or pipe.

Do not backfill until pipe grade and alignment are checked and accepted by the Municipal District.

7.15.3. Laying Corrugated Steel Pipe Culverts

Commence pipe placing at downstream end on the prepared granular bedding with separated sections securely joined together by means of a coupling band.

The couplers are to match thickness and corrugations of the pipe.

Corrugations of pipes and couplers must mate before tightening and joints shall be tapped with a mallet during tightening to ensure proper seating of couplers.

Do not allow water to flow through pipes during construction except as permitted by the Municipal District.

All culverts shall be laid so that the horizontal seams fall at the sides of the culverts.

The pipe shall be laid true to line and grade as shown on the drawings. The pipe shall be carefully handled to prevent damage to the galvanized coating. Damaged pipe sections shall be immediately reported to the Municipal District and repaired and replaced according to their direction. Damaged protective coating shall receive two coats of zinc rich paint.

Centreline of culvert shall not vary from the designated horizontal alignment by more than 75 mm. Invert grade shall not vary from the designated invert grade elevation by more than 12 mm provided positive flow is maintained.

7.15.4. Culvert Backfill

After assembly of the culvert on the bedding, the culvert shall be backfilled with approved granular and random backfill. Backfill shall be brought up on both sides of the culvert simultaneously in 150 mm lifts and shall be compacted with a method approved by the Municipal District to a minimum density of 95% Standard Proctor.

The backfill shall be spread and compacted in 150 mm layers and special care shall be taken to ensure proper filling and compacting under the haunches and within the culvert corrugations. Heavy equipment shall not be allowed over the culvert until a minimum of 0.5 m of fill is obtained above the crown of the pipe.

7.15.5. Rip – Rap

The ends of the culvert shall be finished with the placement of rock rip–rap as shown in the Standard Detail Drawings.

7.15.6. Adjustment and Cleaning

Inlet and outlet ends and waterway through the pipe shall be kept free from debris or foreign matter, to prevent restriction of water flow through the culvert.

8.0 Sewer and Water Service Connections

8.1. Service Connections – Minimum Requirements

The minimum size of service connections to a single-family dwelling shall be as follows:

- Sanitary Sewer 150 mm diameter
- Water Service 25 mm diameter

The minimum grade on a 100 mm sewer service shall be 2.0% and on a 150 mm service shall be 1.0%.

Connection to a main sewer line shall be by means of a tapped service saddle (full wrap) at the top quadrant of the main on existing mains. In-line tees may be used with prior approval of the Municipal District.

Where bends are utilized, the long radius type or a combination of 22½ degree bends and straight pipe shall be used.

For water services sized 50 mm and smaller, the tapping shall be at the 2 to 3 o'clock position on the distribution main.

- Water mains shall be tapped under pressure.
- All water services to be direct tapped or utilize service clamps.

Refer to Standard Drawings located in Section 18.0, Standard Drawings:

1) 8.1 Typical 50 mm and Smaller Residential Water and 150 mm Sanitary Sewer;
2) 8.2 Water Service Connection – Manufactured Home;
3) 8.3 Sanitary Service Connection – Manufactured Home;
4) 8.4 Single and Double Service Layout;
5) 8.5 Typical Sanitary Service Connection;
6) 8.6 Residential Sanitary Sewer Service Riser connection;
7) 8.7 Typical Standard Riser Detail;
8) 8.8 Inspection Chamber Detail;
9) 8.9 Blow Off Valve.

8.2. Sanitary Sewer Service

Service pipe shall be PVC SDR 35 (minimum) building service pipe.

Service fittings shall be either in-line tees or saddle tees, complete with gasket and stainless steel straps and nuts.

8.3. Service Connections – Installation Requirements

Where the water service is 50 mm or smaller in size, the water and sanitary services shall be installed in a common trench to the middle of each lot.

The services shall be installed so that, when facing the lot being served, the water service is on the right of the sanitary service.

Where two services are installed in a common trench, they shall be installed per the Standard Drawing.

The minimum depth of cover over the water and sanitary services at the property line shall be 3.0 m and the maximum shall be 3.5 m, per the Standard Drawing.

Where the sewer services are required to connect to mains in excess of 4.50 m deep, risers shall be installed to within 3.60 m of finished surface.

Corporation main stops and curb stops shall be installed in accordance with the Standard Drawings. Material to be Meuller or approved equal.

Where a copper service is installed, there shall be a vertical loop near the corporation main stop. Water service is to be goose necked. Service shall be snaked in the trench to allow for thermal contraction.

Service box for residential service to have adjustable sliding top section, standard block iron pipe with threaded top. Top section to be 600 mm in length, with a minimum ID of 35 mm and a 10 mm set screw. The service box shall be adjustable from 2.5 to 3.5 m bury. The threaded steel cap shall have a slotted top with a 19 mm pentagon brass plug.

The casing shall be standard block iron pipe with an OD of 33.5 mm. The rod should be T-304 stainless steel, 12.5 mm diameter by 2.2 m long, complete with standard pig tail for 25 mm ID pipe and welded bottom bracket with an 8 mm cored hole. Rod to be complete with a 6 mm diameter cotter pin of sufficient length.

Box bottom boot to be cast or ductile iron, factory coated, with a clear opening to allow curb stop access. The boot is to attach to the casing by means of a threaded joint.

Curb stops shall be installed at property or easement lines as shown on the Standard Drawings and shall be stop and drain unless approved otherwise based on site conditions.

Sewer services shall be installed at property or easement lines as shown on the Standard Drawings, and shall be properly capped or plugged to prevent the entry of earth, water or deleterious material into the pipe.

All services shall be laid on 75 mm of granular bedding, and the bedding material shall be placed up to a level of 300 mm above the crown of the highest service in the trench.

Painted stakes of 50 mm x 100 mm size shall be extended from the end of the service connections to a minimum of 0.70 m above the ground level, per the Standard Drawing.

The Developer shall employ an engineering firm to complete the tests as outlined in Table 10.4 on Page 10-15. One copy of the results shall be submitted to the Municipal District for their review.

8.4. Service Connection Report

The Developer's Engineer shall provide detailed record drawings for all installed service connections, with such drawings providing information related to pipe dimensions, invert elevations, depth of service lines, location of services relative to property line(s), manholes and/or watermain valves.

8.5. Lot Service Connections

8.5.1. Work Included

Provide all labor, products and equipment required for the lot service connections, including but not limited to:

1) water service piping
2) sewer service piping
3) corporation cocks, connection to main
4) curb stops, service boxes, service markers

8.5.2. Quality Standards and Assurances

Products and workmanship shall conform to applicable municipal and provincial standards and to specifications.

All products and workmanship will be subject to inspection by the Municipal District.

Perform all tests required by authorities having jurisdiction. Test water and disinfect services with mains.

Notify the Municipal District and authorities in ample time before testing to permit inspection and to allow tests to be witnessed.

Do not cover work before inspection and testing unless authorized by the Municipal District in writing.

Remove or repair defective products or work which fails to meet specified requirements as directed by the Municipal District.

8.6. Products

8.6.1. Service Pipe, Fittings

Underground copper service pipe - Type K soft copper for a diameter of 25 mm and less, and Type K copper and approved PVC materials for diameters greater than 25 mm.

Main or corporation cocks – Compression type AWWA thread.

Curb stops – Copper to copper ball valve with a drain. Curb stops 38 mm or larger shall be ball bearing type.

Couplings – Standard Brass Compression type.

Service Boxes – Epoxy coated extension type for a maximum extension of 3.5 m, complete with stainless steel operating rod, brass clevis and key. Service box to be supported on a cast iron piece nailed to a pressure treated preserved wood plank.

Service Clamps – Bronze double strap conforming to Smith-Blair 323 or approved stainless steel AWWA Boss.

2.3 kg Zinc Anode Protection to be installed as indicated on Drawing No. 4.10.

Service boxes to be adjustable from 2.4 m to 3.0 m bury, unless otherwise noted on drawings.

8.6.2. Sewer Service Pipe

PVC, SDR 35 minimum.

8.6.3. Sewer Saddles

Manufactured tee saddles, gasketed joints secured with double steel clamps.

8.6.4. Sand Bags

Bags to be new material and in a condition acceptable to the Municipal District. Sand to be clean and free from debris, conforming to imported sand requirements.

8.6.5. Rigid Foam Urethane Insulation

Density (ASTM D1622) not less than 28.8 kg/cubic meter. (Nominal 32.0 kg).

Closed cell content (ASTM D2856) not less than 90%.

Water absorption (ASTM D2842) not greater than 0.34 kg/square meter.

Initial thermal conductivity (ASTM D2326) (K Factor) not greater than watts/meter degree Celsius.

Dimensional stability (ASTM D2126)

Compressive strength (ASTM D1621) not less than 206.8 kPa at 10% deflection.

8.6.6. Water Services

Use tapping machine to drill, tap and thread corporation main stop into main. Use special care to prevent cuttings falling into main. Wherever possible, tap main under pressure and obtain written approval from the Municipal District to do otherwise.

Lay copper service pipe to designated location and connect to existing service lines. Service connections shall be tapped into the upper portion of the watermain at an angle of at least 45 degrees from the horizontal. Tapings shall have a minimum spacing of at least 600 mm. Attach curb stop and set service box to grade where required.

Brace boxes securely to keep plumb during backfilling. Test for operation both before and after pressure test.

Where a curb stop is located under a sidewalk, concrete slab or other structure, set top of extension service box flush with surface and fill hole around pipe neatly with concrete.

Use service clamps on all services tapped into 150 mm mains and on 25 mm and larger services tapped into 200 mm to 300 mm lines. In all other cases, use service clamps where size of main stop is larger than recommended for size of main.

Place water service lines at least 2.7 m below final finished grade elevations, unless otherwise directed.

Lay water service lines in same trench with sewer service line. Install sanitary services on left side of water service as viewed from main towards property line. Install storm sewer service on right side of water service as viewed from main towards property line. Paint last 1 m of sanitary service pipe red. Paint last 1 m of storm service pipe green. Make all connections to existing services using appropriate couplings.

Lot service connections to residential lots (R.1 and R.2) shall be installed inside property line to easement line for lane servicing; and to property line, or easement line if an easement exists, for street servicing. (As shown on the drawings) Water services connections to residential lots (R.1 and R.2) shall be 0.15 m short of the easement line for lane servicing and 0.15 m outside property line or easement line if an easement exists, for street servicing.

The Municipal District may require the delivery of curb stop risers to the public works yard. The Contractor shall confirm this requirement with the Municipal District and shall provide evidence of a receipt signed by the Public Works employee accordingly.

8.6.7. Sewer Services

Connect services to mains with manufactured Tee or Wye fittings placed in mains, or by cutting into mains and installing manufactured Tee saddles or Wye saddles and 45 degree bends. A 150 mm x 100 mm reducer shall be installed at property line to transition from the 150 mm connection at the main to the 100 mm Lot Service Pipe. Take care to avoid cracking pipe and remove all cuttings from pipe. Secure joint between saddle and main with mortar or other means acceptable to the Municipal District.

Do not allow spigots or other obstructions to project into main. Lay service pipe to an even gradient as directed.

Install service lines as detailed, at locations and to grade designated by grade sheet provided in field. Install services at right angle to main, unless otherwise specified.

Bends permitted only at three locations – 45 degree bend with Wye or 22.5 degree bend with tee connection at main, 45 degree bend at top of riser and 22.5 degree bend maximum at property line for house service connection between these points.

Support service lines adequately to prevent dislocation, buckling or settlement. When water lines must be laid below sewer lines, ensure that backfill over water lines is adequately compacted to prevent settlement or dislocation of sewers.

When a connection cannot be made directly to a house service line, plug end of sewer service to prevent entry of water and dirt.

Install service risers only where noted on the lot grading plan. Ensure adequate support for the riser section utilizing sandbags or screened rock.

8.6.8. Markers

A 50 mm by 100 mm marker stake, from invert elevation to 600 mm above ground level shall be placed at the end of each water service line, the top 600 mm to be painted blue. Place a 100 mm diameter white PVC pipe over the water service box from 600 mm below ground to 600 mm above ground.

9.0 Curb, Gutter and Sidewalks

9.1. General

Products, Concrete Materials, Execution and Methods of Concrete Construction shall be in accordance with CSA CAN3-A23.1or as described in this section.

9.1.1. Work Included

The work described in this section pertains to the construction of concrete curbs, gutters, sidewalks, crossings and paving stones. Refer to Standard Drawings that follow:

- 9.2 - Municipal Cul-De-Sac Curb and Gutter;
- 9.3 - Industrial/Commercial Curb and Gutter Crossing;
- 9.4 - Typical Monolithic Lane and Driveway Crossing;
- 9.5 - Wheelchair/Bike Ramp Locations;
- 9.6 - Paraplegic Ramp Details on Tangent;
- 9.7 - Paraplegic Ramp Details at Both Curb Returns;
- 9.8 - Paraplegic Ramp Details at Centre of Curb Return – Rolled Curb;
- 9.9 - 500 mm Curb and Gutter for Arterial Roadways;
- 9.10 - 250 mm Standard Curb and Gutter;
- 9.11 - 250 mm Rolled Curb and Gutter;
- 9.12 - 1.50 m Standard Monolithic Sidewalk;
- 9.13 - 1.50 m Rolled Monolithic Sidewalk;
- 9.14 - 1.20 m or 1.50 m Separate Sidewalk;
- 9.15 - Typical Catch Basin Installation – 150 Curb and 250 Gutter.

9.2. Products

9.2.1. Portland Cement

Portland cement shall meet the requirements of CSA Standard Portland A5-M cement and shall be Type 10 normal, or type 50 sulphate resistant, as required by the Municipal District.

9.2.2. Aggregates

The fine and coarse aggregate used in the concrete mix shall conform to the following specifications:

1) Fine Aggregate - CSA CAN3-A23.1, Clause 5.3.

2) Coarse Aggregate - CSA CAN3-A23.1, Clause 5.4. Table 2 Group 1 (28-5)

Sieve Size (mm)	% Passing by Mass
40.000	100
28.000	95-100
14.000	30-65
5.000	1-10
2.500	0-5

9.2.3. Admixtures

All admixtures used to enhance the concrete shall conform to the following specifications:

1) Air Entrainment: ASTM C260

2) Chemical: ASTM C494

3) Calcium Chloride: ASTM C494

The use of calcium chloride shall only be used when approved by the Municipal District, but in no case will the amount added be greater than 2% of the cement weight. It shall not be used when the air temperature is above 4°C.

Fly ash shall not exceed 10% by weight of cement, and it shall conform to the requirements of CAN/CSA-A23.5. Only approved compatible super plasticizing admixtures and air entertaining agents shall be used with the fly ash. The Municipal District may require characteristic data for fly ash to prove conformance to the standards. After September 1st no portion of the specified cement content may be replaced with fly ash unless approved in writing.

9.2.4. Reinforcing Steel

Reinforcing bars shall be deformed bars in accordance with CSA Standard Specification G30.12-M1977.

Cold drawn wire or welded wire fabric for concrete reinforcement shall be 150 x 150 and conform to the requirements of CSA Standard Specification G30.3-1972.

9.2.5. Expansion Joint Filler

Joint filler shall conform to CGSB Standard Specification for polyurethane sealing compound #19-GP-15 or ASTM Standard Specification for SIKA FLEX 1A.

9.2.6. Membrane Curing Compound

Resin-base impervious curing compound shall conform to ASTM Standard Specification C309 Type 1D-Type B. The curing compound shall contain white fugitive dye.

9.2.7. Preformed Expansion Joint Filler

Preformed expansion joint filler shall conform to ASTM Standard Specification D-1752.

9.2.8. Concrete

Concrete mixes shall be designed by a qualified professional engineer engaged by the Contractor. The mix design shall be submitted to the Municipal District for approval a minimum

of 10 days prior to delivery of any concrete to the site. The specified compressive strength at 28 days shall be 30 MPa. The strength level of 30 MPa shall be considered to be achieved if averages of all sets of 3 consecutive strength tests equal or exceed the specified strength, and no individual strength test is less than 20 MPa.

The concrete shall contain not less than 315 kg of Portland cement per cubic metre of concrete produced.

The air content of the concrete shall be maintained between the limits of 6-8%.

The minimum slump permissible will be that which will allow the concrete to be placed efficiently and provide a homogeneous mass. The maximum allowable slump shall be 70 mm +/- 10 mm for all hand-poured concrete and 40 mm +/-10 mm for all machine-extruded concrete.

9.2.9. Retempering With Air

If, due to a low air entrainment percentage, as specified, the Municipal District feels it is necessary to add an approved air-entraining agent on site, placement of concrete shall stop to allow the concrete truck's drum to turn at mixing speed for a minimum of 3 minutes. Should the air content of the concrete not conform to specifications after retempering with air, then the concrete shall be rejected.

The Municipal District has the right to withdraw permission to add an air-entraining agent to the mix and reject the concrete if this practice is being abused.

9.2.10. Retempering With Water

If, due to a low slump as specified, the Municipal District feels it is necessary to add water to the mix, it shall be injected into the drum under such pressure and direction of flow that it conforms to the specifications in ASTM C-94, Appendix XI. Placement of concrete shall stop at that point to allow the concrete truck's drum to turn at mixing speed for a minimum of 3 minutes. Should the slump of the concrete not conform to specifications, after retempering with water, then the concrete shall be rejected.

The Municipal District has the right to withdraw permission to add water to the mix and reject the concrete if this practice is being abused.

9.3. Execution

9.3.1. Placing Concrete

Concrete shall not be placed until the subgrade, sub-base and base course materials have been completed, and approved by the Municipal District. The base shall be sufficiently moist to prevent absorption of water from the concrete, and free from mud or water ponding.

The concrete shall be placed within 90 minutes of initial mixing at the plant, or before the drum on the concrete truck has turned 300 revolutions. Complete discharge of concrete shall not exceed 2 hours. The concrete shall be transported by methods which will prevent segregation and deposited on the subgrade so that as little handling as possible is required.

Concrete shall be placed continuously until a complete section between expansion joints has been poured.

The concrete shall be thoroughly consolidated against and along the faces of the forms. Hand spreading shall be done with shovels, not with rakes, in order that the concrete will not be segregated. Precautions should be taken to prevent overworking of the concrete.

Concrete shall be handled from the mixer to the place of final deposit as rapidly as practicable by methods which shall prevent the separation or loss of the ingredients. It shall be deposited in the forms as near as practicable to its final position to avoid rehandling.

The sequence of concrete placement shall be arranged so that concrete which has partially hardened shall not be subjected to injurious vibration.

The vertical free fall height of concrete shall not exceed 1.0 m. For falls greater than 1.0 m chutes or tremies shall be used.

During placement, concrete shall be sufficiently tamped or vibrated with suitable equipment to secure a close bond with the reinforcement, eliminate entrapped air voids and ensure a homogeneous structure with adequate consolidation.

The rate of delivery of mixed concrete shall be such that the interval between the placing of successive truck loads shall not exceed 30 minutes. If the time exceeds 30 minutes, then a construction joint shall be formed.

After the initial set of the concrete, neither the forms or the concrete structure shall be jarred and no strain shall be placed on the ends of projecting reinforcement.

Construct all pararamps and crossings monolithically to the dimensions and at locations specified.

9.3.2. Joints

Curb, gutter and sidewalk contraction joints shall be constructed at 3.0 m intervals and as detailed on the standard drawings, and shall not be less than 50 mm deep. Contraction joint widths shall not be greater than 5 mm.

Midway between each contraction joint on the sidewalk, a surface joint, 13 mm deep, shall be constructed. These joints shall not extend into curb and gutter.

A surface joint shall be constructed longitudinally at the location shown on the standard drawings and shall continue through all driveways and lane crossings.

A construction joint shall be formed at the end of every pour. This joint shall be constructed in a "V" shape, as directed by the Municipal District, and using 10 M rebar 600 mm long, spaced every 500 mm.

10 M bars at 500 mm on centre shall be dowelled and epoxied into the back of the existing curb prior to placing concrete.

9.3.3. Finishing

Sidewalk surfaces, either separate or monolithic with curb and gutter, shall be struck off and screeded to the slope, cross-section and elevation shown on the drawings or as directed by the Municipal District. The surface shall be consolidated and smoothed using a wood float. Light-steel trowelling shall be used followed by a uniform brush finish. Sidewalk shall be edged at all joints to prevent chipping of the concrete.

The exposed surfaces of concrete curbs and gutters, either separate or monolithic with sidewalks, shall be finished by means of a wood float then light-steel trowelling followed by uniform brushing, and all edges shall be rounded to the required radius. No patching will be allowed.

Pararamps, and crossings to lanes and private property shall be struck off and screeded to the required slope and cross-section. The finished surface shall be brushed as specified above.

All edges, including contraction or surface joints, shall be tooled for a width of 50 mm and rounded to a radius of 6 mm. The brush grooves shall be transverse on the sidewalk and longitudinal on the curb and gutter. The finished surface shall have no exposed aggregate or honeycomb.

If there is evidence of excess water on the concrete surface, finishing shall be delayed until the excess water has evaporated.

Surface grooves made by the broom shall not be more than 3 mm deep. Before brushing, all surplus water shall be removed from the brush.

9.3.4. Curing

Immediately after finishing, the concrete surface shall be protected by applying a membrane curing compound. After finishing and removal of forms if necessary, all exposed surfaces shall be wetted with water and then thoroughly sprayed with membrane curing compound. The membrane curing compound shall be applied in accordance with the manufacturer's instructions with an approved pressurized spray.

The curing compound shall be applied in such a manner as to cover the entire surface thoroughly and completely with a uniform film at a rate which shall depend on the roughness of the surface of the concrete, but in no case at less than 0.25 litres per square metre of concrete surface.

9.3.5. Backfilling

Unless otherwise directed by the Municipal District, the Contractor shall backfill along the back of the curb edges, to the top of the concrete, within 3 to 7 days of the placing of the concrete. The backfill shall be mechanically tamped in maximum lifts of 150 mm, to a minimum of 95% Standard Proctor Density and to a distance of 300 mm from the back of the walk or curb.

Where landscaping is to be carried out immediately after completion of the walks or curbs and gutters, the backfilling shall be left 100 mm low to allow for the topsoil.

9.3.6. Forming

Forms shall be steel or wood of sufficient strength to resist the pressure of wet concrete, and the supply shall be sufficient to permit their remaining in place until hydration has occurred, or longer if the Municipal District considers it necessary. The Contractor shall remove all face forms to allow for a smooth brush finish. The use of bent, twisted, battered or worn-out forms will not be permitted. Forms will be checked for alignment and elevation by the Municipal District before concrete is poured, and shall be cleaned and oiled before each use.

Where required, reinforcement shall be secured in the location shown on the standard drawings and shall be free from mill scale, grease and rust prior to placing concrete. Forms shall be held

securely by approved methods to prevent movement and bulging when the concrete is placed. Forms must be approved by the Municipal District before concrete is poured.

Curbs having a radius of less than 40 m shall be constructed with flexible forms. A sufficient length of form (not less than 50 metres) shall be placed and checked before concrete is poured to ensure true line and grade. The forms shall be well staked, braced or otherwise held rigidly true to the established line and grade. The Municipal District may, at any time, reject the use of any forms considered unsatisfactory.

9.4. Mechanical Extruding Machines

Slip-form paving machines or concrete extruding machines may be used for placing concrete provided they have received the approval of the Municipal District prior to commencement of the work and meet the following requirements:

1) The vibrators on the equipment shall be capable of producing a dense mass with a smooth surface, free of honeycombing.
2) The equipment shall include automatic grade and line controls which shall be used at all times.

Commence placement of concrete only after the subgrade has been prepared and approved by the Municipal District.

Any special grading or preparation of the base required by the Contractor to accommodate equipment shall be the responsibility of the Contractor, and shall restore the roadway and boulevards to their original condition within 3 to 7 days of the initial disturbance.

The extruded concrete shall be checked for alignment and elevation by the Municipal District while the concrete is being placed. All incorrectly placed or misaligned work shall be immediately removed while the concrete is still wet, and the work redone to the proper specifications using whatever means required.

Whenever possible, the forming and placing of concrete by conventional hand pouring methods (as may be required at corners, crossings and catch basins) shall be carried out in conjunction with the extruding machine operation. Where this procedure is not practical, the "tie-ins" shall be completed within 3 days of construction of the adjacent extruded section, using 10 M rebar at all joints. All "tie-ins" shall be completed in one continuous pour.

9.4.1. Consolidation

The concrete shall be consolidated by means of an approved vibrating screed or, in the case of curb and gutter only, by means of a poker or pencil vibrator not exceeding 50 mm in diameter.

Particular care shall be given to placing and tamping along the faces of the forms to ensure a dense, smooth surface.

Vibrations shall be of sufficient duration to thoroughly compact the concrete but not long enough to cause segregation. Vibrators shall not be used for moving concrete.

9.5. Inspection

All exposed concrete surfaces shall be checked by the Contractor with a 3 m straight-edge, and any water pockets or deviations in line or grade exceeding a total of 6 mm shall be corrected immediately.

Differences in elevation at any given point from that given by the design shall not exceed 13 mm, and the maximum variation shall not be greater than 13 mm.

Deviations in horizontal alignment at any given point from that given by the design shall not exceed 25 mm, and the fluctuations in the horizontal alignment shall not be greater than 25 mm.

Concrete not meeting the above criteria shall be replaced.

9.6. Field Tests

Testing shall be performed by a qualified CSA testing laboratory in accordance with the following:

1) Samples of concrete shall be obtained in accordance with CSA Test Method A23.2-1C for sampling plastic concrete.
2) Test cylinders shall be made and stored in accordance with CSA Test Method A23.2-3C. No less than 1 strength test shall be made from samples from each 150 cubic metres of concrete placed, and in no case shall there be less than 1 test from each day's pour. Each strength test shall consist of 3 test cylinders, 1 tested at 7 days and 2 at 28 days.
3) Air content determinations shall be made in accordance with CSA Test Method A23.2-7C, air content of plastic concrete by the volumetric method.

During construction start-up, every load or batch of concrete shall be tested until such time as satisfactory control of the air content has been established. Air content tests taken with the test cylinders will be sufficient once satisfactory control has been established. Whenever a test falls outside the specified limits, the testing frequency shall revert to one test per load or batch until satisfactory control is re-established. Any concrete that falls outside specified air control levels shall be rejected from use.

Slump tests made in accordance with CSA Test Method A23.2-5C, Slump of Concrete, shall be made in conjunction with each strength test.

9.7. Clean-Up

As the work progresses, the Contractor shall clean up the site and all areas in which work has been done shall be left in a neat and presentable condition. All gutters and street drainage ditches that have been blocked as a result of the Contractor's operation shall be restored or repaired.

The Contractor shall dispose of all surplus excavated material, organic soil, rock, boulders and pieces of concrete and masonry at an approved location.

9.8. Protection

The Contractor shall be responsible for keeping all animals and pedestrians off the newly constructed sidewalks or curb until completely set. The Contractor shall also be responsible for keeping all vehicles off the work for a period of 3 days after the concrete has been finished.

9.9. Deficiency Penalty

Where there are variations from specified design strength, the following Deficiency penalty shall be assessed based on the 28-day, laboratory-cured cylinders.

1) When the concrete strength of any set exceeds 95% of design strength, no deficiency penalty will be administered.

2) When the concrete strength of any set is greater than 80% but less than 95% of design strength, the deficiency penalty will be administered as follows:

$$\frac{Q\,[P \times 2\,(A - B)]}{A}$$

Where: P = unit price

A = specified strength

B = average 28 day cylinder strength

Q = quantity of deficient concrete

3) If the concrete strength of any set is less than 80% of design strength, the work represented by that set of cylinders will be rejected and replaced by the Contractor.

10.0 Roadways

10.1. Statement:

The Municipal District Council is responsible for the direction, control and management of all roads within the Municipal District.

10.2. Definitions:

Fence: Means a protective or confirming barrier of posts and wire used to keep animals in or out.

Road: Means a road other than a primary highway subject to the direction, control and management of the Municipal District and the Alberta Minister of Transportation and Utilities.

10.3. Responsibilities:

1) Annually, the Municipal District Council will set road construction/maintenance priorities.
2) The Municipal District is not obligated to provide roads to any parcel.
3) Once priorities are established for the upcoming construction season, they may be advertised on the Municipal District information page of the newspaper and or web page for ratepayer information.
4) Priorities for roads involving Municipal District funds will be established annually by the Municipal District Council in the following order:
    - Surfacing to protect existing road infrastructure;
    - Upgrading or new construction;
    - Cost shared residential / farm access roads;

10.3.1. Criteria

10.3.2. Roads to Provide Access to Residences

Roads must be constructed within a quarter section along existing road allowances or by a forced road (which ever is more cost effective) and only if no other physical access exists on the quarter or portion thereof.

Higher priority will be given to new roads benefiting more than one landowner.

10.3.3. Farm Access

Access is required in order to be accessible by machinery and equipment performing agricultural activities on titled parcels.

There is no existing physical means of access to the quarter.

Access to be provided on a road allowance or by a forced road (which ever is more cost effective) via the shortest route as determined by the Municipal District and the Municipal District Council.

In the event of more than one application, higher priority will be placed on the application assisting the greater number of applicants (i.e. two or more farmers).

10.4. Cost Share Criteria

10.4.1. *Procedure*

When an individual requests the construction of a road that is not necessarily in the best interest of the public, the Municipal District Council may approve its construction on a cost-sharing basis with the landowner requesting the road.

The Director of Field Services will prepare an estimate for Municipal District council consideration relative to the costs of building the roadway to the Municipal District's classification standard.

The Municipal District Council may accept up to 25% of the cost to a maximum contribution of $20,000 per project with the applicant paying the remaining cost. This amount shall be based on the approved estimate of the Director of Field Services.

The cost-share of the applicant shall be paid in the form of cash or an irrevocable letter of credit to the Municipal District preceding the work, based upon the approved costs of the project. Any excess funds from the deposit will be refunded upon completion of the work.

The applicant shall have no claim for a refund of the cost-share if at any future date the use of the road develops to the extent that it may be considered in the interest of the present public.

10.5. Grazing Lease Roads

The successful bidder of a grazing lease accepts responsibility for providing his/her own access to the disposition area as stated in the tender documents for Public Lands.

10.6. Fencing

Fencing along new or improved roads will only be considered where additional right-of-way is required, and the said right-of-way destroys the existing fence.

Existing fences will be repaired or replaced, or to Municipal District standards by a similar fence when road construction requires relocation.

10.7. Geometric Design Standards

Street classification and designation shall be in accordance with the classification system outlined in the Transportation Association of Canada (TAC) Manual - Geometric Design Standards for Canadian Roads and Streets, and the Urban Supplement to the Geometric Design Guide for Canadian Roads.

The following are general minimum requirements and shall be used in the design of streets.

Street cross-sections shall be as defined in Table 10.3 on Page 10-14 and Standard Detail Drawings. Curb and gutter will be required in some areas, at the discretion of the Municipal District.

Straight face curb and gutter shall be constructed on all streets, in accordance with the design Drawings. With written approval by the Director of Field Services, rolled curb and gutter may be constructed in accordance with the drawings.

Separate Sidewalks shall be preferred, although conditions requiring monolithic sidewalks may occur. Separate sidewalks shall be 1.5 m wide and shall be constructed in accordance with the Standard Drawings, with written approval by the Director of Field Services. Monolithic curb, gutter

and sidewalks may be constructed in accordance with the Standard Drawings. Sidewalks shall be clear of all obstructions including surface utilities. Sidewalk locations shall be in accordance with the Standard Roadway Drawings. Wider sidewalks may be required in areas of high pedestrian activity, as determined by the Director of Field Services.

Rear lanes (alleys) shall have a surfaced width of 5.5 m within a 6.0 m right-of-way. Where rear lane traffic activity is expected to be high, such as for certain commercial developments, a wider surfaced width and right-of-way may be required as determined by the Director of Field Services.

All driveways shall be constructed to give a minimum of 1.5 m clearance from any structure, (e.g. hydrants, light standards, service pedestals), and shall be constructed in accordance with the Standard Drawings.

Curb ramps shall be constructed in accordance with Standard Drawings.

The following Drawings are located in Section 18 Standard Drawings:

- 10.1 - Typical Road Intersections;
- 10.2 - Pavement Crown for Various Road Widths;
- 10.3 - Local Residential (Urban);
- 10.4 - Divided Arterial;
- 10.5 - Undivided Arterial (Urban);
- 10.6 - Minor Residential Collector (Urban);
- 10.7 - Major Residential Collector (Urban);
- 10.8 - Local Industrial (Urban);
- 10.9 - Rural Residential Road Standard Cross-Section;
- 10.10 - Rural Residential Subdivision with Utilities Standard Cross-Section;
- 10.11 - Typical Trail Cross Section;
- 10.12 - Asphalt Speed Bump;
- 10.13 - Paved Road Standard Cross-Section;
- 10.14 - Chip Seal Road Standard Cross-Section;
- 10.15 - Gravel Road Standard Cross-Section;
- 10.16 - Limited Access Road Standard Cross-Section;
- 10.17 - Rural Road Standard Cross Section.

10.7.1. Vertical Alignment

Minimum gutter grades around all curves and along all tangents shall not be less than 0.6%. Minimum gutter grades on curb returns shall be 1.0%.

Maximum gutter grades shall not exceed those defined in Table 10.3 on Page 10-14.

All paved roadways shall be crowned at a rate of 2.0%, while all gravel surface roadways shall be crowned at a rate of 3.0%.

The grades at intersections for all roadway classifications shall not exceed 2% for a minimum distance of thirty (30) metres, measured form the shoulder edge of the receiving road.

All vertical curves shall be designed to meet or exceed the following minimum requirements:

TABLE 10.1

Design Speed (km/h)	Crest (K)	Sag (K)
50	8	7
70	22	15
80	35	20

K = L/A

L = length of vertical curve in metres

A = algebraic difference in grades percent

The maximum super elevation is shown in Table 10.3.

Rear lanes (alleys) shall have a minimum longitudinal grade of 0.6%. If gravel-surfaced, the lane shall be cross sloped to one side at 3.0%. If paved, the lane shall be cross sloped to one side at 2.0%. Paved lanes that have a centre swale must be approved in writing by the Municipal District and shall have cross slopes of 2.0%.

Horizontal Alignment

The minimum radius is relative to the Road Classification, the design speed and the maximum super elevation. See Table 10.3 on Page 10-14.

All horizontal curves shall be designed to meet the minimum design requirements shown in Table 10.3 on Page 10-14.

Minimum radius for cul-de-sacs is 14.0 m to face of curb in residential areas, 14.0 m in rural areas and 15.0 m in industrial areas.

Maximum cul-de-sac length shall be 120.0 m.

Flares at intersecting roadways shall have the following minimum radius from shoulder to shoulder:

- Residential access and local 10.0 metres
- Residential collector 15.0 metres
- Industrial local and collector 15.0 metres

10.7.2. Stop Sight Distance

The minimum Stop Sight Distance criteria is show in the table below:

TABLE 10.2

STOP SIGHT DISTANCE	
Design Speed km/h	**Minimum Stopping Sight Distance Metres**
50	65
60	85
80	140

10.8. Approach Construction Guidelines

10.8.1. Statement

To outline the circumstances and specifications for the construction of approaches to local roads.

10.8.2. Procedure

One approach per parcel per 805 metres (1/2 mile) is allowed at no cost to the landowner. Physically severed parcels may be allowed additional accesses, providing the cost to the Municipal District is reasonable. A gate, if required, must be installed at the expense of the landowner before construction of the approach is done and to enable the staff to properly finish the approach and ensure that the landowner is committed to access the land from the new access point.

Approaches shall be constructed to the standards shown on Drawings 10.24 and 10.25.

If the Municipal District determines that a culvert is required, the minimum allowable size is 500 mm.

All approaches should be at a lower elevation than the applicable public road so that drainage patterns remain unaffected.

On requests for widening of existing approaches, the Municipal District will supply all materials and installation to complete widening of one approach per 805 metres (1/2 mile) to the applicable standards.

Should the landowner require an approach with the finished driving surface exceeding the applicable standards, the additional cost shall be borne by the landowner.

If landowners desire to install their own approaches, the Municipal District, Public Works have the discretion to first approve the application, and secondly to determine the required specifications.

The Municipal District, Public Works Department will check with the Municipal District Planning Department to ensure that the Municipal District is not building or upgrading access to comply with a subdivision requirement. If so, the responsibility for the cost lies with the applicant.

10.8.3. Curb Returns

Curb returns at residential local street intersections shall be constructed to a minimum radius of 10.0 m at face of curb.

Curb returns at residential collector street intersections shall be constructed to a radius of 12.5 m at face of curb.

In industrial/commercial areas, the face of curb radius should be a minimum of 15.0 m to accommodate truck turning movements.

For arterial street intersections the curb returns shall be designed in consideration of the type and volume of the turning traffic. Two and three centred curves, with or without islands, may be required.

Curb ramps are required at all intersections which have sidewalks.

10.8.4. Culverts and Drainage

The minimum allowable ditch grade shall be 0.5%. Ditch grades in excess of 2.0% shall be protected against erosion through rock ditch checks, silt fences, Enviroberm fences and/or erosion control blankets. Typical installation is illustrated in Standard Detail Drawing 10.26.

Ditch side slopes and back slopes shall not be steeper than 3:1.

The minimum ditch bottom width shall be 3.0 metres along arterial roads and 1.0 m along the collector and local roadways, sloping away from the roadway at a minimum of 5.0%.

Culvert size requirements shall be determined through the storm water drainage analysis; however, the minimum size culverts shall be as follows:

- Roadway cross culvert 600 mm
- Residential approach culvert 500 mm
- Industrial approach culvert 500 mm

Culverts shall be new galvanized C.S.P. with a minimum wall thickness of 1.6 mm, or as required by the loading criteria.

All culverts shall be installed in accordance with the manufacturer's recommendations.

In high density residential developments, all culverts shall be installed with bevelled end sections on both the inlet and outlet sides, with the invert extended to the toe of the side slope.

All culverts, except those in industrial developments, shall be installed to provide a minimum depth of cover of 300 mm or one-half the culverts diameter, whichever is greater. This should be measured from the finished shoulder grade of the roadway to the top of the culvert as shown on the Standard Detail Drawings. Culverts in industrial developments shall be installed to

provide a minimum depth of cover of 500 mm or one-half the culverts diameter, whichever is greater, as measured from the finished shoulder grade of the roadway to the top of the culvert.

Riprap shall be placed around the inlet and outlet of each culvert, with the riprap extending a minimum of 1.0 metre beyond the ends of the culvert. Rip-rap material shall consist of rock ranging in size from 150 mm to 350 mm with 50 % of the rock material being larger than 200 mm. A typical rip-rap installation is illustrated in the Standard Detail Drawings.

10.9. Road Approaches

This sub-section outlines the requirements respecting the design and construction of approaches within subdivision developments.

Residential approaches shall typically be located as follows:

- For low density residential, the approach shall typically be located to provide the best and most direct access to the building site on the lot.
- For internal high-density residential lots, the approach shall typically be centered on the lot frontage.

A residential approach shall not exceed eight (8.0) metres in width; and industrial lot approach shall not exceed fifteen (15.0) metres in width. Any deviation from these maximum widths requires the approval Director of Field Services.

All approaches shall be constructed to the same structure as the adjoining roadways, with asphalt surfacing extending to the property line:

All residential subdivision development shall require the Developer to construct one approach to each lot, consistent with the standard outlined herein.

Approaches to industrial/commercial lots are required to be constructed by the Developer where the access locations are known. Where access locations cannot reasonably be determined, the Municipal District may choose to have the Developer provide materials and/or securities to permit future construction of the approaches.

Minimum approach standards are located in Standard Drawings 10.24 and 10.25.

10.10. Road Surface Finishes

The Municipal District presently approves three types of roadway surface finishes:

1) Graveled surface,
2) Asphalt stabilized base course surface (A.S.B.C.),
3) Asphaltic concrete (hot mix asphalt) pavement surface (A.C.P.)

Roadways in all subdivision developments shall be surfaced with asphaltic concrete pavement (hot mix asphalt). The exception, with the approval of the Director of Field Services, is in low-density residential subdivisions where Asphalt Stabilized Base Course may be permitted, provided the subdivision is approved without water truck haul traffic. The Municipal District will require the developer to supply a deposit to complete the A.S.B.C. surfacing as part of the development agreement. The Municipal District will consider the surfacing when the subdivision is two-thirds occupied.

Irrespective of the roadway surface finish approved by the Municipal District for a specific development, good roadway industry construction practices and techniques shall be employed at all times. Furthermore, roadway subgrade and base construction shall be undertaken with the view that an asphaltic concrete pavement will ultimately be placed as the surface finish for the roadway.

Should a graveled surface be approved, even for an interim period, the surface gravel shall be a minimum compacted layer of 50 mm depth of 20 mm crushed gravel. All approaches shall be similarly treated.

10.11. Pavement Structure

All roadways other than rear lanes (alleys) shall be paved with hot mix asphalt. A geotechnical report with recommended pavement designs shall be conducted by a Professional Engineer and submitted to the Municipal District for review.

Paved roadways shall be designed in accordance with the Asphalt Institute Method of pavement design, using minimum design loadings of 8,165 kg (18,000 pound) axle loads. The design parameters, such as traffic count, percentage of trucks, California Bearing Ratio (CBR), are to be outlined to the Director of Field Services. The Municipal District reserves the right to request the Developer to engage an engineering firm to carry out tests, prior to paving, to confirm adequacy of design.

The following are the minimum pavement structure requirements. An independent pavement design is required for all developments. Additional pavement structure strengths and/or materials may be required in areas with poor subgrade materials, pending the results of the geotechnical investigation.

Street	Residential Land Use	Industrial/Commercial Land Use
Local	▪ 150 mm Subgrade Prep. to 100% SPD ▪ 250 mm Pitrun Gravel ▪ 100 mm -19mm Road Crush ▪ 90 mm Asphaltic Concrete Surface(Light Duty)-2 lifts 50 mm/40 mm final*	▪ 300 mm Subgrade Prep. to 100% SPD ▪ 250 mm Pitrun Gravel ▪ 100 mm -19mm Road Crush ▪ 100 mm Asphaltic Concrete Surface (Heavy Duty)
Collector	▪ 150 mm Subgrade Prep. to 100% SPD ▪ 300 mm Pitrun Gravel ▪ 150 mm – 19mm Road Crush ▪ 100 mm Asphaltic Concrete Surface (Heavy Duty)	▪ 300 mm Subgrade Prep. to 100% SPD ▪ 300 mm Pitrun Gravel ▪ 150 mm – 19mm Road Crush ▪ 100 mm Asphaltic concrete Surface (Heavy Duty)
Arterial	▪ 300 mm Subgrade Prep. to 100% SPD ▪ 350 mm Pitrun Gravel ▪ 200 mm – 19mm Road Crush ▪ 125 mm Asphaltic Concrete Surface(Heavy Duty)	▪ 300 mm Subgrade Prep. to 100% SPD ▪ 350 mm Pitrun Gravel ▪ 200 mm – 19mm Road Crush ▪ 125 mm Asphaltic Concrete Surface (Heavy Duty)

Note: *The final 40 mm lift of asphaltic concrete shall be placed in the second year of the maintenance period, 60 days prior to Final Acceptance Certificate.

Alternative pavement designs, such as soil cement base, may be considered. Approval of alternate pavement designs must be obtained in writing from the Director of Field Services prior to submission of design drawings.

Gravel surfacing is permitted on rear lanes (alleys). Aggregate base material shall be used to a minimum depth of 250 mm, with 150 mm placed during initial construction and 100 mm placed during the final year of the maintenance period.

10.12. Right-of-Way Preparatory Requirements

The entire road right-of-way (R.O.W.) shall be cleared of all vegetation (trees, shrubs, brush, etc.) including removal of all tree roots and stumps. All such material shall be removed from the site for disposal at approved locations. No burying of this material, or any portion thereof, shall be permitted within the R.O.W.

Organic soil and material are not acceptable as subgrade materials and shall be stripped within the roadway, ditch and back slope portion of the new construction. Organic soils (horizon A) shall be stockpiled in approved locations for the re-spreading on the ditches and back slopes after completion of the roadway construction.

TABLE 10.3
SUMMARY OF RECOMMENDED DESIGN STANDARDS FOR STREETS (TAC 1999)

Classification	Traffic Volumes (vpd)	Design Speed[a] (km/h)	Right-of-Way Width (m)	Pavement Widths (m)	Travel Lanes[c]	Parking Lanes	Maximum Gradients (%)	Maximum Super elevation (m/m)
Undivided Arterials	5,000-12,000	60 - 70	30.0	14.8	4-3.7 m	outside lanes	5	.04 - .06
Major Residential Collector UAU 60	2,500-5,000	60	24.0	14.0	2 - 3.7 m	2 - 2.5 m	6	.025 - .04
Minor Residential Collector UCU 60	1,000-2,500	60	20	12.0	2 - 3.5 m	2 - 2.5 m	6	.025 - .04
Local Residential ULU 50	Up to 1,000	60	18	10.0	2 - 3 m	2 - 2 m	6	.025
Industrial Collector	N/A	60 - 70	22.0	14.0	N/A	Optional	6	.025
Local Industrial	N/A	60	18.5[d]	12.0	N/A	Optional	6	.025
Cul-de-Sac	Up to 1,000	60	18	10.0	N/A	N/A	6	.025

Notes: a. Posted speed to be 10 km/h less than design speed. Rear lane (alley) access preferred.

Classification	Minimum Radius of Curvature (m)	Minimum Intersection Spacing (m)	Minimum Corner Cuts at Intersections	Sidewalks	Lighting Poles and Other Obstructions	Parking	Access
Undivided Arterials	170	150	30 m Radius	Separate, 1 or 2 sides	2.5 m min. from face of curb or behind sidewalk	Restricted	Restricted[e]
Minor and Major Residential Collectors	150	60	10 m	Separate, both sides	2.0 m min. From face of curb 1.5 m min. from face of curb	Permitted	Permitted[f]
Local Residential	90	60	6 m	Both sides	1.8 m min. From face of curb	Permitted	Permitted
Local Industrial	90	60	6 m	Optional	1.65 m min. From face of curb	Optional	Permitted
Industrial Collector	150	60	10 m	Optional	2.25 m min. From face of curb	Optional	Some Restrictions
Cul-de-Sac	90	60	6 m	Separate or mono, 2 sides	1.65 m from face of curb	Permitted	Permitted

b. Land for noise attenuation will be in addition to the road right-of-way requirement.
c. Additional travel lane width may be required to accommodate cyclists, e.g. on arterials the outside lanes are 4.2 m wide.
d. Additional right-of-way required where rural roadway cross-section is used for initial stage. Prohibited for residential land uses.

TABLE 10.4
TEST FREQUENCY

Specification	Type of Test	Recommended Test Frequency	Remark:
Trenching, Backfilling and Compaction for sewers, catch basins leads, watermains and hydrants sewer and water service connections, shallow utilities, and for Electrical Installation	Density Test: -Trench longer than 15 m -Trench shorter than 15 m	2 tests per 600 mm of depth for every 100 m of trench length 3 tests per trench	Testing will vary with location of project and consequences of trench settlement.
Roadway Excavation, Backfill and Compaction	Grading/Fill Compaction: Subgrade Preparation Proof Rolling:	1 density test per 2,000 sq.m of compacted lift 1 density test per 1,000 sq.m of compacted subgrade lift Entire project	
Aggregate: General Granular Sub-base Granular Base	Source Sampling: Compaction: Proof Rolling:	1 sieve analysis per 500 tonnes of asphalt aggregate for crushing control 1 sieve analysis per 2,500 tonnes of base and sub base aggregate 1 density test per 1,500 sq.m of compacted granular lift of road Entire project	Required 2 weeks prior to commencing work
Stabilization: Lime	Source Sampling: Test Area: Proof Rolling:	400 sq.m to establish and demonstrate work methods and timing At completion of curing period	Required 2 weeks prior to commencing work
Soil Cement	Source Sampling (aggregate): Mix Design: Thickness Test: Compaction Test: Strength Test:	1 sieve analysis per 2,500 tonnes 1 core sample per 1,000 sq.m of soil cement in place 1 density test per 1,000 sq.m of soil cement in place 1 7-day compressive strength test per 1000 tonne of soil cement	Required 2 weeks prior to commencing work Required 2 weeks prior to commencing work Areas suspected to have inadequate Thickness
Topsoil	Topsoil Analysis: -On-site Sources -Contractor Supplied	1 analysis report for each topsoil source Contractor to supply 1 litre sample of each topsoil type for testing	Required 4 weeks prior to commencing work

Asphaltic Concrete Paving	Mix Design: Density/Thickness Test: Mix Proportions:	3 cores per 600 tonnes of asphalt pavement 1 Marshall per 600 tonnes of mix, with a minimum of 1 test from each full day's production	Required 2 weeks prior to commencing work
Water Main	Hydrostatic/ leakage test* Bacteria/Chlorine Test *	Test section not to exceed 450 m in length	Provide Municipal District at least 24 hours notice
Storm Water Sanitary Sewer	Television and Photographic Inspections:* Infiltration and Exfiltration*	Upon completion of sewer installation, after backfilling As directed by the Director of Field Services	Performed by Contractor Performed by Contractor
Force Mains	Hydrostatic/ leakage tests *	Test section not to exceed 450 m in length	Provide Municipal District at least 24 hours notice
Concrete Curbs and Gutters, Walks, Medians, Driveways and Swales General Concrete Slip Formed Concrete	Mix Design: Slump Test: Air Content Test: Strength Test:	1 per 20 cu.m for each class of concrete poured, min. 1 per day 1 per 20 cu.m for each class of concrete poured, min. 1 per day 1 per 20 cu.m for each class of concrete poured, min. 1 per day	Required 2 weeks prior to commencing work Every truck until consistency is established Every truck until consistency is established
*Tests to be witnessed by Municipal District			

10.13. Road Standards (Rural Road Study)

In this section we examine the existing road standards to ensure the Municipal District's needs reflect current design practices in the transportation and road building industry. Before setting road standards it is helpful to classify the roads according to the type and volume of anticipated traffic.

There are two means of classifying roads. One is by design standard, which includes a definition for road width, surface type, number of lanes, and design speed. The other is by function.

Functional classifications indicate the anticipated role that the road plays in the network and the broad set includes freeways, expressways, industrial/arterials, collectors, local roads, including roads within Hamlets, machinery and resource roads. Within the Municipal District's local road network, there are no freeways or expressways.

10.13.1. Former Standards

The Municipal District conducted a study in 1999 which defined seven road classifications. These classifications are: (1) Industrial Road, (2) Resource Road, (3) Main Road, (4) Country Residential, (5) Local, (6) Farm Access, and (7) Machinery Road. Following the 1999 study the Municipal District reviewed the standards and reduced the number of classifications to five.

10.13.2. Current Standards

Following the 1999 study, the Municipal District reviewed the standards and reduced the number of classifications to five. These classifications range from Class 1 – Industrial roads to Class 5 – Farm Machinery roads. The definition and function of each road class was determined and minimum geometric and structural specifications were defined. In the 2001 Study update, EXH Engineering Services Ltd. defined the classifications of Industrial, Major Collectors and Collectors, as "Key" local roads and new standards were developed for each of these classifications. Table 10.5 below provides the design parameters for the five proposed road standards.

Table 10.5 - Design Parameters for Road Standards

	Industrial Road	Major Collector Road	Collector Road	Minor Collector Road	Farm Access Road
Typical Daily Traffic Volume	>500	500	250	<100	<100
Roadway Width (metres)	9	8	8	7.6	6.5
Recommended R.O.W. (metres)	40	30	30	20	20
Desirable Side Slope	4:1	3:1	3:1	3:1	3:1
Desirable Back Slope	5:1	4:1	4:1	4:1	As Required
Minimum Back Slope	2:1	2:1	2:1	2:1	
Minimum Radius (metres) (with spirals)	600	600	600	600	300
Minimum Sight Distance (metres)	140	140	140	140	85
Maximum Gradient %	7%	7%	8%	8%	9%
Recommended Surfacing	Paved/Gravel	Gravel	Gravel	Gravel	Gravel

The standards for Key Local roads and for non-key local roads are set out in the following sections.

10.14. Class 1: Industrial Road

10.14.1. Function

These roads serve the resource sector such as forestry or oil and gas. They usually accommodate higher than average volumes of heavy truck traffic and can link with any arterial or collector road and sometimes with provincial highways. An industrial road meets one or more of the following criteria:

1) Roads constructed to provide all weather access to heavy resource and industrial traffic.
2) Accommodates heavy resource and industrial traffic.
3) Traffic volumes in excess of 500 AADT.
4) Nine metre road top.

10.14.2. Right of Way Requirements

1) Minimum 40-metre right of way, with backsloping easement for construction.
2) Full width of right of way to be cleared.

10.14.3. Cross-Section Elements

1) Finished road top – 9.0 metres, 10.0 metres for roads with greater than 500 AADT.
2) Side slope
    - Minimum 1.0 metre vertical @ 4:1 slope
    - 4:1 slope up to 2 metres of fill.
    - 3:1 slope in 2 – 4 metres of fill.
    - 2:1 slope over 4 metres of fill.
3) Minimum 1.5 metres of fill above high water level or ground water table.
4) Ditch – flat bottom @ 3.5 metres width.
5) Back slope – Desirable @ 5:1 with a maximum of 2:1.
6) Minimum stopping sight distance – 140 metres @ 80 km/h.
7) Horizontal curve – Minimum radius 600 metres.
    - Spiral curve required for less than 600-metre radius.
    - Minimum 300-metre radius for spiral curves.
8) Maximum super elevation – 6 %.
9) Maximum gradient 7 % - preferred maximum gradient 6 %.
10) Intersection sight distance – Minimum 85 metres from the point of intersection or as per AIT guidelines.
11) Average shoulder elevation of road surface to be approximately 0.5m above adjacent ground surface except in cuts.

10.14.4. Structural Requirements

1) Surface aggregate – Des 4 Class 20 material
    - 9.0 metre road top – 330 cubic metres / km.
    - 10.0 metre road top – 400 cubic metres / km.
2) Grade - Minimum 1.0 metre non-organic material.
3) Compaction - Top 0.3 metres - 100 % of standard proctor density.
    - Below 0.3 metres - 95 % of Standard Proctor Density

Moisture Content - Optimum moisture content.

Refer to Standard Drawing 10.18, Industrial Road Standard Cross-Section.

10.15. Class 2: Major Collector Road

10.15.1. Function

Major collector roads are the main thoroughfares and generally have the highest traffic volumes within the Municipal District's subsystem of roads (excluding industrial roads). They are designed to handle traffic that is going from a provincial highway to another provincial highway or going from a community, through other communities on the way, to a provincial highway. They also handle traffic heading to and from numerous resources in the area. The major collector roads provide an integrated network of connections to the provincial highway system. They serve both local and through traffic. The major collector road meets one or more of the following criteria:

1) Major collector roads constructed to provide market access for agriculture, industry as well as access to recreational facilities and country residential subdivisions.
2) Market access for agriculture and industry.
3) Grid road collector.
4) Provides access to recreational facilities.
5) Traffic volumes of 250 – 500 AADT.
6) Eight metre road top.

10.15.2. Right of Way Requirements

1) Minimum 30-metre right of way with backsloping easement for construction.
2) Full width of right of way to be cleared.

10.15.3. Cross-Section Elements

1) Finished road top width – 8.0 metres for gravel surface roads, 8.6 metres for oil surface roads or asphalt concrete paved roads and 10 metres for roads with greater than 250 AADT.
2) Road top widened an additional 0.6 metres in embankment areas over 3.0 metres and all curves.
3) Side slope – minimum 1.0 metre vertical @ 3:1 slope.
    - 3:1 slope up to 3 metres of fill.
    - 2:1 slope over 3 metres of fill.
4) Minimum 1.5 metres of fill above high water level or ground water table.
5) Ditch – flat bottom @ 3.5 metres width.
6) Back slope – Desirable @ 4:1 with a maximum of 2:1.
7) Minimum stopping sight distance – 140 metres @ 80 km/h.
8) Horizontal curve – Minimum radius 600 metres.
    - Spiral curve required for less than 600 metre radius.
    - Minimum 300-metre radius for spiral curves.
9) Maximum super elevation – 6 %.

10) Maximum gradient 7 % - preferred maximum gradient 6 %.

11) Intersection sight distance – Minimum 85 metres from the point of intersection or as per AIT guidelines.

12) Average shoulder elevation of road surface to be approximately 0.5m above adjacent ground surface except in cut areas.

10.15.4. Structural Requirements

1) Surface aggregate – Des 4 Class 20 material @ 280 cubic metres / km.

2) Grade – Minimum 1.0 metres of non-organic material.

3) Compaction – Top 0.3 metres – 100 % of standard proctor density.

4) Below 0.3 metres – 95 % of Standard Proctor Density

5) Moisture Content – Optimum moisture content.

10.15.5. Typical Drawing

Refer to Standard Drawing 10.19, Major Collector Road Standard Cross-Section and 10.20 Major Collector Paved Road Standard Cross-Section.

10.16. Class 3: Collector Road

10.16.1. Function

A collector road serves the purpose of linking Minor Collector roads to Major Collector roads. They also serve the purpose of gathering traffic from internal country residential roads or multi parcel subdivisions to the Major Collector roads.

1) Provide access from minor collector roads and internal country residential subdivision roads to the major collector system.

2) Access to country residential subdivisions.

3) Access to recreational facilities.

4) Accommodate traffic volumes of 100 – 250 AADT.

5) Eight metre road top.

10.16.2. Right of Way Requirements

1) Minimum 30-metre right of way.

2) Full width of right of way to be cleared.

10.16.3. Cross-Section Elements

1) Finished road top width – 8.0 metres.

2) Road top widened to 8.6 metres in embankment areas over 2.0 metres and all curves.

3) Side slope – minimum 1.0 metres vertical @ 3:1 slope.

- 3:1 slope up to 3 metres of fill.
- 2:1 slope over 3 metres of fill.

4) Minimum 1.5 metres of fill above high water level or ground water table.
5) Ditch – flat bottom @ 3.5 metres width.
6) Back slope – Desirable @ 4:1 with a maximum of 2:1.
7) Minimum stopping sight distance – 110 metres @ 70 km/h.
8) Horizontal curve – Minimum radius 600 metres.
    - Spiral curve required for less than 600 metre radius.
    - Minimum 300-metre radius for spiral curves.
9) Maximum super elevation – 6 %.
10) Maximum gradient 8 % - preferred maximum gradient 7 %.
11) Intersection sight distance – Minimum 85 metres from the point of intersection or as per AIT guidelines.

10.16.4. Structural Requirements

1) Surface aggregate – Des 4 Class 20 material @ 230 cubic metres / km.
2) Grade – Minimum 0.6 metres of non-organic material.
3) Compaction – Top 0.3 metres – 100 % of standard proctor density.
    - Below 0.3 metres – 95 % of Standard Proctor Density
4) Moisture Content – Optimum moisture content.

10.16.5. Typical Drawing

Refer to Standard Drawing 10.21 Collector Standard Cross-Section.

10.17. Class 4: Minor Collector Road (Non Key Local Road)

10.17.1. Function

Minor collector roads are the first level of roads within the network, which provide a means to funnel traffic to a higher classification of road. These roads would serve as collector roads where a minimal number of residences are involved in a rural setting or to gather traffic onto the internal road of a rural residential area.

1) Roads constructed to provide access to Collector roads.
2) Provides access to Collector roads.
3) Accommodate traffic volumes of less than 100 AADT.
4) 7.6 metre road top.

10.17.2. Right of Way Requirements

1) Minimum 20.12 metre right of way with backsloping easement for construction if required.
2) Full width of right of way to be cleared.

10.17.3. Cross-Section Elements

1) Finished road top width – 7.6 metres.
2) Road top widened to 8.1 metres in embankment areas of 2 -3 metres and all curves.
3) Road top widened to 8.6 metres in embankments over 3 metres.
4) Side slope – minimum 1.0 metres vertical @ 3:1 slope.
    - 3:1 slope up to 3 metres of fill.
    - 2:1 slope over 3 metres of fill.
5) Minimum 1.5 metres of fill above high water level or ground water table.
6) Ditch – flat bottom @ 1.25 metres width.
7) Back slope – Desirable @ 4:1 with a maximum of 2:1.
8) Minimum stopping sight distance – 140 metres @ 80 km/h.
9) Horizontal curve – Minimum radius 600 metres.
    - Spiral curve required for less than 600 metre radius.
    - Minimum 300-metre radius for spiral curves.
10) Maximum super elevation – 6 %.
11) Maximum gradient 8 % - preferred maximum gradient 7 %.
12) Intersection sight distance – Minimum 85 metres from the point of intersection or as per AIT guidelines.

10.17.4. Structural Requirements

1) Surface aggregate – Des 4 Class 20 material @ 230 cubic metres / km.
2) Grade – Minimum 1.0 metres of non-organic material.
3) Compaction – Top 0.3 metres – 100 % of standard proctor density.
    - Below 0.3 metres – 95 % of Standard Proctor Density
4) Moisture Content – Optimum moisture content.

10.17.5. Typical Drawing

Refer to Standard Drawing 10.22 Minor Collector Standard Cross Section.

10.18. Class 5: Farm Machinery Road (Non Key Local Road)

10.18.1. Function

Rural roads that are not included in the above classification system or the provincial highway system are considered to be non-key local roads. Non-Key Local roads meet one or both of the following criteria:

1) Roads constructed to minimal standards to provide farm machinery access to agricultural land.

2) Generally 0.8 – 3.2 km long.
3) 6.5 metre road top.

10.18.2. Right of Way Requirements

1) Minimum 20.12 metre right of way with back sloping easement for construction.
2) Full width of right of way to be cleared.

10.18.3. Cross-Section Elements

1) Finished road top width – 6.5 metres.
2) Road top widened to 7.1 metres in embankment areas over 2 metres, and all curves.
3) Side slope – minimum 0.6 metres vertical @ 3:1 slope.
    - 3:1 slope up to 2 metres of fill.
    - 2:1 slope over 2 metres of fill.
4) Ditch – V-ditch.
5) Back slope – as required.
6) Minimum stopping sight distance – 85 metres @ 60 km/h.
7) Horizontal curve – Minimum radius 300 metres.
8) Maximum super elevation – 6 %.
9) Maximum gradient 9 % - preferred maximum gradient 7 %.
10) Intersection sight distance – Minimum 85 metres from the point of intersection.

10.18.4. Structural Requirements

1) Surface aggregate – Des 4 Class 20 material as required.
2) Grade – Minimum 0.6 metres of non-organic material.
3) Compaction – 95 % of Standard Proctor Density
4) Moisture Content – Optimum moisture content.

10.18.5. Typical Drawing

Refer to Standard Drawing 10.23, Farm Machinery Road Standard Cross Section

10.19. Aggregates

10.19.1. General

This section specifies general requirements for supplying and processing of aggregates to be stockpiled or incorporated into work. Specific requirements for physical properties of aggregates not provided in this section are given in related work section.

10.19.2. Source Approval

Source of materials to be incorporated into work or stockpiled requires approval.

10.18 (a) Class 6: Recreational Land Access Road (Non Key Local Road)

10.18.1 (a) Function

Rural roads that are not included in the above classification system or the provincial highway system are considered to be non-key local roads. Non-key local roads meet one or both of the following criteria:

1) Roads constructed to minimal standards to provide access to recreational lands.

2) 3.0 metre road top. (10 ft)

10.18.2 (a) Right of Way Requirements

1) Minimum 20.12 metre right of way with back sloping easement or construction.

2) Full width of right of way to be cleared if adjacent to deeded and/or leased lands.

10.18.3 (a) Cross-Section Elements

1) Finished road top width – 3.0 metres. (10 ft)

2) Road top widened to 3.6 metres in embankment areas over 2 metres, and all curves.

3) Side slope – minimum 0.3 metres vertical @ 3:1 slope

4) Ditch – V-ditch.

5) Back slope – as required.

10.18.4 (a) Structural Requirements

1) Surface aggregate – Des 4 Class 20 material as required.

2) Grade – minimum 0.3 metres of non-organic material.

3) All topsoil, organics and sub soil to be removed prior to grade fill being added.

4) Ditch grades in excess of 2% shall be protected against erosion by rock ditch checks, silt fences or erosion control blankets.

5) Drainage courses shall be maintained by use of galvanized C.S.P. with a minimum thickness of 1.6 mm. Culvert size requirements shall be determined at site specific. Culverts shall be placed to prevent water from collecting within the road allowance, private and leased lands.

10.18.5 (a) Typical Drawing

Refer to Standard Drawing 10.23 (A), Recreational Land Access Road Cross Section

Inform the Municipal District of proposed source of aggregates and provide access for sampling at least two weeks prior to commencing production.

If, in the opinion of the Municipal District, materials from proposed source do not meet, or cannot reasonably be processed to meet specified requirements, produce an alternative source or demonstrate that material from source in question can be processed to meet specified requirements.

Should a change of material source be proposed during work, advise the Municipal District two weeks in advance of proposed change to allow sampling and testing.

Acceptance of a material at source does not preclude future rejection if it is subsequently found to lack uniformity, or if it fails to conform to requirements specified, or if its field performance is found to be unsatisfactory.

10.19.3. Production Sampling

Aggregate will be subject to continual sampling during production.

Provide the Municipal District with ready access to source and processed material for purpose of sampling and testing.

The developer will bear the cost of sampling and testing of aggregates in order to meet design gradations and specifications.

10.20. Products

10.20.1. General

All imported backfill, granular material, gravel and screened rock shall be suitable for the uses intended.

Aggregate shall be sound, hard, durable material free from soft, thin, elongated, or laminated particles, organic material, or other deleterious substances.

Flat elongated particles are those whose greatest dimension exceeds five times their least dimension.

Fine aggregates satisfying requirements of applicable section shall be one, or a blend of following:

1) Natural sand
2) Manufactured sand and/or fines
3) Screenings produced in crushing of quarried rock, boulders, gravel or slag.

Course aggregates satisfying requirements of applicable section shall be one of following:

1) Crushed rock or slag.
2) Gravel composed of naturally formed particles of stone.

10.20.2. Materials

Gradation: To be within the limit and for the types of materials specified below, when tested to ASTM C117 and ASTM C136, and having a smooth curve without sharp breaks when plotted on a semi-log grading chart to ASTM E11.

Production of Manufactured Fines: Manufactured fines are defined as that portion of the material passing the 5.0 sieve size which is produced by the crushing process.

In the event the manufactured fines in the total combined aggregate do not meet the requirement for the specified Asphaltic Concrete Mix, extra manufactured fines shall be produced by screening the Pitrun material so that the screened material contains no more than 5% material passing a 5.0 sieve. This screened material shall then be crushed so that 100% passes the 10.0 sieve and a minimum of 95% passes the 5.0 sieve. All material produced by this crushing process shall be placed in a separate stockpile and designated as manufactured fines.

Moisture Content: As specified in specific sections.

Bedding Sand: Bedding sand shall be free from organic material and meet the following gradation:

Bedding and Imported Sand	
Sieve Size (mm)	**% Passing by Mass**
12.500	100
5.000	90-100
1.250	55-85
0.315	10-35
0.080	0-5

The liquid limit shall not exceed 25 and the Plasticity Index shall not exceed 6.

Granular Material (Imported Sand): Imported sand shall be free from rubbish, rubble, organic material, vegetation, clay lumps and meet the gradation of bedding sand.

Granular Material (Imported Gravel): Imported gravel shall be a well graded mixture of sand and gravel meeting the following gradation:

Imported Gravel	
Sieve Size (mm)	**% Passing by Mass**
80.0	100
50.0	80-100
25.0	50-75
5.0	25-55
0.080	2-10

Screened Rock: Screened rock shall be composed of sound, hard uncoated particles free from clay lumps, flaky particles, soft shale, friable materials, roots, vegetable matter and frozen lumps meeting the following gradation:

Screened Rock	
Sieve Size (mm)	**% Passing by Mass**
50.0	100
40.0	95-100
20.0	5-10
10.0	0-5
5.0	0-5

10.21. Execution

10.21.1. Processing

Process aggregate uniformly using methods that prevent contamination, segregation, and degradation.

Split and combine aggregates if required to obtain gradation requirements specified. Use approved methods and equipment. Do not blend in stockpiles.

Blending to increase percentage of crushed particles or decrease percentage of flat and elongated particles is permitted.

Wash aggregates, if required to meet specifications. Use only equipment approved by the Municipal District.

10.21.2. Handling

Handle and transport aggregates to avoid segregation, contamination and degradation.

10.21.3. Stockpiling

Stockpile aggregates on site in location indicated or designated. Do not stockpile on completed pavement surfaces where damage to pavement may result.

Stockpile aggregates in sufficient quantities to meet project quantities schedules.

Stockpiling sites shall be level, well drained, and of adequate bearing capacity and stability to support stockpiled materials.

Except where stockpiled on acceptably stabilized areas, provide a compacted sand base not less than 300 mm in depth to prevent contamination of the aggregate or, if permitted, stockpile aggregates on ground but do not incorporate bottom 300 mm of pile into work.

Separate aggregates by substantial dividers or stockpile far enough apart to prevent intermixing.

Reject intermixed or contaminated materials. Remove and dispose of rejected materials as directed within 48 hours of rejection.

Stockpile materials in uniform layers of thickness as follows:

1) Max 1 m for course aggregate and base course materials
2) Max 2 m for fine aggregate and sub base materials.
3) Max 1.5 m for other materials

Complete each layer over entire stockpile area before beginning next layer.

Uniformly spot-dump aggregates delivered to stockpile in trucks and build up stockpile as specified.

Coning of piles or spilling of material over edges of pile will not be permitted. Stacking conveyors will not be permitted for stockpiling road base and graded seal coat aggregates.

During winter operations, prevent ice and snow from becoming mixed into stockpile or in material being removed from stockpile.

10.21.4. Stockpile Cleanup

Leave stockpile site in a tidy, well drained condition, free of standing surface water.

Remove any unused aggregates as directed.

10.22. Subgrade Preparation

10.22.1. Work Included

The work described in this section pertains to the preparation and construction of the subgrade.

10.22.2. Subgrade

Subgrade is that material immediately beneath the compacted granular course as detailed on the drawings.

10.22.3. Common Excavation

Common excavation shall consist of all materials such as earth, topsoil, organic material, muskeg, clay, hardpan, shale, silt, sand, gravel, fractured bedrock, cobbles and frozen material, removed from the roadway and placed in fill or embankment areas, or otherwise disposed as approved by the Municipal District. Excavation shall be to the lines and grades indicated on the plans, or as directed by the Municipal District. Schedule work to utilize all excavation materials completely. Borrow material will be authorized only after excavated materials have been utilized.

10.22.4. Scarify and Compact

In excavation areas, the top 150 mm of the subgrade shall be scarified and compacted to 95% Standard Proctor Density at optimum moisture content. In lieu of sub-grade preparation a geotextile filter fabric will be accepted.

No stones or boulders larger than 100 mm in diameter shall be left within the top 200mm of the subgrade unless otherwise directed by the Municipal District.

10.22.5. Over Excavation

Notify the Municipal District whenever unsuitable materials are encountered.

Materials which cannot be compacted to the specified density due to high or low moisture content shall be dried or watered by the Contractor to their optimum moisture content in order to achieve the specified compaction.

All common excavation materials below subgrade elevation which, in the opinion of the Municipal District, are considered unsuitable shall be removed and disposed in a site located by the Contractor, and approved by the Municipal District.

10.22.6. Stockpiling of Material

To facilitate the Work, the Contractor may stockpile embankment material. Such material shall be piled at a location determined by the Contractor, approved by the Municipal District, and in such a manner that it will not endanger persons, the Work, or adjacent properties, and ensure proper drainage is maintained. If the construction site does not facilitate stockpiling, the Contractor shall haul material to an approved location.

10.22.7. Excavation Waste

All common and rock excavation deemed unsuitable for use in embankments, or in excess of that required for embankment, shall be disposed of at locations determined by the Contractor and approved by the Municipal District.

All disposal areas shall be left in a neat and tidy condition satisfactory to the Municipal District. Excavation materials shall be graded smooth to promote surface drainage and not to impede existing surface drainage by the Contractor to the approval of the Municipal District.

10.22.8. Common Embankment (For Site Grading)

Embankment placed on lots and within the road right of way, but not under the road structure, shall be uniformly constructed to the typical cross-section and grades shown on the plans or as set out by the Municipal District, and shall include the formation, compaction and shaping of the embankment.

The full depth of fills shall be constructed of suitable material in layers not exceeding 200 mm compactive depth. Each layer shall be compacted to 95% Standard Proctor Density (SPD) at optimum moisture content. All fills greater than 1.0 m are to be compacted to 95% SPD.

Do not place material in free standing water. Drain all areas before placing materials.

Materials which cannot be compacted to the specified density due to high or low moisture content shall be dried or watered by the Contractor to their optimum moisture content as necessary to achieve the specified compaction.

10.22.9. Shaping and Finishing

The finished compacted subgrade shall be constructed to within 30 mm of the design section. Localized soft spots that develop in the finished subgrade due to poor work shall be corrected by excavating the material to a depth approved by the Municipal District, and replacing it with suitable subgrade material compacted in place.

Subgrade shall be true to the design cross-section.

Maintain and keep ditches open and free from debris to permit ready flow of surface water, and until final acceptance of the Work.

10.22.10. Tests

Field density and moisture content tests shall be carried out by a representative approved by the Municipal District in accordance with the following ASTM standards:

- Standard Proctor Compaction Test - ASTM D698, Methods (A) and (B)
- ASTM D1556 or In-Place Density Test - ASTM D2167 or ASTM D2922 and D3017.

The frequency of field density and moisture content tests shall be at minimum 1 test per 100 metres of constructed roadway and at various locations left and right of centre line, or as directed by the Municipal District.

Before approval by the Municipal District, the subgrade shall conform to the compaction requirements specified and shall show no visible subsidence or deflection under the wheels of a loaded gravel truck. Such trucks shall be provided by the Contractor, as the Municipal District requires, for proof rolling of the subgrade.

10.23. Granular Sub-Base

10.23.1. Work Included

The work described in this section pertains to granular sub-base material as detailed on the drawings.

10.24. Products

10.24.1. Granular Sub-Base

Granular sub-base is the material lying above the subgrade and below the base course. The gradation to be utilized shall be as designated by the Municipal District.

10.24.2. Gradation

The granular sub-base material shall consist of rock, gravel, and sand consisting of hard, clean, durable material, free from coatings of silt, clay or other deleterious materials and contain no organic matter.

The following gradation shall apply to pit run granular sub-base courses:

Pit Run and Granular Sub-Base Courses	
Sieve Size (mm)	**% Passing by Mass**
150.0	100
80.0	80-100
25.0	50-80
5.0	25-55
0.080	2-10

10.24.3. Approval

Preliminary approval of the material as represented in the test results shall not constitute general acceptance of all material in the deposit or source of supply, and acceptance shall be subject to confirming field tests taken at the discretion of the Municipal District. Materials may be considered unsuitable, even though particle sizes are within the limits of the gradation sizes required, if any characteristic precludes satisfactory compaction or if the material fails to provide a roadway suitable for traffic. The acceptability of the final material shall be determined by the Municipal District.

10.24.4. Quality

The material shall consist of durable rock or gravel. The granular sub-base shall not contain any organic or other deleterious materials. The material shall have a minimum California Bearing Ratio of 55% at the specified compaction as determined by the current issue of ASTM D1883.

10.25. Execution

10.25.1. Placement

The granular sub-base material shall not be placed until the underlying subgrade has been inspected and approved by the Municipal District.

Unless otherwise specified, the granular material shall be placed in uniform layers not exceeding 200 mm in thickness before compaction. The material shall be placed by mechanical spreaders or deposited in windrows and levelled with a suitable motor grader.

10.25.2. Compaction

The material shall be compacted by rolling with a pneumatic-tired or vibrating roller of a type approved by the Municipal District. The material shall be compacted at or near optimum moisture content to 98% Standard Proctor Density.

If the moisture content exceeds the optimum during compaction, the material shall be aerated by mechanical means until the material has been dried sufficiently to obtain the specified density.

If the moisture content is below optimum, water shall be added by an acceptable applicator and in such quantities to achieve specified compaction.

10.25.3. Shaping and Finishing

A motor grader shall be used in conjunction with the compaction equipment to keep the finished surface of each layer even and uniform. The finished surface of the granular sub-base shall conform to the required cross-section and grades as shown on the drawings or as directed by the Municipal District, within a tolerance of 30 mm. The sub-base material shall be uniform and show no signs of segregation.

10.25.4. Tests

Field density, moisture content and sieve analysis tests will be carried out by the representative of the Municipal District to ensure that the material is satisfactory.

The frequency of field density and moisture content tests shall be 1 test per approximately 100 metres of constructed roadway and at various locations offset left and right of centre line, or as directed by the Municipal District.

All sieve tests should comply with the gradation limits as stated in above.

The Contractor will, as the Municipal District requires, provide a loaded gravel truck with operator for visual checks of soft spots.

10.26. Granular Base Course

10.26.1. Work Included

The work described in this section pertains to base course gravel as detailed in the Drawings.

10.27. Products

10.27.1. Gradation

Granular base course material shall consist of crushed rock and/or crushed gravel and sand consisting of hard, clean, durable material, free from coatings of silt, clay or other deleterious materials, and containing no organic matter. The base course aggregate shall meet the following gradation requirements when tested to ASTM C136 and C117, (AASHTO T11 and T27):

Gradation Requirements	
Sieve Size (mm)	**% Passing by Mass**
20.000	100
16.000	84-94

10.000	63-86
5.000	40-67
1.250	20-43
0.630	14-34
0.315	9-26
0.160	5-18
0.080	2-10

A minimum of 60% by weight of the material retained on the 5.0 sieve shall have at least 2 fractured faces. Other properties shall be as follows:

- Liquid Limit: maximum 25, ASTM D423-66
- Plasticity Index: maximum 6, ASTM D424-59
- Los Angeles AbrasionGradation "B":35% maximum loss by mass, ASTM C131-76
- Sand Equivalent: minimum of 35%, ASTM D2419-74

10.27.2. Approval

Preliminary approval of the material as represented in the test results shall not constitute general acceptance of all material in the deposit or source of supply, and acceptance shall be subject to confirming field tests taken at the discretion of the Municipal District.

Materials may be considered unsuitable even though particle sizes are within the limits of the gradation sizes required, if particle shapes are thin or elongated, if any other characteristic precludes satisfactory compaction or if the material fails to provide a roadway suitable for traffic.

The acceptability of the final material will be determined by the Municipal District.

10.27.3. Quality

The material shall consist of durable rock or gravel. The base course shall not contain any organic or other deleterious materials. The material shall have a minimum California Bearing Ratio of 55%, as determined by the current issue of ASTM D1883 at the specified compaction.

10.28. Execution

10.28.1. Placement

The granular base course material shall not be placed until the underlying subgrade or granular sub-base course has been inspected and approved by the Municipal District. The subgrade or sub-base shall be shaped to cross section shown on the drawings, or as directed by the Municipal District, and shall be maintained free of ruts, waves, and undulations by what ever means are necessary.

Unless otherwise specified, the granular material shall be placed in uniform layers not exceeding a 200 mm compactive depth. The material shall be placed by mechanical spreaders or deposited in windrows and levelled with a suitable motor grader.

When called for in the contract, temporary material shall be placed from the granular base course level to the lip of gutter, with a 1% crown. The following year this material shall be excavated, reshaped and recompacted prior to paving. Any additional material shall be used as sub-base material in lanes or as directed by the Municipal District.

10.28.2. Compaction

The material shall be compacted by rolling with a pneumatic-tired or vibrating roller of a type approved by the Municipal District. The material shall be compacted at or near the optimum moisture content to 100% Standard Proctor Density.

For temporary material, compaction shall be 95% Standard Proctor Density.

If the moisture content exceeds the optimum during compaction, the material shall be aerated by mechanical means until it has dried sufficiently to obtain the specified compaction.

If the moisture content is below the optimum, water shall be added by an acceptable applicator and in such quantities to achieve the specified moisture content.

10.28.3. Shaping and Finishing

A motor grader shall be used in conjunction with compaction equipment to keep the finished surface of each layer even and uniform.

The finished surface of the granular base course shall conform to the required cross-section and grade as shown on the drawings or as directed by the Municipal District, within a tolerance of plus or minus 20 mm.

The granular base course shall be uniform and show no signs of segregation of the material placed.

10.28.4. Tests

Field density, moisture content and sieve analysis tests will be carried out by the representative of the Municipal District to ensure that the material is satisfactory.

The frequency of field density and moisture content tests shall be 1 test per approximately 100 metres of constructed roadway and at various locations offset left and right of centre line, or as directed by the Municipal District.

The Contractor will, as the Municipal District requires, provide a loaded gravel truck with operator for visual proof rolling of soft spots. The granular surface course shall show no visible subsidence of deflection under the wheels of the truck.

10.29. Prime, Tack and Fog Coats

10.29.1. Prime Coat

Prime coat shall be the application of bituminous material to previously prepared granular base course, prior to placing bituminous surfacing materials.

10.29.2. Tack Coat

Tack coat shall be the application of bituminous material to a previously constructed paving surface of any type in preparation of placing bituminous surfacing materials, and against curb and gutter faces, manholes, valves and other appurtenances in the street to be paved.

10.29.3. Fog Coat

Fog coat shall be the application of bituminous material to seal small cracks and surface voids on surface materials.

Fog coat shall only be required if, in the opinion of the Municipal District, the asphalt is open in texture.

10.30. Products

10.30.1. Prime Coat

The bituminous material for priming the base course shall be liquid asphalt. The asphalt types may vary from medium curing (MC) type MC-30 to MC-250; from slow setting (SS) type SS-1 to SS-1H or a special emulsified asphalt primer S.E.P. to suit the condition of the base.

10.30.2. Tack Coat

The bituminous material for tacking the existing asphalt surface shall be liquid asphalt. The asphalt types may vary from rapid curing (RC) type RC-30 to RC-250; from slow setting (SS) type SS-1 to SS-1H depending on conditions to suit the base. The SS emulsion shall be diluted by adding an equal amount of water prior to application.

10.30.3. Fog Coat

The bituminous material for sealing the surface course if specified shall be liquid asphalt. The asphalt types may be slow setting (SS) type SS-1 or medium curing (MC) type MC-30 depending on the surface material to be sealed.

10.30.4. Sand Blotter

The materials for sand cover shall consist of clean granular mineral material approved by the Municipal District, all of which shall pass a 5,000 sieve.

10.31. Execution

10.31.1. Equipment

Cleaning equipment shall consist of power brooms, flushers, and whatever hand scrapers may be necessary to remove all foreign material.

The pressure distributor used for applying asphaltic material shall distribute the asphaltic material at an even temperature, uniformly on variable widths of surface up to 5 metres. Uniform spray without atomization shall be determined and controlled from 0.2 to 5.4 litres per minute (L/m) with uniform pressure, and with an allowable variation from any specified rate not exceeding 0.1 L/m.

Suitable means for accurately indicating the temperature of the asphaltic material shall be provided at all times. The thermometer well shall be so placed as not to be in contact with a heating tube.

If provided with heating attachments the distributor shall be so equipped and operated that the asphaltic material shall be circulated or agitated throughout the entire heating process.

10.31.2. Preparation

Immediately prior to applying the asphalt primer, tack or fog coat, the surface shall be brought to uniform cross-section by patching all depressions and defective areas using an approved patching material and by removing all bumps and irregularities.

All loose and foreign material shall be removed by light sweeping.

10.31.3. Application

Obtain Municipal District's approval of existing surface before applying asphalt prime, tack or fog coats. Clean surface as required.

Upon the prepared surface the asphalt shall be applied uniformly at a rate of from 0.50 to 1.50 litres/square metre (L/m^2) for asphalt primer, and at a rate of from 0.25 to 0.90 L/m^2 for tack coat. The asphalt primer, tack or fog coat shall be applied only when the surface is dry or slightly damp, unless otherwise allowed by the Municipal District in writing, or only when the air temperature in the shade is above 10°C.

The application temperature of the asphalt primer, tack or fog coat shall be as follows:

Rapid Curing Asphalt:

- RC-30 51 – 68°C
- RC-70 74 – 88°C
- RC-250 100 – 110°C

Medium Curing Asphalt:

- MC-30 51 – 68°C
- MC-70 74 – 88°C
- MC-250 100 – 110°C

Emulsified Asphalt:

- SS-1 20 – 50°C
- SS-1H 20 – 50°C

Special Emulsified Primer Asphalt

- S.E.P. 15 – 50°C

Coat contact surfaces of curbs, gutters, headers, manholes and like structures with a thin uniform coat of asphalt material. Do not prime or tack surfaces that will be visible when paving is complete. Work adjacent to the roadway shall be completely protected from the application operation by a suitable covering. Any unnecessary splashing of the concrete shall be cleaned.

Do not apply asphalt coat when air temperature is less than 5°C or when rain is forecast within 2 hours.

The Contractor shall maintain the primed surface until the surface course has been placed. Maintenance shall include spreading any additional sand and patching any breaks in the primed surface with additional asphaltic material.

The asphalt primer should preferably be entirely absorbed by the base course and therefore require no sand cover. If, however, the asphalt has not been completely absorbed 24 hours after application, just sufficient sand shall be spread over the surface to blot up excess asphalt and prevent it from being picked up by any traffic.

Traffic shall not be permitted to travel on tack or fog coat until cured. The Contractor shall use flagmen, if required, and signage to control traffic until the tack or fog coat has cured.

Traffic shall not be permitted to travel on prime coat until 6 hours after application or until it has cured. After this period of time, excess asphalt material remaining on the surface shall be blotted by sand before traffic is permitted to travel on the surface.

10.32. Hot Mix Asphaltic Concrete

10.32.1. General

The work of this section pertains to urban roadways. The Municipal District, in their sole discretion, may apply Alberta Infrastructure and Transportation guidelines for asphalt or road construction for any roadway in their jurisdiction.

10.32.2. Work Included

The work described in this section is that required for construction of a hot-mix asphaltic concrete surface course.

10.33. Products

10.33.1. Aggregates

The Contractor shall submit to the Municipal District at least ten (10) work days before start of paving, a mix design using the Marshall Method and performed by an independent testing laboratory acceptable to the Municipal District. The Contractor shall submit a separate mix design for each change in the supplier or source of materials. No mixing of asphaltic concrete shall proceed until the job mix formula or any subsequent change is approved by the Municipal District.

Preliminary approval of the aggregate as represented by the samples shall not constitute general acceptance of all material in the deposits or source of supply; acceptance shall be subject to field tests taken at the discretion of the Municipal District.

Materials may be considered unsuitable even though particle sizes are within the limits of the gradation sizes required if particle shapes are thin or elongated or any other characteristic precludes satisfactory compaction, or if the material fails to provide a pavement suitable for traffic. The acceptability of the final material shall be determined by the Municipal District.

10.33.2. Gradation

Aggregate shall consist of hard, durable, uniformly graded, crushed gravel, free of coatings of silt or clay, and shall not contain organic or soft materials that break up when alternately frozen and thawed, or wetted and dried, nor other deleterious materials.

Coarse aggregate is aggregate retained on the 5000 µm sieve. Fine aggregate is aggregate passing the 5000 µm sieve.

The combined aggregates shall meet the following gradation requirements when tested to ASTM C136 and C117.

Gradation Requirements	
Sieve Size (mm)	% Passing by Mass
12.500	100
10.000	83-92
5.000	55-70
1.250	26-45
0.630	18-38
0.315	12-30
0.160	8-20
0.080	4-10

Additional properties that shall be met are as follows:

- Plasticity Index - Non Plastic, ASTM D424-59
- Los Angeles Abrasion Gradation "B" - 35% maximum loss by mass, ASTM C131-76

10.34. Asphalt Cement

The asphalt cement shall be uniform in character, free of water and shall not foam when heated to 175 degrees Celsius and it shall have a penetration value of 150-200 mm at 25°C and shall meet all specifications as to viscosity, flash point, thin film oven test and solubility established by Alberta Infrastructure and Transportation for the Premium Grade 150 – 200 (A) Asphalt Cement.

10.34.1. Design Mix

A qualified testing laboratory engaged by the Contractor shall be employed to prepare a mix design and job mix formula for the aggregate on which the tender is based. The mix design and job mix formula shall be submitted to the Municipal District for approval a minimum of 10 days prior to paving. No paving shall commence before the Municipal District's approval is given for the mix design or job mix formula.

The laboratory mix design shall be based on the Marshall Method. Absorption of asphalt into the aggregate shall be taken into account using the ASTM bulk specific gravity of the aggregate in calculating optimum asphalt content.

The mix design shall meet the following specifications:

Mix Design		
		Local Residential Only
Number of compaction blows each face of specimen:	75	50
Min. Stability (kN) at 60 degrees Celsius:	10	5.3
Flow (mm):	2 to 3.5	2 to 4
% Air Voids total mix:	3.5 to 4	3.5 to 4
% Voids in Mineral Aggregate (min):		
at 3.5% air voids	13.5	13.5
at 4% air voids	14	14
% aggregate Voids Filled with Asphalt:	65 to 75	65 to 78
Retained Stability (%)(min):	70	70
Minimum Theoretical Film Thickness (µm)		
Design Air Voids (%)		
4.0 and 3.9	6.0	6.5
3.7 and 3.8	6.1	6.6
3.5 and 3.6	6.2	6.7
Crushed Fragments: minimum material retained on the 5 000 µm with two crushed faces:	70	60
Manufactured fines content as a percentage of fine aggregate mass (minimum)	70	50

The mix produced shall conform to the job mix formula approved by the Municipal District and to the following tolerances:

1) The percent of asphalt in the mix shall not vary by more than 0.3% from the percentage indicated in the approved mix design.
2) The mixing temperature for asphaltic materials shall not vary from those specified in the job mix formula by more than 9 degree Celsius. In no case shall the mixing temperature exceed the maximum mix temperature indicated from the asphalt temperature-viscosity curve data.

10.34.2. Data

The Contractor shall make available to the Municipal District any of the following upon request:

- Temperature-viscosity data or curves, as obtained from the refineries, for the various grades and types of asphaltic material.
- All test data performed by the testing company licensed to practice in the Province of Alberta.

10.34.3. Changes

The Contractor shall notify the Municipal District of all proposed changes in the mix proportions. No changes shall be made until a representative of the Municipal District is there to witness the change.

10.35. Execution

10.35.1. Transportation

The mixture shall be transported from the mixing plant to the work in vehicles with tight metal bottoms previously cleaned of all foreign materials. The vehicle shall be suitably insulated, and each load shall be covered with canvas or other suitable material of sufficient size to protect it from weather conditions.

The inside surface of the box may be lubricated with a light coating of soap or detergent solution; petroleum derivatives shall not be permitted. Any accumulation of asphaltic material which has collected in the box shall be thoroughly cleaned before loading with hot mix. Trucks shall be clean of mud or any substance which could contaminate the working area.

10.36. Preparation of Existing Surface

10.36.1. General

Before the asphalt mix is placed, dirt and other objectionable material shall be removed from the surface to be paved, by brooming or other methods and a tack coat shall be applied.

Contact edges of existing mats and contact faces of curb, gutters, manholes, sidewalks and other structures shall be coated with a film of liquid asphalt material before placing the asphalt mix.

10.36.2. Preliminary Levelling

Areas that require preliminary levelling will be identified. Generally areas that show depressions, rutting or other deformations to a depth of 15 mm or greater will be designated for preliminary levelling and all the following shall apply for acceptance.

1) Asphalt mix for preliminary leveling shall be spread by means of a motor grader or other approved method.
2) only pneumatic tired rollers will be allowed for compaction, and a minimum density of 91.0% of the Marshall density, is required.
3) preliminary leveling is intended to be a separate operation and shall not be done as part of the construction of the subsequent lift of asphaltic concrete pavement.

10.36.3. Placing

Unless otherwise permitted by the Municipal District, the mixture shall be spread by a mechanical self-powered paver, with an automatic levelling device and automatic grade control capable of spreading the mix without segregation or tearing, in thicknesses varying from 12 mm to 150 mm and in widths greater than 3.0 m and to true line, grade and cross-section as shown on the plans.

The mixture shall be laid at a temperature not lower than 120 degrees Celsius or higher than 140 degrees Celsius. The air temperature shall not be less than 2 degrees Celsius and rising, no frost shall be present and the roads dry.

Where the asphaltic surface course is to be placed in 2 lifts, the first lift shall be placed, finished and compacted for the full width as shown on the drawings, prior to commencing on the second lift. The maximum lift thickness is 75 mm.

In placing the second lift, the individual mixture spreads shall be aligned in a manner such that the longitudinal joints in each layer will not coincide.

In narrow areas, deep or irregular sections, intersections, turnouts or driveways, where it is impractical to spread with a paver, the Contractor may use hand methods as directed by the Municipal District.

10.36.4. Weather Limitations

The mixture shall not be placed:

1) during periods of rain or when there is an imminent danger of rain;
2) during excessive winds; or
3) when air temperature is 2 degrees Celsius or cooler or frost is present on the surface.

10.36.5. Joints

The mixture shall be laid so that all longitudinal joints are made while the first mat of the 2 being laid is still hot. A narrow strip along the edge of a mat which is joined with another asphalt mat shall be left without rolling until the adjoining mat has been placed against it. The joint which is formed shall be rolled immediately after the adjacent mat has been placed to ensure a bonding of the material while the asphalt is still hot.

Transverse joints shall be carefully constructed and thoroughly compacted to provide a smooth-riding surface. Joints shall be straight-edged to assure smoothness and true alignment and shall be offset at least 1 metre from joints of adjacent mats.

All concrete or metal structures such as gutters, manholes, etc. shall be painted with an approved bituminous material prior to placing the asphalt.

10.36.6. Tolerance and Penalties

The pavement shall have the thickness specified on the Municipal District's drawings. Areas suspected to be deficient shall be cored, as directed by the Municipal District, on the basis of 1 core for every 1000 square metres of pavement. At least I core shall be taken at the designated Marshall location.

Should the asphalt be found to be deficient in thickness, the Contractor will be permitted to take 2 additional cores in an effort to isolate and confirm the deficient areas. The location of the two additional cores shall be located no further than half way between the deficient core, and the next adjacent core, or contract boundary.

The exact location of the core locations are to be determined by the Contractor, and approved by the Municipal District. The Contractor shall be responsible for all costs associated with the recoring of the asphalt.

A deficiency penalty shall be assessed according to the following:

Tolerance and Payments	
Thickness Deficiency (mm)	Payment Reduction Factor %
0 to 5	0
6 to 9	10
10 to 12	25
13 to 15	50
Over 15	Remove and Replace

No additional payment will be made to the Contractor for greater thicknesses.

The Contractor shall fill all core holes within a maximum period of 24 hours.

10.36.7. Densities

Densities shall be based on core samples, each of which shall represent approximately 1000 square metres per constructed lift. Asphalt densities are specified as 97% of the standard laboratory Marshall. A minimum of 1 Marshall per day shall be performed with 1 core sample taken at a designated Marshall location.

If any core fails to meet the density specified, no more than 2 additional cores may be taken by the Contractor within 1 metre of the first core sample, and the average density of the three cores shall represent the area. No additional rolling to achieve a more favourable density shall be allowed without the written consent of the Municipal District. The Contractor shall be responsible for all costs associated with the recoring of the asphalt.

If the densities are less than specified, a deficiency penalty shall be assessed according to the following:

Densities and assessed Deficiency Penalties	
Field Density	Payment Reduction Factor (%)
97.0 to 96.6	0
96.59 to 96.1	3
96.09 to 95.6	12
95.59 to 95.0	25
<95.0	Remove and Replace

All asphalt below 95% standard Marshall Density shall be removed and replaced at the Contractor's expense.

No adjustment to the unit price is to be made for areas with a density higher than that specified.

10.36.8. Smoothness

The surface of the compacted pavement shall be true to the required grade and cross-section with a smooth riding quality acceptable to the Municipal District.

In addition to the above, when checked with a 3.0 metre straight-edge, held in successive positions parallel or perpendicular to the centre line and in contact with the surface, the pavement surface shall not deviate from the straight-edge by more than 3 mm.

If, in the opinion of the Municipal District, an objectionable riding surface exists, the Contractor shall either grind and resurface with an asphalt overlay or remove and replace the asphalt surface.

10.36.9. Texture

The completed pavement shall have a tightly knit texture and shall be free from segregation and surface cracking. Mixes that are excessively tender or difficult to roll shall be redesigned in order to remedy the situation. The new design shall meet all of the requirements of this section, and shall be submitted to the Municipal District for approval at least three (3) working days prior to its use.

10.36.10. Traffic

No traffic shall be allowed on the finished surface until it has cooled to atmospheric temperature.

10.37. Asphaltic Concrete Pavement Milling

10.37.1. General

This section specifies requirements for milling or grinding existing asphalt pavement to lines, grades, and typical cross sections indicated on plans or as established by the Municipal District.

10.37.2. Protection

Protect existing pavement, utility appurtenances, traffic detector loops, home runs, light units, and structures from damages. In event of damage immediately replace or make repairs to approval of the Municipal District and at no additional cost to the Owner.

10.38. Execution

10.38.1. Preparation

Inspect site and verify with the Municipal District areas designated for milling.

Arrange for temporary traffic control in areas where signal light traffic detector loops and home runs are to be removed.

10.38.2. Equipment

Use cold milling or grinding equipment capable of removing part of asphalt pavement surface to depths or grades indicated with a tolerance of +/- 10 mm within areas designated.

Sweeping and collecting equipment capable of removing all residues from planning operation.

Apply water as necessary during milling operation to suppress dust.

10.38.3. Asphalt Removal

Mill asphalt pavement to grade and cross section dimensions indicated or as directed by the Municipal District.

Exercise care to avoid disturbance to pavement or other work designated to remain.

Keep drainage system clear of loose and waste materials.

Asphalt is to be removed to a uniform level including areas surrounding valves, manholes or other appurtenances.

Remove all residue materials resulting from milling operation.

Milling may be restricted on designated roads and streets with particular time frames throughout the week. The Contractor shall abide by these restrictions.

Surface to be left in a condition that can be reopened to traffic following removal of grindings.

10.38.4. Disposal of Materials

Removed pavement material is the property of the Owner and is to be stockpiled at a location designated by the Municipal District.

10.38.5. Finish Tolerances

Milled surfaces to be within +/- 10 mm of specified grade but not uniformly high or low.

10.39. Asphalt Pavement Crack Routing and Sealing

10.39.1. General

The Work Consists of routing, cleaning and drying cracks in pavement surfaces, supplying crack sealant material and sealing the routed cracks with the sealant.

10.39.2. Material

Hot poured rubberised asphalt products generally accepted for this work are Husky 1G11, CRAFCO 522, KOCH 9030 or Beram 195LM.

The use of other materials will be subject to the approval of the Municipal District. In situations where the Contractor obtains approval to use a material not included in the above list, he shall provide the Municipal District with the following information 5 days prior to commencing the Work:

1) Name and mailing address of the crack sealant supplier and manufacturer
2) Name of crack sealant product to be supplied
3) Written confirmation from the manufacturer that the crack sealant to be supplied meets all specified requirements along with test results that demonstrate that the product meets all specified requirements.

The Contractor shall verify that the crack sealant delivered and used in the Work is the type and grade ordered.

10.39.3. Procedure

No Work shall be performed during rain, snow or when the pavement surface is wet.

The crack sealant shall not be applied when the pavement temperature is below 10 degrees Celsius.

Unless otherwise directed by the Municipal District, all cracks between 2 mm and 12 mm in width shall be routed and sealed. All cracks shall be routed to a minimum width of 20 mm and a depth of 10 mm.

Prior to the application of crack sealant, the entire road surface shall be cleaned ensuring all loose material and moisture is removed from the routed cracks and surrounding areas.

Crack sealant shall be heated and applied in accordance with the manufacturer's recommendations. Routed cracks shall be filled with crack sealant such that upon cooling the sealant shall not be more than 3 mm below the pavement surface.

Excessive crack sealant shall be removed from the pavement surface immediately following application. Traffic shall be kept off sealed cracks until the crack sealant has cured. At locations such as intersections where this is not practical, the Contractor shall prevent tracking by applying a blotting agent to the crack sealant. When a blotting agent is used, it shall not be applied until the sealant has cooled sufficiently to prevent inclusion of the blotting agent into the sealant.

When necessary, the Contractor shall supply one of the following blotting agents:

1) Screened sand with a maximum topsize of 2 mm
2) Cement
3) Fly ash

The use of other blotting agents shall be subject to the approval of the Municipal District.

Fuel, asphalt and any other spills shall be cleaned up to the satisfaction of the Municipal District at the Contractor's expense.

10.39.4. Sampling and Testing

The Contractor shall supply material samples to the Municipal District for Quality Assurance (Audit) testing purposes when requested.

10.39.5. Acceptance Criteria

Evaluation of the Work will be based on a visual inspection by the Municipal District. To be acceptable, the Work must conform to the following:

1) All routed cracks conform with the specified rout profile
2) The rout conforms to the path of the crack with no part of the crack outside or touching the edge of the rout cross section
3) All routed cracks have been sealed
4) At least 95% of the cracks treated have been filled with an adequate amount of crack sealant material.

Failure to comply with the acceptable criteria will result in the Contractor re-treating all failed cracks at their own expense.

10.40. Asphaltic Pavement Crack Sealing

10.40.1. General

The work consists of supplying crack sealant and sealing cracks in asphalt concrete pavement.

10.40.2. Materials

The type and grade of asphalt/emulsified asphalt material generally accepted for this work are Alberta Infrastructure and Transportation designated EC101 or HC200.

The use of other materials will be subject to the approval of the Municipal District. In situations where the Contractor obtains approval to use a material not included in the "Recognized Products List", he shall provide the Municipal District with the following information 5 days prior to commencing the Work.

1) Name and mailing address of crack sealant supplier and manufacturer
2) Name of crack sealant product to be supplied
3) Written confirmation from the manufacturer that the crack sealant to be supplied meets all specified requirements along with test results that demonstrate that the product meets all specified requirements.

The Contractor shall verify that all crack sealant delivered and used in the Work is the type and grade ordered.

10.40.3. Procedure

No Work shall be performed during rain or snow or when the pavement surface or cracks are wet.

Crack sealant shall not be applied when the atmospheric temperature at the work site is below 10 degrees celsius.

All cracks within the entire width of the pavement surface, which are between 5 mm and 25 mm in width, shall be sealed.

Prior to the application of crack sealant, the Contractor shall ensure that the road surface adjacent to the cracks is clean.

Hot Pour crack sealant shall be heated to the temperature specified by the manufacturer. Overheating will not be permitted.

Crack sealant shall be applied within the manufacturer's specified temperature range. Crack sealant shall be applied so that the crack is flush filled immediately following application and a thin overband of sealant extends approximately 25 mm beyond the edges of the crack. Excess crack sealant shall be removed from the pavement surface immediately following application. Removal shall involve the use of a squeegee, starting from the centreline and proceeding to the shoulder.

Traffic shall be kept off sealed cracks until the crack sealant will not track under action of traffic. At locations such as intersections where this is not practical, the Contractor shall prevent tracking by applying a blotting agent to the crack sealant.

When necessary, the Contractor shall supply one of the following blotting agents:

1) Screened sand with a maximum topsize of 2 mm

2) Cement

3) Fly ash

The use of other products shall be subject to the approval of the Municipal District.

Fuel, asphalt and other spills shall be cleaned up to the satisfactory of the Municipal District at the Contractor's expense.

10.40.4. Sampling and Testing

The Contractor shall supply material samples to the Municipal District for Quality Assurance (Audit) testing purposes when requested.

10.40.5. Acceptance Criteria

Evaluation of the Work will be based on a visual inspection by the Municipal District. To be acceptable, all applicable cracks must be treated as specified herein and at least 95% of the treated cracks must contain an adequate quantity of crack sealant material.

Failure to comply with the acceptable criteria will result in the Contractor re-treating all failed cracks at his own expense.

Cold pour rubber filled bituminous emulsified pavement crack sealant shall conform to the requirements specified in the following table, for the grade designated by the Municipal District:

Specification for Cold Pour Rubber Filled Bituminous Emulsified Pavement Crack Sealant

Asphalt Grade	EC-101		Test Method	
Requirements	Minimum	Maximum	Alberta Transportation	A.S.T.M
Uniformity	Pass		9.1	-
Viscosity @ 25°C, Krebs units	70	90	9.2	D562
Solids Content by Evaporation, % by mass	59	-	9.3	D244
Ash Content, % by mass	-	2.0	9.4	-
Rate of Curing, %	-	-	9.5	-
24 hour	50	-	-	-
6 days	80	-	-	-
Low Temperature Flexibility	Pass		9.6	-
Elastic Recovery, %	40	-	9.7	-

Specifications for Hot Pour Bituminous Crack Sealant

Hot pour bituminous crack sealant shall conform to the requirements specified in the following table, for the grade designated by the Municipal District:

Asphalt Grade	HC200		A.S.T.M Test Method
Requirements	Minimum	Maximum	
Softening Point, °C	80	95	D36
Flash Point, C.O.C. , °C	230	-	D92
Penetration	-	-	D5
@ 0 °C, 200g, 60 sec.	30	-	-
@25 °C, 100g, 5 sec.	55	60	-
@46 °C, 50g, 5 sec.	-	150	-
Ductility @ 25 °C	45	-	D113
Solubility in Trichloroethylene, % by mass	98	-	D2042
Viscosity @ 177 °C, mm^2/s	-	1200	D2170

10.41. Pavement Markings

10.41.1. Samples

If requested by the Municipal District, submit the following material sample quantities at least 4 weeks prior to commencing work.

1) Two 1 L samples of each type of paint.
2) One 1 kg sample of glass beads.
3) Sampling to CGSB 1-GP-71.

Mark samples with name of project and its location, paint manufacturer's name and address, name of paint, CGSB specification number and formulation number and batch number.

10.42. Products

10.42.1. Painted Markings

To CGSB 1_GP_74M, alkyd traffic paint.

Colour: to CGSB 1_GP_12C, yellow 505_308, white 513_301.

Thinner: to CAN/CGSB_1.5.

10.42.2. Permanent Markings

The use of other permanent marking materials that do not meet the following requirements will be subject to approval by the Municipal District. Acceptance during the warranty period will be based on the following:

1) not lift from the pavement,
2) exhibit no material loss within 4 weeks of installation,

3) not deteriorated by contact with sodium, calcium chloride or traffic residue,

4) show no appreciable deformation or discoloration under exposure to traffic and road temperatures between –40°C and 40°C and,

5) maintain their original dimension and placement without chipping or cracking.

Cold Plastic Marking: two-component, cold-extruded and cold-curing, having a specific gravity of 1.9 minimum at 25°C.

Hot Thermoplastic Marking: hot-extruded, having a specific gravity of 2.0 minimum at 25°C, having a softening point of 90°C minimum according to ASTM E28.

Both cold and hot plastic markings shall conform to the following:

1) Water Absorption: 0.5% maximum by mass retained water after 24 hour immersion, according to ASTM D570 Procedure A.

2) Impact Resistance: minimum 1.13 J at 25°C when material is cast into bar of 25 mm^2 cross-section by 75 mm long, with 25 mm extending above vice jaws in a cantilever beam (Izod type) tester using the 2.82 J scale, according to ASTM D256 Method C.

3) Abrasion Resistance: maximum weight loss of 0.50 g when subjected to 200 revolutions on Taber abrader at 25°C using H-22 Calibrade wheels weighted to 500 g with sample kept continuously wet with distilled water. Prepare test sample with representative material placed on 100 mm square plate, 3 ±0.1 mm thick.

4) Chemical Resistance: Test samples of 50 mm square, no degradation after exposure to:

   - 24 hours immersion in 5% NaCl.
   - 24 hours immersion in 5% CaCl.
   - 1 hour spot test with mineral oil.

5) No deterioration when in direct contact with asphalt cement in asphalt materials, or with sodium chloride, calcium chloride or other de-icing chemicals.

6) Non-toxic and not harmful to persons or property when in hardened state.

7) No discoloration from sunlight ultraviolet exposure and no bond failure for warranted life of material.

Glass Beads: minimum 80% true spherical shape; clear of cloudiness, dark inclusions, trapped air, or other defects; and conforming to the following:

1) Index of Refraction: 1.5 minimum when tested in liquid immersion at 25°C according to CGSB 1-GP-71 Method 49.1.

2) Gradation of glass beads for mixing with and for surface application on thermoplastic material, tested according to ASTM D1214:

Gradation of Glass Beads	
Sieve Size (mm)	**% Passing by Mass**
850	90 – 100
300	15 – 50

180	0 – 10

Premarking Paint: as reviewed by the Municipal District.

Groove Filler: LRS 424 or approved equal.

10.42.3. Mix Formulation

Glass Sphere Content: minimum 20%, maximum 30% by mass of thermoplastic material.

White Colour: brilliant white, 70% minimum when measured with the Gardner Multi-Purpose Reflectometer 0, 45° daylight luminous directional reflectance, with a green filter.

Yellow Colour: conforming to CGSB Colour #505-308 or U.S. Federal Standard 595a, Colour Chip 33538, 45% minimum when measured with the Gardner Multi-Purpose Reflectometer 0, 45° daylight luminous directional reflectance, with a green filter. Colour tolerance to be within limits of U.S. Department of Transport Yellow Tolerance Chart PR#1 December 1972.

No formulation change unless approved by the Municipal District. Any significant change will be subject to field trials.

10.43. Execution

10.43.1. Equipment Requirements

Paint applicator to be an approved pressure type distributor capable of applying paint in single, double and dashed lines. Applicator to be capable of applying marking components uniformly, at rates specified, and to dimensions as indicated, and to have positive shut-off.

Grooving machine subject to the Municipal District's approval.

10.43.2. Condition of Surfaces

Pavement surface to be dry, free from ponding water, frost, ice, dust, oil, grease and other foreign materials.

Remove conflicting markings.

10.43.3. Traffic Control

Conduct all traffic control to the requirements as specified.

10.43.4. Paint Application

Lay out pavement markings and review with the Municipal District.

Apply paint only when air temperature is above 10°C, wind speed is less than 60 km/h and no rain is forecast within next 4 hours.

Apply traffic paint evenly at rate of 3.0 m2/L.

Paint lines to be of uniform colour and density with sharp edges.

Thoroughly clean distributor tank before refilling with paint of different colour.

10.43.5. Cold Plastic Application

Mix components and apply cold plastic marking according to manufacturer's surface application procedure, to a thickness of 2 mm minimum and 3 mm maximum.

Apply when ambient temperature is between -10°C and 30°C.

Apply glass beads to surface of extruded material before it has set, at a rate of 140 to 250 g/m^2.

Let marking cure into a hardened state.

10.43.6. Hot Thermoplastic Application

Cut groove into pavement surface to designated width and depth. Remove grindings and haul to designated location. Sweep or air blast groove clean and dry.

Heat material and apply according to manufacturer's hot extrusion process.

Fill groove with hot molten material. Do not overfill more than 3.0 mm above pavement surface.

Apply glass beads to surface of extruded material while it is still molten at a rate of 140 to 250 g/m^2.

Trim surplus material to give clean straight edges.

Let marking cool to a hardened state.

10.43.7. Protection and Cleanup

Do not permit traffic over applied markings until they have adequately hardened.

Protect surrounding areas and structures from disfiguration and damage. Repair any damage as directed by the Municipal District.

On completion of work, clean up and leave site free of debris and waste matter.

10.43.8. Tolerance

Paint markings to be within plus or minus 12 mm of dimensions indicated.

Remove incorrect markings.

Cold Plastic Marking:

Measurement: The quality assurance laboratory will measure suspect markings with a surface micrometer. The average of 5 measurements will represent 300 m of marking, or one job site, whichever is less.

Thickness Deficiencies: Where a significant number of deficiencies occur in the work, involving average thicknesses greater than 3.0 mm or less than 1.8 mm, the Municipal District may order removal and replacement, or application of additional material.

If surface dishing deeper than 0.5 mm occurs, the Municipal District may order removal and replacement.

The quality assurance laboratory will determine the width of suspect markings by the average of 5 measurements representing 300 m of marking, or one job site, whichever is less.

10.43.9. Hot Thermoplastic Marking

Measurement: The quality assurance laboratory will core suspect markings. The average thickness of 3 cores will represent 300 m of marking, or one job site, whichever is less.

Overfill Thickness: That portion of marking above pavement surface will receive no additional payment. If overfill exceeds 3.0 mm, the Municipal District may order removal and replacement of marking.

Groove Thickness Deficiencies: Where a significant number of deficiencies occur, involving average thicknesses less than 70% of that specified, the Municipal District may order removal and replacement.

If surface dishing deeper than 0.5 mm occurs, the Municipal District may order removal and replacement. Variations in asphalt surface profile may be taken into consideration.

The quality assurance laboratory will determine the groove width of suspect markings by average measurement of 3 cores representing 300 m of marking, or one job site, whichever is less.

10.43.10. Width Deficiencies

Where a significant number of deficiencies occur greater than 10 mm in average widths of cold plastic, or in average groove widths of hot thermoplastic, the Municipal District may order removal and replacement.

10.43.11. Protection of Completed Work

Protect pavement markings until dry.

10.43.12. Protection

Place temporary covering on signboards where required. Covering to be capable of withstanding rain, snow and wind and be non-injurious to signboard. Replace deteriorated covering and remove covers as reviewed by the Municipal District.

10.43.13. Correcting Defects

Correct defects, identified by the Municipal District, in consistency of reflectivity, colour or illumination.

10.44. Traffic Control Devices-Roadway Signs

Plans shall be provided to the Director of Field Services that depicts the locations and details of all traffic control devices (traffic signs and traffic signals), street name signs and pavement markings.

All traffic control devices and pavement markings shall be designed and installed in accordance with the manual "Uniform Traffic Control Devices for Canada" as issued and revised from time to time by the Transportation Association of Canada (formerly RTAC).

Guide and information signing shall be designed and installed in accordance with the "Urban Guide and Information Sign Manual" as issued by the Alberta Government.

Street signing shall be standard aluminium, white on green, with a minimum vertical dimension of 150 mm.

10.44.1. Materials

All signs shall utilize High Intensity reflectorized material to ASTM-D4956, Type III.

All sign posts shall be U Channel, galvanized Schedule 40 steel unless otherwise approved in writing by the Director of Field Services.

Along arterial streets and at arterial street intersections, pavement markings shall be of a "permanent" type, thermoplastic. Painted markings are acceptable elsewhere.

10.44.2. Installation

All traffic control signs shall be mounted to provide 2.0 m vertical clearance to the lowest portion of the sign, unless otherwise approved by the Director of Field Services.

All signs shall be mounted to provide a minimum of 0.3 m of horizontal clearance from back of curb or back of walk. Where there is no curb or walk within the right-of-way, the sign location is to be approved by the Municipal District.

10.44.3. Roadway Signs

Any product that meets the requirements of Alberta Transportation Standard Specifications for Highway Construction, Specification 5.18 Supply of Permanent Highway Signs, Posts and Bases or Highway Maintenance Specification, Specifications 54.12 Supply of Permanent Highway Signs; Specification 54.13 Maintenance of Highway Signs; qualifies under this section.

1) **Standard Signs**

Aluminum for standard signs shall be a minimum of 2 mm flat sheet tension leveled, sign grade aluminum and shall conform to the requirements of ASTM B209M, "Specification for Aluminum and Aluminum-Alloy Sheet and Plate", Alloys 6061-T6 or 5052-H38.

2) **Non-Standard Sign**

Extruded Aluminum panels for major signs, shall be Alcan Shape #73247 with anodize treatment and shall conform to ASTM B221M "Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes and Tubes:, Alloys 6061-T6 or 6063-T5.

Plywood – Sanded one side

3) **Reflective Sheeting**

- Regulatory/Warning/Information Signs

Reflective sheeting shall meet or exceed minimum requirements as specified in ASTM-D4956 Performance Requirements Type III, High Intensity Retro-reflective Sheeting. 3M (High Intensity Grade) 3800 or equivalent.

- Temporary Orange Work Zone/Construction Signs

The orange portion of all signs and barricades shall be fully reflectorized using High Brightness, Retroreflective Non-Metalized, Prismatic Sheeting Material which incorporates durable, transparent, fluorescent pigment and meets the brightness requirements as specified in ASTM D4956 Type VIII sheeting material. 3M Durable Fluorescent (3924S) or equivalent.

- School Zone and School Cross Walk Ahead Signs

3M Diamond Grade Series 3983 (Fluorescent Yellow Green) or equivalent.

- Stop, Yield, Wrong Way, Do Not Enter Signs and Overhead Signs Without Illumination

3M Diamond Grade (VIP) Series (3990) or equivalent.

Warning Signs (Design Bulleting #50/2007)

3M Vinyl Roll Up RS-33 Fluorescent Pink, 3M Diamond Grade Cubed 4081 Series (DG^3) or equivalent.

4) **Sign Post**

Any product that meets the requirements of Alberta Transportation Specification TEB 1.83 Breakaway Ground Mounted Bases Steel I-Beam Posts qualifies under this section.

- Cluster Frames

Any product that meets the requirements of Alberta Transportation Specification TEB 1.71A C-Cluster Frame qualifies under this section.

The Frames shall be painted with rust resistant aluminum paint or a metal primer and aluminum paint suitable to the Engineer.

- Breakaway Steel

Any product that meets the requirements of Alberta Transportation Specification TEB 1.82 Breakaway Ground Mounted Bases Steel I-Beam Posts qualifies under this section. Steel "W" or "S" shapes with breakaway slip base.

- Post Support

Break Safe Support System

- Wood Posts

Wood posts shall be pine or spruce No. 2 or better, as per NLGA, CCA (Copper, Chromate, Arsenate) pressure treated in accordance with CSA 080. Material shall be free from wane. Wood 100 mm x 100mm, Wood 150 mm x 200 mm or Wood 100 mm x 150 mm.

10.44.4. Design Requirements

Sign supports and appurtenances to be capable of withstanding summation of following loads:

1) Wind and ice loading specified to be consistent with anticipated loads in locality of installation. Refer to current edition of the National Building Code of Canada and/or applicable provincial building code.
2) Dead load of signboards, sign supports and appurtenances.
3) Ice load on one face of signboards and around surface of all structural members and appurtenances.

Structural deflections and vibration in accordance with American Association of State Highway and Transportation Officials (AASHTO), "Specifications for the Design and Construction of Structural Supports for Highway Signs".

Street name signs shall be green with white lettering. Lettering sizes shall be as follows:

Arterial and major collector roadways – 250mm an a 300mm blade

Minor collector and local roadways – 100mm on a 150mm blade

Signs requiring single posts shall be supported with steel posts. Signs that are 1500mm or greater in width require two wooden posts.

10.44.5. Shop Drawings

Submit shop drawings for signage structures indicating product data and design.

10.44.6. Products

10.44.6.1 Sign Supports

Steel posts: to CAN_G40.21, 3.1 m long, flanged "U" shaped in cross section, measuring 65 mm wide by 30 mm deep. Metal thickness: 4.5 mm. Hot dipped galvanized: to CAN/CSA_G164

Base plates for mounted signs: to ASTM B209M.

Fasteners: bolts, nuts, washers and other hardware for roadside signs to be cast aluminium alloy, or galvanized steel.

Wooden posts: shall be pine or spruce structural framing no. 2 or better, as per NLGA 1980 Rules Par. 123C. Posts are to be CCA (Copper, Chromate, Arsenate) pressure treated in accordance with CSA 080.14 and CSA 081.1. Material shall be supplied free from wane and shall be clean and dry. Post sizes to be supplied shall be 100mm x 150mm dimension lumber, in lengths ranging from 3650mm to 6100mm.

10.44.6.2 Signboards

Aluminium sheet shall be tension levelled, sign grade aluminium and conform to ASTM B209M, Alloys 6061-T6 or 5052-H38 pre-cut to required dimensions. Minimum thickness to be 1.6 mm for signboards up to 750 mm wide. Minimum thickness to be 2.0 mm for signboards 750 to 1200 mm wide.

Connecting straps and brackets to ASTM B209M.

Reflective sheeting shall meet or exceed the minimum requirements specified in ASTM-D4956 Performance Requirements Type III, High Intensity Retro Reflective Sheeting.

Signs requiring plywood backing shall be ½" or ¾" 100/100 or 120/120 Hi-Density.

10.44.7. Fabrication

Signboards:

Aluminium blanks: Degrease, etch and bond with chemical conversion coating. Clean surfaces with xylene thinner. Dry. Aluminium signboards are to be painted before installation. Spray and bake face of signboards with two coats of enamel in accordance with CAN/CGSB_1.104.

Sign identification:

Apply sign number and date of installation with 25 mm high stencil painted black letters on lower left back face of each signboard.

10.44.8. Execution

10.44.8.1 Installation

Sign Support:

1) Erect supports where indicated. Where separate concrete footings have been placed, erect posts with base plates resting on aluminum nuts and restrained with nuts and washers.
2) Coat underside of base plate with corrosion protective paint before installation.

3) Close open aluminum tubes and posts with aluminum cap.
4) Erect posts plumb and square to details as indicated.
5) Single channel steel posts are to be driven to required depth without damage to posts. If rock or concrete is encountered, auger hole to required depth and set post in sand.
6) In finished concrete or asphalt surfaces, backfill with concrete or grout. Protect from adverse conditions until cured.
7) Wooden post installations are to be excavated with an auger. Compact bottom of hole to provide firm foundation. Set post and backfill in 150 mm layers with excavated material. Compact each layer before placing each subsequent layer.
8) Permissible tolerance is ±12 mm departure from vertical.

Signboard:

1) Fasten signboards to supporting posts and brackets as indicated.
2) Use strapping with crimped or bolted connections where signs fastened to utility poles.

10.44.9. Naming of Neighborhoods, Districts, Streets, Parks and Public Facilities

10.44.9.1 General Naming Guidelines

The Name and assigned prefix or suffix shall not be duplicated, or phonetically similar for any development area, roadway, district, or public facility within Municipal District of Lesser Slave River No. 124.

Roadways within the same neighborhood may bear the same name but with a different suffix providing the roadways intersect. However, similar sounding street names in the same neighborhood shall be avoided.

In the event that a theme is assigned to a neighborhood or an approved Area Structure Plan area, the name of all roads within the plan area shall be consistent with the theme name for the Area Structure Plan, unless otherwise approved by Council.

Names should not be suffixed with teh word "Park" unless the facility falls under the park naming category section outline in Section 2.4.

Names of persons of honor, community importance or historical significance in the municipality should be used where appropriate, and generally correspond to the alphabetical designation or the theme of the area and with the procedures outlined in Section 4.0.

- Street names will utilize names of historical significant.
- The Municipal District would like to honor our veterans and those individuals who have fought for Canada by including these individuals in our criteria for Street Naming.
- Names should give a sense of place, continuity, belonging and celebrate distinguishing characteristics and uniqueness of the Municipal District.
- Names should maintain long standing local area identification and/or recognition with the residents of the Municipal District.
- Street names may strengthen neighborhood identity.

- Street names after individuals may reflect the significant contribution they have made to the Municipal District, taking into consideration their length of residency.
- Street names may attempt to reflect a direct relationship or association that existed between the place of residence of the individual and the location of the street.
- Street names may recognize native wildlife, flora, fauna or natural features related to the community and the Municipal District.
- The Municipal District has the right to refuse any or all street names.

Names shall be determined and applied in accordance with the specific requirements set out in these guidelines and procedures. Final approval of neighborhood names, district names, street names, park names and public facility names shall rest with Council.

All requests for street names shall be made in writing and have a completed Street Name Request Form found in the Forms Section. The requests shall include background information concerning the rationale for the request and geographical association, biographical information and documentation providing support for the request. The applicant must assume responsibility for obtaining the support for the request where applicable (Appendix D).

10.44.9.2 Naming Procedures

10.44.9.3 Neighborhood/Districts

All neighborhood/district naming requirements shall be specified at the Area Structure Plan or Area Redevelopment Plan stage, or in the absence of these two plans, at the subdivision plan stage.

Before final approval of an Area Structure Plan or Area Redevelopment Plan, proponents shall submit a neighborhood/district theme(s) consisting of alphabetical designation(s) to Planning & Development Services for circulation, review and recommendation, which will subsequently be forwarded to Council for consideration and final approval. Upon approval of an Area Structure Plan, or Area Redevelopment Plan and subsequent approval of neighborhood/district naming requirements by Council, all proposed names for that area (i.e. Subdivision names, street names, park names, public facility names shall correspond to the approved alphabetical designation.

Changes in the names of existing neighborhoods and districts shall be referred to Planning & Development Services for review and recommendation, and referred to Council for a decision.

10.44.9.4 Subdivisions

At the time an application for subdivision is submitted for approval the following information shall be provided:

1) a compiled list of proposed street/subdivision name(s) on a tentative plan. This list/plan will be circulated to Planning & Development Services for circulation, review and preparation of a report and recommendations to Council for final approval.
2) in the absence of proposed names for the subdivision, the department of Planning & Development Services may select names and then prepare recommendations to be forwarded to Council for final approval.

Upon Council's decision, the proponent shall appropriately label/list the final subdivision plan with street names approved by Council.

10.44.9.5 Streets/Roads

Proponents of new street names for proposed subdivisions shall follow procedures outlined in Section 2.2 above.

Streets within a neighborhood shall begin with the same first letter as the name of the designated letter for the neighborhood.

Generally, all street names shall have a suffix appended as outlined in Appendix A in order to more clearly define its appropriate configuration and function. Planning & Development Services may consider other suffixes at the applicant's request, however, final approval is at the discretion of Council.

Generally, the continuation of an existing street will have the same name throughout neighborhood area.

Naming of existing unnamed streets or changes in the names of existing subdivisions and streets shall be submitted to Planning & Development Services for circulation, review and a recommendation, to be forwarded to Council for a decision.

10.44.9.6 Parks

The word "Park" usually designates neighborhood level open space which includes neighborhood parks (i.e. primary parks, secondary parks, open space, small ornamental parks, tot lots, buffers, etc.), district level open space which includes larger parks, athletic grounds and Municipal open space in industrial subdivisions.

Parks and open spaces shall be named at the subdivision stage or the development stage.

Generally, the primary park within a neighborhood or district shall be named after:

1) The established naming requirements of the area; or
2) The adjoining roadway or significant public facility; or
3) Persons of honor, community importance, or historical significance.

Secondary parks and open space (small ornamental parks, tot lots, buffers, etc.) within a neighborhood or district shall be named after:

1) The adjoining roadway or significant public facility; or
2) Persons or honor, community importance, or historical significance. Changes in the names of existing parks shall be referred to Planning & Development Services for circulation, review and recommendation and forwarded to Council for a decision.

Names proposed for municipal buildings and facilities, which would include stormwater detention lakes, shall be forwarded to Planning & Development Services for circulation review and recommendation, and forwarded to Council for a decision.

10.44.9.7 Historical Names

Regard should be paid to the use of historical names in as much as they relate to the matters under consideration and to their suitability in relation to the use and function of the

neighborhood, district, street, park or public facility, under consideration, and providing they follow the preceding guidelines and procedures outlined in this policy.

The name should have historical significance to the municipality or shall reflect individuals who were instrumental in the development of the municipality and have contributed and/or participated in a broad range of public service and/or community activities. Recognition of these persons shall not be restricted to only municipal residents, but may be extended to include persons who have made a significant contribution at provincial, national or international level.

Planning & Development Services in cooperation with local historical groups may establish historical name list for reference on naming matters.

10.44.9.8 Guidelines for Street Naming

1) All streets accessible to vehicles shall be named including a roadway within a mobile home park.
2) Street names should not have more than 20 characters.
3) Names shall assist with emergency response situations by being consistent with street names and geographical locations.
4) Street names should continue across intersections.
5) Names with spelling that leaves proper pronunciation in question shall be avoided.
6) Street names shall be simple to pronounce and understandable to the majority of residents.
7) Where street names in a development are based on a particular theme, the names of all streets within the development shall be consistent with the same theme. Major through fare road names may not be based on the theme.
8) North, South, East and West may be used when a newly created street is an extension of an existing street which cannot be renumbered or for which no municipal numbers are available.
9) No profane or derogatory words or terms shall be used for street names.
10) Names shall be unique. Similar sounding or duplicate street names will not be considered.
11) Redundant street type designations are to be avoided (i.e. Renaud Line Rd).
12) Major thoroughfares oriented north-south are to be named Streets or Roads.
13) Major thoroughfares oriented east-west are to be named Avenues or Roads.
14) Cumbersome, corrupted or modified names, discriminatory or derogatory names, from the point of view of race, sex, color, creed, political affiliation or other social factors are not acceptable.
15) Names for public streets that could be construed as advertising a particular business shall be avoided.
16) The re-use of former street names should be discouraged because of the confusion this causes in property records management.
17) Only Canada Post accepted street Type Abbreviations shall be used.

18)If a proper name is to be used, it shall only be a person's first or last name, not both for the street name.

10.44.9.9 Street Type Designations

Street type designations, depending on roadway function, length and configuration, exist to define the character of a street.

Street Type	Description	Designations
General	Major Thoroughfare	Parkway, Boulevard, Road, Avenue, Highway
Loop	A street that has two connections to a general street	Crescent, Trail, Path, Way
Cul-de-sac	A dead end street	Court, Place, Gardens, Grove, Circle, Terrace, Close
Connector	A short street providing access to a development to which there are no fronting lots	Gate
All others		Lane, Heights, Alley, Crossing, Street, Drive, Walk

10.44.9.10 Street Name Request

Street name if not submitted with Subdivision Engineering plans can be applied for by using a Street Name Request Form in Section 17 – Forms and Certificates.

10.44.9.11 Glossary of Terms

- **Avenue:** A roadway essentially in an east/west direction.
- **Boulevard:** A collector or arterial roadway that has a landscaped median or boulevard character implied in the name.
- **Crescent:** A "U" shaped roadway, which connects to an adjoining roadway at each end of the loop.
- **Drive:** A winding collector roadway that is scenic.
- **Easement:** The right, such as a right of way, afforded a person to make limited use of another person's real property.
- **Lane:** A roadway that does not lend itself to a specific definition category.
- **Loop:** A "P" shaped minor roadway, which begins and ends in the same street.
- **Public Road:** Any road under the jurisdiction of the Municipal District.
- **Private Road:** Any thoroughfare that is not a public road but that is accessible to motor vehicle traffic and which affords the principal means of access to abutting property and from which driveway access is thereby gained to more than one property.
- **Road:** A lengthy roadway which runs diagonally or which may change its direction.

- **Street:** Any official name recognized by the Municipal District. A street shall include *public roads* and *private roads* but shall not include an *easement* that serves only one property.
- **Terrace:** A roadway that generally follows sloping terrain.
- **Trail:** A roadway serving as a collector or arterial, with historical connotations.
- **Way:** A roadway that does not lend itself to a specific definition category.

The following suffixes may be considered where 6 of more lots are located on the "cul-de-sac" to be named:

- **Bay:** A cul-de-sac having a relatively short length.
- **Close:** A cul-de-sac having a relatively short length.
- **Court:** A cul-de-sac.
- **Place:** A cul-de-sac.

10.44.9.12 Street Type Abbreviations

Based on the Canada Post Addressing Guide

STREET TYPE	ABBREVIATION	STREET TYPE	ABBREVIATION
Acres	ACRES	Harbor	HARBR
Alley	ALLEY	Heath	HEATH
Avenue	AVE	Heights	HTS
Bay	BAY	Highlands	HGHLDS
Beach	BEACH	Highway	HWY
Bend	BEND	Hill	HILL
Boulevard	BLVD	Hollow	HOLLOW
By-pass	BYPASS	Impasse	IMP
Byway	BYWAY	Inlet	INLET
Centre	CTR	Island	ISLAND
Cercle	CERCLE	Knoll	KNOLL
Chase	CHASE	Landing	LANDING
Chemin	CH	Lane	LANE
Circle	CIR	Line	LINE
Circuit	CIRCT	Lookout	LKOUT
Close	CLOSE	Loop	LOOP
Common	COMMON	Mall	MALL
Concession	CONC	Meadow	MEADOW
Corners	CRNRS	Mews	MEWS
Court	CRT	Mountain	MNT
Cove	COVE	Orchard	ORCH
Crescent	CRES	Park	PK
Crossing	CROSS	Parkway	PKY
Cul-de-sac	DCS	Passage	PASS
Dale	DALE	Path	PATH
Dell	DELL	Pathway	PTWAY
Diversion	DIVERS	Pines	PINES
Downs	DOWNS	Place	PL
Drive	DR	Plaza	PLAZA
End	END	Point	PT
Estates	ESTATE	Private	PVT
Expressway	EXPY	Promenade	PROM
Extension	EXTEN	Quay	QUAY
Farm	FARM	Range	RG
Field	FIELD	Ridge	RIDGE
Forest	FOREST	Rise	RISE
Freeway	FWY	Road	RD
Front	FRONT	Route	RTE
Gardens	GDNS	Row	ROW
Gate	GATE	Run	RUN

Glade	GLADE	Square	SQ
Glen	GLEN	Street	ST
Green	GREEN	Subdivision	SUBDIV
Grounds	GRNDS	Terrace	TERR
Grove	GROVE	Thicket	THICK
Towers	TOWERS		
Townline	TLINE		
Trail	TRAIL		
Turnabout	TRNABT		
Vale	VALE		
Via	VIA		
View	VIEW		
Village	VILLGE		
Vista	VISTA		
Walk	WALK		
Way	WAY		
Wharf	WHARF		
Wood	WOOD		

END OF SECTION

11.0 Geotechnical

Please refer to the current edition of Environmental Guidelines for the Review of Subdivisions in Alberta for geotechnical standards and regulations and to the recommendations contained within this manual. Also, refer to the following list of pertinent sections that follow:

2.3.2	Geotechnical Report
2.3.5	Engineering Design Approval Process
7.2	Design Requirements for Stormwater & Storage Facilities
10.12	Pavement Structure

12.0 Street Lighting

12.1. General

The following standards are applicable to all types of development in the Municipal District, except for industrial developments. Standards for industrial developments shall be determined by the Municipal District during the initial planning stages of the proposed development.

All street lighting cables in new subdivisions shall be installed underground. Additional street lights in neighborhoods with overhead cabling may be installed if approved by the Director of Field Services.

12.1.1. Design

Street lighting posts with fixtures shall be steel posts, comparable to the existing posts within the neighborhood, for the several types of streets. Wooden Poles may be permitted in existing neighborhoods were additional lighting is being added and wooden poles presently exist.

The location and density of street lights shall provide the following minimum lighting levels:

1) Street lighting fixtures shall be high pressure sodium type.
2) Street lighting design shall be approved by Fortis.

12.1.2. Location

The Developer shall coordinate the location of street lights to ensure that they do not interfere with other utilities and driveways.

Street lights shall be provided for each internal park area that does not abut onto a lighted street. A street light shall be located at the point where each walkway opens out onto the park area.

All street light standards shall be galvanized in a manner comparable to the existing standards within the Municipal District.

12.1.3. Costs

Any capital contribution that the utility company may charge for installation of underground street lighting shall be paid by the Developer.

13.0 Lot Grading

13.1. Design

The grading design shall compliment the overall design of both the minor and major storm drainage system. In general, the lots shall be graded and sloped in such a manner that a minimum of surface run-off water will be conducted to other properties. Where surface drainage swales direct run-off from one lot to the next, the necessary drainage easements shall be registered concurrently with the plan of subdivision.

Reserves and public lands shall be graded to drain towards developed streets and/or storm water catch basins or drainage channels.

Boulevard areas shall be graded to provide a minimum slope of 2% from property line to top of curb.

Commercial and industrial lots shall be graded to drain to on-site storm water catch basins.

In cases where the backyard slopes towards the building, provisions are required to keep the runoff at least 3.0 m away from the building, with the possibility of draining the surface water along the lot lines onto the streets.

Where drainage swales are provided on rear property lines in laneless subdivisions, the developer shall provide an approved concrete drainage swale. The drainage swale shall be provided on one side of the property line and be placed in a drainage easement.

The maximum slope draining towards property lines shall not exceed 10% within 1.5 metres of the property line. The slope away from buildings shall meet the minimum requirements of the Alberta Building Code. Downspouts from eavestroughs and discharges hoses from sump pumps shall not discharge within 0.6 metres from the property line.

Drawings 3.1, Typical Lot Grading and 3.2, Building Grade Certificate are located in Standard Drawings.

13.2. Retaining Walls

Where extremes in elevation of adjoining lots require the construction of a retaining wall, such shall be indicated on the proposed grading plan and no work or construction will be permitted on the building lots that are the subject of, or adjacent to, the said retaining wall without a signed commitment by either owner of the two lots involved to construct such retaining wall at the time of construction of the proposed building.

14.0 Landscaping

14.1. Storm Water Management Facilities

Dry pond and areas surrounding new storm water management lake facilities must be graded, top soiled, seeded or sodded, and landscaped by the Developer to the satisfaction of the Director of Field Services.

Plant materials will be selected to respect hydrological and soil saturation characteristics of the facility.

Public lands within the facility must be planted with a minimum of 30 trees per landscaped acre above normal water line, and designed and massed into major groupings. Minimum deciduous tree caliper 60 mm. Minimum coniferous tree height 2.5 m. Tree mix 60% coniferous and 40% deciduous suggested.

Shrubs may be substituted for trees at a rate of five shrubs for one tree, to a minimum of 15 trees per landscaped area, with approval from the Director of Field Services.

Shrubs to be massed within large planting beds above the 1:5 year flood line to create major focal areas on the slopes of the dry pond. Minimum shrub size to be five gallon pot planted 1 m o.c. or appropriate to species. Minimum shrub height and spread 600 mm, subject to availability. Suggest trees be positioned within planting beds.

Planting bed layouts will provide a minimum width of turf areas between planting beds of 2.0 m. Landscape edging may be required in formal shrub beds.

Planting beds shall be designed complete with weed liners. Use of weed liners for planting beds located in flood prone areas is strongly recommended.

Major storm water outlets/inlets should be landscaped with plant materials and large rockery to provide visual screening and security buffering for pedestrians and dry pond users.

Where possible, relatively flat open areas should be designed to encourage active recreational uses.

Approved furniture may be provided by the Developer and placed at strategic locations within the dry pond.

Lighting, if provided, to be to the satisfaction of the Director of Field Services.

Special or unique features, such as recreational facilities, bridges and architectural and structural features will be designed and sealed by recognized accredited professionals.

14.2. Natural Areas

Existing natural and naturalized areas impacted by the proposed improvements that cannot be protected during construction must be re-naturalized with native plant materials having regard for the surrounding environment, new drainage patterns, soil conditions, and ecological rehabilitation.

The Developer will determine the level of restoration to be completed in consultation with the Director of Field Services.

The Developer will design an appropriate mix of native trees, shrubs, ground covers and wild seed mixes to rehabilitate impacted naturalized areas.

The Developer will design any required subsurface drainage, surface drainage and erosion control measures in the rehabilitation area.

The Developer shall, if required, coordinate this rehabilitation with other consultants to implement geotechnical, structural and bioengineering principles and recommendations.

The landscape drawings will identify all plant communities to be established and all other information necessary to implement the proposed improvements.

The Developer will specify all tree, shrub and ground cover sizes. No minimum or maximum sizes are specified. Tree mix to match natural setting.

Forestry stock, seedlings, deciduous tree whips, and propagated and rooted cuttings are acceptable for use.

All plant materials to be nursery stock or obtained from Provincial Government sources.

The Landscape Architect will identify appropriate planting installation specifications and detailing on landscape drawings.

"Round-Up" or other approved herbicides may be used to eradicate natural slopes prior to planting of trees and shrubs. Herbicide shall be applied by a licensed applicator.

14.3. Maintenance Period

The maintenance period for all planted material shall be two (2) years from the date of issuance of a Completion Certificate.

Any plant that is dead, not true to name or size as specified, or not in satisfactory growth, as determined by the Director of Field Services, shall be removed from the site. In case of any question regarding the condition and satisfactory establishment of a rejected plant, the Contractor may elect to allow such a plant to remain through another complete growing season, at which time the rejected plant, if found to be dead or in an unhealthy or badly impaired condition, shall be replaced by the Contractor.

The applicant shall be responsible for, and at his own expense to remedy, any defect, fault or deficiency in the completed works during the maintenance period.

15.0 Utility Companies

The following guidelines apply to all developers for the construction of municipal improvements, as well as Utility companies wishing to repair, replace or otherwise modify their existing services, within the Municipal District.

15.1. Power, Telephone, Gas and Cable TV Services

15.1.1. General

Private utility companies provide electrical power service, gas service, telephone service, and cable TV service.

15.1.2. Rights-of-Way

Where required, the Developer shall provide right-of-way and easements of sufficient size and location to satisfy the above mentioned Utility Companies.

Utilities shall be located according to the Standard Drawings, or as directed in writing by Director of Field Services.

All easements on Municipal District property shall be registered in the name of the Municipal District of Lesser Slave River No. 124.

15.1.3. Installation

An approval must be obtained from the Municipal District for any excavation on Municipal District property.

All distribution cables shall be installed in one common trench, a minimum of 300 mm wide, at the required alignment. All power and communication cable trenches on the road allowance shall be at a minimum of 1.5 m below finished grade level. The trench bottom shall be free of stones, loose earth and sharp objects.

All gas trenches on the road allowance shall be at a minimum of 1.0 m below finished grade level. Trenches shall be a minimum of 300 mm wide. The trench bottom shall be free of stones, loose earth and sharp objects.

Gas lines shall be installed in a separate trench from cable installations, and shall maintain a minimum distance of 3.0 m from any valve, hydrant, catch basin, manhole, vault and sanitary and storm water lines. A minimum 3.0 m clearance is required to any water lines.

Power, telephone, or cable TV cables shall maintain a minimum distance of 3.0 m from any valve, hydrant, catch basin, manhole, vault, watermains, sanitary mains, and storm water line. A minimum clearance of 0.3 m in all directions is to be maintained when crossing gas service lines.

Extreme care must be taken when backfilling so as not to disturb any Legal survey pins. Any survey pins disturbed during installation shall be replaced at the Utility Company's expense.

Trenches shall not be left open, with cables or gas line exposed, longer than forty-eight (48) hours without permission of the Director of Field Services. In such cases, the open trenches shall be properly marked and barricades with flashers provided by the developer. In locations where flooding of the trenches may occur, or the open trench creates a public hazard, the

Director of Field Services may, at his discretion, require the excavation to be appropriately covered.

The use of trench digging machinery will be permitted, except where its operations will cause damage to trees, buildings, fences, or other existing structures or municipal infrastructure above or below the ground. At such locations, hand digging shall be employed to avoid damage.

To protect persons from injury and to avoid property damage, adequate barricades, construction signs, warning lights and guards, as required, shall be placed. Whenever required, watchmen shall be provided to prevent accidents.

Backfill material shall be native soil material excavated from the ditch/trench or Fillcrete, at the discretion of the Director of Field Services. Sand must be substituted for poor existing soils. Poor existing soils are defined as organic soils, peat, black loam, sod, clay that has hardened and stones. Backfill material shall be compacted to 95% density of the maximum density of a standard proctor compaction test within boulevards and 98% within streets under concrete, asphalt structures or lanes. All backfill material may be subject to the approval of the Director of Field Services.

Augering, in some instances, may be required. In cases where augering is necessary, the diameter of the augered hole shall not be over 50 mm greater than the diameter of the duct to be installed.

15.1.4. Costs

Any capital contribution that the utility company may charge for installation of the above services shall be paid by the Developer.

16.0 Pipeline Crossing Agreements

The contractor shall be responsible in obtaining and providing to the Municipal District, all pipeline crossing agreements from the respective pipeline companies and all work orders from Alberta1Call.

17.0 Forms and Certificates

17.1. Request for Power Line Extension

Refer to the Request for Power Line Extension form on Page 17-2.

Request for Power Line Extension

Date

Company Name

Attention

Re:

Project

Customer

Location

Description

Your request for the proposed power line extension has been reviewed by the Municipal District of Lesser Slave River No. 124.

Permission is hereby granted to ATCO Electric within the boundaries (the Work) as required, subject to the following:

1) The Work shall be conducted within the right-of-way boundaries and shall be conducted in accordance with the latest safe work procedures, including the installation of signs and use of flagmen. The Applicant shall be the Prime Contractor for the Work and shall comply with all legal obligations associated with that designation.
2) No installation shall be allowed within one meter from the right-of-way boundary, or within one meter of any other installation within the right-of-way, unless prior approval is obtained.
3) The minimum height of any road crossing shall be 6 meters.
4) The applicant shall be responsible for any and all costs associated with the Work, and for making all arrangements with other users of the right-of-way, and costs associated with the same, including any relocation costs.
5) The Applicant shall be responsible for locating any other work or undertaking within the right-of-way.
6) The Applicant shall maintain the Work in good order and condition and carry out all necessary maintenance or construction work within the right-of-way, or other Municipal purposes.
7) The Applicant shall be liable to the Municipal District for all loss, damages and expenses which the Municipal District may suffer, sustain, pay or incur by reason of any matter or thing arising out of or attributable to any act or omission of the Applicant, it's servants, agents, contractors or employees in respect of the Applicant's use of the crossing area or by reason of this Agreement.
8) The Municipal District shall be liable to the Applicant for all loss, damages and expenses which the Applicant may suffer, sustain, pay or incur by reason of any matter or thing arising out of or attributable to any act or omission of the Municipal District., its servants, agents, or contractors or employees in respect of the Municipal District's use of the crossing area or by reason of this Agreement.

9) Notwithstanding be any other provisions of this Agreement, the parties shall in no event be responsible for or held liable for consequential damages, including without limitation, liability for loss of use of existing property, loss of profits, and loss of product or business interruption however the same may be caused.

10) This authorization does not supersede any other approvals required by Statute or otherwise. The applicant is responsible for obtaining all necessary approvals, authorizations, licenses or permits.

11) A signed copy of this letter agreeing to the terms and conditions hereof must be returned to this office prior to commencement of this Work.

12) A copy of this letter shall be available for the construction crew, if requested.

Sincerely,

Mr. George Snider

Name **Authorized Signature**

Director of Field Services

Title

Municipal District of Lesser Slave River No.124

District

17.2. Request for Approach Construction

Refer to the Request for Approach Construction Form on Page 17-5.

REQUEST FOR APPROACH CONSTRUCTION

The access request on this application will be investigated and evaluated prior to the commencement of any installation. In order for our request to be processed, the following details and location sketch are required.

LAND LOCATION _____ ¼ Sec _____ Twp. _____ Range _____ West of _____ Meridian _____

Lot _____ Block _____ Plan _____

NAME OF LANDOWNER _____

POSTAL ADDRESS _____

TELEPHONE NO. _____ POSTAL CODE _____

Access: Initial ☐ Additional ☐ Relocate ☐

Access required for: Residential ☐ Field ☐

How have you been getting on to this land . . . . . .

. . . . . .

What is the condition of the present access . . . . . .

. . . . . .

Why is the additional/relocate access required . . . . . .

. . . . . .

If access is required for residential use, please complete the following:

Do you presently reside on the land Yes ☐ No ☐

If not, where do you presently reside . . . . . .

Anticipated date you will reside on the land . . . . . .

Have you started to build on-site . . . . . .

Note: The location sketch must be completed. Please indicate low areas (i.e. sloughs, muskeg) drainage courses, cultivated and treed areas. Should the space provided be insufficient when answering any of the above questions, please attach a list of additional information.

Signature of Applicant _____ Date _____

Address _____ Telephone Number _____

APPROVAL

Signature of Municipality Representative _____ Date _____

17.3. Request for Street Name

Refer to the Street Name Request Form on Page 17-7

Street Name Request Form

Street Name Information

Street Name or Theme Requested	
Background Support	
Geographical Association (Description of Location)	

Contact Information For the Person Making the Request

Full Name(s)
Daytime Telephone: Alternate Number: Email:
Mailing Address:
Date Submitted DD-MM-YYYY

Further documentation supporting this request can be attached. If the requested street name is for an individual, a letter of support from the family must be attached.
Note: All proposed street names must follow the Street Naming Policy.

For Office Use Only

Received Date	
Circulation To	
Meet Policy Requirements	

17.4. Approval for Regular Use of Roadway within Municipal Boundary

Refer to the Approval for Regular Use of Roadway Within Municipal Boundary on Page 17-10.

Approval for Regular Use of Roadway within Municipal Boundary

Date

Company Name

Attention

Re:

Project

Customer

Location

Description

Municipal District Ref. No.

Your File

Company Name is granted approval for the use of the section of roadway within the municipal boundaries and for the above noted works on the municipal road right-of-way subject to the road standards and conditions as set out by the Municipal District of Lesser Slave River No.124. Further, it is understood that it is the developer's responsibility to satisfy, in addition to Municipal District requirements, all other regulations and conditions that are required by Government authorities pursuant to other applicable Acts.

The applicant shall save harmless and indemnify the Municipal District for any claim for damages and losses attributable to the applicant's operations.

The applicant expressly waives any right to claim damages or compensation for damages and losses attribute to the applicant's property, which at any time in the future may be required for the widening of the right-of-way for highway improvement purposes and for any injurious affection claims as a result of such land acquisition, within 30 meters of proposed highway right-of-way. **Further, a minimum setback of 30 meters shall be provided from the developed or undeveloped road allowance for any permanent development.**

Conditions and standards are as follows:

17.4.1. Roadways

1) Wherever possible it is encouraged that when road construction is required that it be carried out on theoretical or undeveloped road advances.
2) Road construction shall be to a minimum, Municipal District Standard Class 5 – Farm Machinery Road.
3) All brush, trees and debris shall be disposed of to the standards required by Alberta Environment Protection.
4) No brush, tree or other debris shall be buried within the boundaries of the road right-of-way.
5) No horizontal or vertical pipeline bends are to be constructed within the road right-of-way.
6) Drainage ditches are to be constructed with erosion protection where required.

7) All disturbed areas shall be landscaped and seeded (minimum Canada Certified No.1 seed and free of noxious weed seeds).

8) All centerline culverts shall be installed to accommodate the maximum anticipated flows, but shall not be less than 500 mm in diameter.

9) Culverts shall be installed to provide a minimum depth cover of 300 mm or one half the diameter of the pipe, whichever is greater, as measured from the finished shoulder grade of the roadway to the top of the pipe.

10) Gravel surfacing shall be placed if applicable.

11) Undercut is required in any area where embankment construction is less than 0.6 m high.

12) Minimum wall thickness of all culverts shall be 1.6 mm or as required by the loading criteria.

17.4.2. Pipeline Right-of-Way Crossing

1) Work shall be carried out within the right-of-way in accordance with good engineering and construction practices and in accordance with the Canadian Standards Association for Pipeline Installations, Alberta Public Highways Development Act, Alberta Pipeline Act and Regulations, the National Energy Board Regulations, Rural Gas Act and all other relevant Acts and Standards.

2) No horizontal or vertical bends are to be constructed within the right-of-way.

3) A minimum of 2 meters of cover over the lowest area of the roadway (bottom of ditch) shall be used over the pipe located within the right of way as otherwise noted.

4) Pipeline warning signs shall be posted on each right-of-way boundary.

5) All disturbed areas shall be returned to its original condition, landscaped and seeded (minimum, Canada Certified No.1 seed and free of noxious weed seeds).

6) No brush or debris from clearing operations shall be left or disposed of within the right-of-way.

7) In the event of future roadway improvements, all necessary adjustments or relocation of the pipelines(s) or related work as required to accommodate the roadway shall be the responsibility of the Applicant and at their cost.

17.4.3. Approaches:

1) Approaches shall be constructed so as to conform to Alberta Infrastructure and Transportation specifications as detailed.

2) Only suitable, compactable material is to be used.

3) The approach shall intersect at 90 degrees to local municipal road.

4) The approach shall be gravel surfaced.

5) All disturbed areas in the road right-of-way shall be landscaped and seeded (minimum Canada Certified No.1 seed and free from noxious weed seeds).

6) Minimum 500 mm culvert shall be installed.

7) Sight distance must be a minimum of 300 meters from the approach in each direction.

8) No brush or debris shall be left or disposed of within the right-of-way.

9) Temporary approaches must meet the above requirements and be removed upon completion of the project.

10) All disturbed areas shall be returned to its original condition, landscaped and seeded.

17.4.4. Hauling on Developed Roads

1) The transportation of loads to axle weights and load dimension should be consistent with the weights specified in the carrying vehicles Certificate of Registration or as per the provisions of Provincial and Local Regulations is permitted. Hauling is not permitted over municipal bridges where loads exceed the posted weight restrictions. **Overweight and Over Width loads require permitting, which are issued through Road Data Services at 1-888-830-7623.**

2) Should damages occur while actively hauling, the contractor shall be responsible for the maintenance and repair costs to restore the roadway to the condition that existed prior to use as a haul road. The contractor will maintain the said highways in good repair at all times when hauling.

3) At least 72 hours prior to the start of the haul the contractor will indicate the local roads to be utilized and obtain concordance from the Municipal District of Lesser Slave River No.124's Transportation Supervisor or designate at 849-4888.

4) If a route deteriorates where considerable damage may result, the Director of Field Services might implement a weight restriction on roads that are under Municipal District jurisdiction.

5) Application must be made for permanent or temporary approaches off a Secondary Highway or local road. Construction must conform to Municipal District's specifications. All requests must be submitted two weeks in advance on Municipal District's. "Request for Road Access": application forms and addressed to:

Municipal District No. 124

Box 722, Slave Lake, AB T0G 2A0

6) The Contractor must erect suitable signs and devices as per Canadian Uniform Traffic Control Devices Guidelines, so as to ensure the safe use of the roads. They shall be installed at such places and in such numbers as directed by the Municipal District and its agents.

7) Stop signs will be required at all locations where permanent or temporary haul roads intersect or cross Municipal District roadways. Truck entrance signs must be used at locations where trucks are entering, leaving or crossing a roadway where there is an unusual degree of hazard. Where routes conflict with recreational traffic, extreme caution is expected and reduced speed limits may be imposed. Warning signage shall be required where designated by the Municipal District Road Supervisor.

8) This authorization does not supersede approvals required pursuant to other applicable Acts or Regulations. All motor transport regulations and specifications shall be adhered to.

9) This approval applies to Municipal District roads only. The applicant is responsible for any additional approvals for roads not under the Municipal District of Lesser Slave River No. 124 jurisdiction.

Please contact the undersigned at (780) 822-5446 prior to construction or for further information.

Please acknowledge receipt and acceptance of the foregoing by signing and returning a copy of this letter to our office.

Acknowledged and Accepted By	Authorized Signature
Mr. George Snider	
Name	Authorized Signature
Director of Field Services	
Title	
Municipal District of Lesser Slave River No.124	
District	

Attachments: Construction Standards, Local Roads Cross Section, Approach Standards, Road Terminals

17.5. Approval for Geophysical Use of Roadway within Municipal Boundary

Refer to the Approval form for Geophysical Use of Roadway within Municipal Boundary on Page 17-15.

Geophysical Use of Roadway within Municipal Boundary

Date

Company Name

Attention

Re:

Project

Customer

Location

Description

Municipal District Ref. No.

Your File

Company Name is granted approval for the use of the section of roadway within the municipal boundaries and for the above noted works on the municipal road right-of-way subject to the road standards and conditions as set out by the Municipal District of Lesser Slave River No.124. Further, it is understood that it is the developer's responsibility to satisfy, in addition to Municipal District requirements, all other regulations and conditions that are required by Government authorities pursuant to other applicable Acts.

The applicant shall save harmless and indemnify the Municipal District for any claim for damages and losses attributable to the applicant's operations.

Further, it is understood that Alberta Regulation 214/98 Exploration Regulation in addition to all other regulations and conditions that are required by the Government Authorities and pursuant to all other applicable Acts shall be followed. **It should be noted that no energy source or drilled holes on a constructed road surface, shoulder or slope of a shoulder will be permitted.**

Conditions and standards are as follows:

17.5.1. Hauling or use of Developed Roads and Underdeveloped Roads

1) The transportation of loads at axle weights and load dimensions that are consistent with the weights specified in the carrying vehicles Certificate of Registration or as per the provisions of Provincial and Local Regulations is permitted. Hauling is not permitted over Municipal District bridges where loads exceed the posted weight restrictions. **Overweight and over width loads require permitting, which issued through Road Data Services at 1-888-830-7623.**
2) Should damages occur while actively hauling, the contractor shall be responsible for the maintenance and repair costs to restore the roadway to the condition that existed prior to use as a haul road. The Contractor will maintain the said highways in good repair at all times when hauling.

3) At least 72 hours prior to the start of the haul the contractor will indicate the local roads to be utilized and obtain concordance from Municipal District's Transportation supervisor or designate in Slave Lake at 780-849-4888.

4) The Municipal District will provide a level of maintenance for gravel-surfaced roads consistent with the established policy.

17.5.2. Summer

- The regular scheduled maintenance will be carried out once every six working days

17.5.3. Winter

- Plowing will be determined by weather conditions, which are normally when snow accumulations reach 10 cm – 15 cm or drifting occurs. Plowing will be carried out on a priority basis. The degree and frequency to service levels from No.1 to No.5 based on road type and Municipal District Policy E-15.

This authorization does not supersede approvals required to other applicable Acts or Regulations. All motor transport regulations and specifications shall be adhered to.

This approval applies to Municipal District roads only. The applicant is responsible for any additional approvals for roads not under the Municipal District jurisdiction.

Please contact the undersigned at (780) 822-5446 prior to construction or for further information.

Please acknowledge receipt and acceptance of the foregoing **by signing and returning a copy of this letter to our office.**

Acknowledged and Accepted By	**Authorized Signature**
Mr. George Snider	
Name	**Authorized Signature**
Director of Field Services	
Title	
Municipal District of Lesser Slave River No.124	
District	

17.6. Construction Completion Certificate

Refer to the Construction Completion Certificate on Page 17-18.

MUNICIPAL DISTRICT OF LESSER SLAVE RIVER No.124
CONSTRUCTION COMPLETION CERTIFICATE
DEVELOPMENT PROJECTS

Development Area: _____

Developer: _____

Servicing Agreement Date: _____ Servicing Agreement No. _____

Contractor: _____

Municipal Improvement
(as specified in the agreement) _____

Boundaries of Development Area: _____

Date of Application: _____

Pursuant to the Municipal District of Lesser Slave River No.124 Servicing Agreement No. _____ Dated: _____

I, _____ of _____

Hereby certify that as of the above date, the said municipal improvement noted herein meets all the requirements for a final Construction Completion Certificate as specified by the said Development Agreement mentioned above, and constructed, as far as can be practically ascertained, according to the specified standards as per the requirements of the said Development Agreement, I hereby recommend this municipal improvement for the approval of the Construction Completion Certificate.

_____

Project Engineer (Consulting engineer or Municipal District Representative) Date

_____

Signing Officer (Consulting Engineer or Municipal District Representative) Date

_____

Developer Date

_____

Authorized Municipal District No. 124 Inspector Date

Approved on _____

_____

Municipal District No.124 Representative

Causes for Rejection: (See Attached Report)

_____

I hereby certify that the items listed as reasons for rejection have been corrected.

Approved: _____

Date

_____

Development Officer Date

Date Maintenance period to start: _____

Date Maintenance period to end: _____

17.7. Final Acceptance Certificate

Refer to the Final Acceptance Certificate on Page 17-20.

MUNICIPAL DISTRICT OF LESSER SLAVE RIVER No.124
FINAL ACCEPTANCE CERTIFICATE
DEVELOPMENT PROJECTS

Development Area: _____

Developer: _____

Servicing Agreement Date: _____ Servicing Agreement No. _____

Contractor: _____

Municipal Improvement
(as specified in the agreement) _____

Boundaries of Development Area: _____

Date of Application: _____

Pursuant to the Municipal District of Lesser Slave River No.124 Servicing Agreement No. _____ Dated: _____

I, _____ of _____

Hereby certify that as of the above date, the said municipal improvement meets all the requirements for final acceptance as specified by the said residential servicing agreement, and I hereby recommend this municipal improvement for final acceptance by the Municipal District of Lesser Slave River No.124.

_____
Project Engineer (Consulting Engineer or Municipal District Representative) Date

_____
Signing Officer (Consulting Engineer or Municipal District Representative) Date

_____
Developer Date

_____
Authorized Municipal District No. Inspector Date

Approved on _____

_____
Municipal District No.124 Representative

_____
Municipal District No.124 Representative

Causes for Rejection: (See Attached Report)

I hereby certify that the items listed as reasons for rejection have been corrected.

_____
Project Engineer (Consulting Engineering Firm or Municipal District Representative) Date

Approved: _____

Date

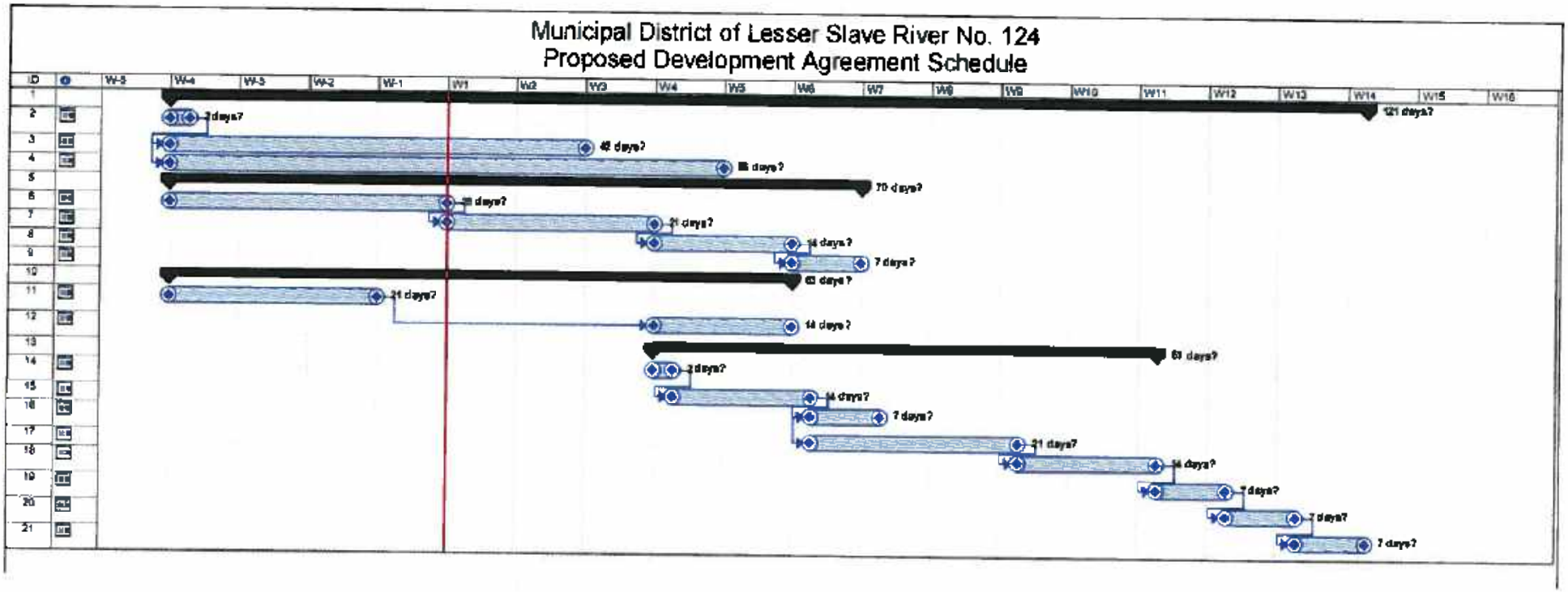
_____
Development Officer Date

Date Maintenance period to start: _____

Date Maintenance period to end: _____

17.8. Proposed Development Agreement Schedule

Refer to the Proposal Development Agreement Schedule on Page 17-22.

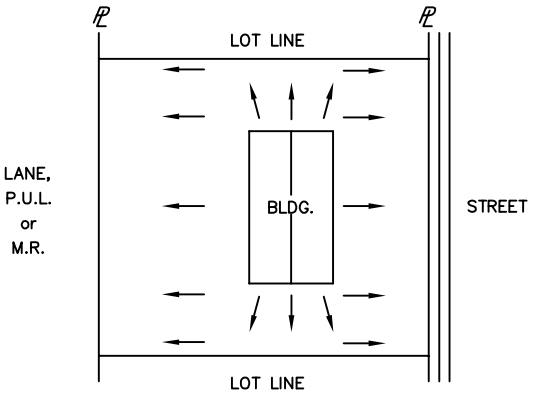

Municipal District of Lesser Slave River No. 124
Proposed Development Agreement Schedule

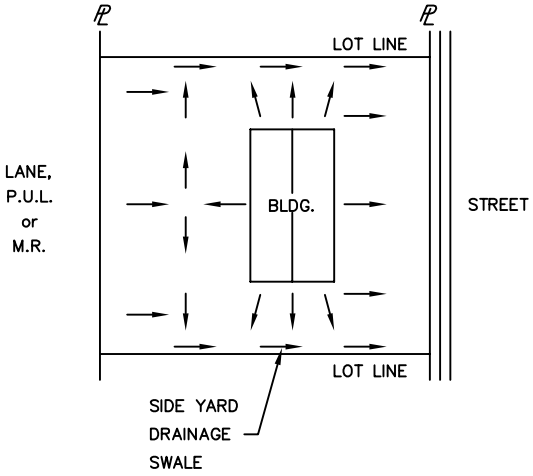
18.0 Standard Detail Drawings

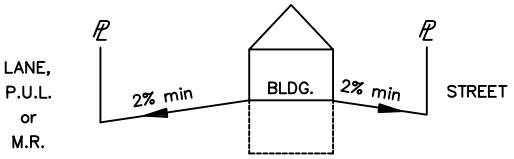
Drawing Number	Title
Section 3	
3.1	Typical Lot Grading
3.2	Building Grade Certificate
Section 4	
4.1	Typical Water Service Connection
4.2	Typical Hydrant and Valve Detail
4.3	Main Valve Casing Detail
4.4	Valve Box Detail – Sliding Type A and Screw Type B
4.5	Valve Box Construction Detail
4.6	Thrust Block Details
4.7	Vertical Bend Thrust Block Detail
4.8	Anode Installation Cadweld
4.9	Anode on 50 mm and Smaller Copper Water Service
4.10	Typical Anode Installation at Valves, Iron Fitting, and Hydrants
Section 5	
5.1	Air Relief Valve and Flushing Chamber
5.2	Pipe Bedding Details
5.3	Typical Trench Detail
Section 5	
6.1	Manhole Safety Platform
6.2	Manhole Detail Type 5A Pre-Cast
6.3	Interior Drop Manhole Detail
6.4	Exterior Drop Manhole Detail
6.5	Typical Perched Manhole for 600 to 1050 mm Diameter Pipes
6.6	T-Riser Manhole for Pipes 1200 mm and Larger
6.7	PreBenched Manhole Base
6.8	Grinder Pump Station Installation
NA0057P07	E/ONE - WH101/WR101 Grinder Pump & Sump
6.9	Service Connection Detail
Section 7	
7.1	Concrete Drainage Swales
7.2	Catch Basin Manhole
7.3	Catch Basin Typical 900 mm
7.4	Storm Catch Basin Assembly c/w 300 mm Sump
7.5	Trash Grate Inlet
7.6	Typical Dry Pond Detail
7.7	Access Installation

Drawing Number	Title
Section 8	
8.1	Typical 50 mm and smaller Residential Water and 150 mm Sanitary Sewer
8.2	Water Service Connection – Manufactured Home
8.3	Sanitary Service Connection – Manufactured Home
8.4	Single and Double Service Layout
8.5	Typical Sanitary Service Connection
8.6	Residential Sanitary Sewer Service Riser Connection
8.7	Typical Standard Riser Detail
8.8	Inspection Chamber Detail
8.9	Blow-Off Valve
Section 9	
9.2	Municipal Cul-De-Sac Curb and Gutter;
9.2A	Rural Cul-De-Sac Details
9.3	Industrial/Commercial Curb and Gutter Crossing;
9.4	Typical Monolithic Lane and Driveway Crossing;
9.5	Wheelchair/Bike Ramp Locations;
9.6	Paraplegic Ramp Details on Tangent;
9.7	Paraplegic Ramp Details at Both Curb Returns;
9.8	Paraplegic Ramp Details at Centre of Curb Return – Rolled Curb;
9.9	500 mm Curb and Gutter for Arterial Roadways;
9.10	250 mm Standard Curb and Gutter;
9.11	250 mm Rolled Curb and Gutter;
9.12	1.50 m Standard Monolithic Sidewalk;
9.13	1.50 m Rolled Monolithic Sidewalk;
9.14	1.20 m or 1.50 m Separate Sidewalk;
9.15	Typical Catch Basin Installation – 150 Curb and 250 Gutter.

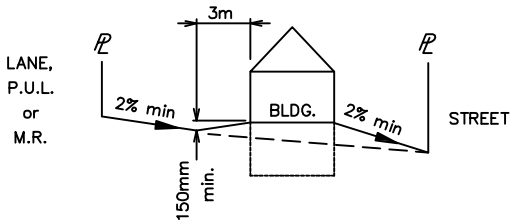
Drawing Number	Title
Section 10	
10.1	Typical Road Intersections
10.2	Pavement Crown for Various Road Widths
10.3	Local Residential (Urban)
10.4	Divided Arterial
10.5	Undivided Arterial (Urban)
10.6	Minor Residential Collector (Urban)
10.7	Major Residential Collector (Urban)
10.8	Local Industrial (Urban)
10.10	Rural Residential Subdivision with Utilities Standard Cross-Section
10.11	Typical Trail Cross-Sections
10.12	Asphalt Speed Bump
10.16	Limited Access Road Standard Cross-Section
10.18	Industrial Road Standard Cross Section (Class 1)
10.19	Major Collector Standard Cross Section (Class 2)
10.20	Major Collector Paved Road Standard Cross Section (Class 2)
10.21	Collector Standard Cross Section (Class 3)
10.22	Minor Collector Standard Cross Section (Class 4)
10.23	Farm Machinery Road Standard Cross Section (Class 5)
10.24	Minimum Approach Standards
10.25	Approach Treatment for Minor Intersecting Roadway
10.26	Hand Laid Riprap Details
10.27	Culvert Material Details
10.28	Corrugated Metal Pipe Culvert Installation
10.29	Street Name Sign Layout
10.30	Rural Address Sign Layout
10.31	Subdivision Sign Layout



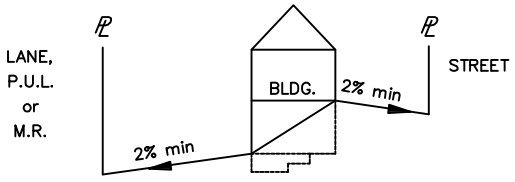




SPLIT DRAINAGE



BACK TO FRONT
DRAINAGE



REARYARD
BASEMENT WALKOUT
SPLIT DRAINAGE

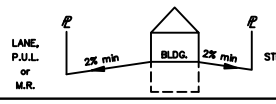
TYPICAL LOT GRADING

Project No.	4006035
Scale	N.T.S
Date	MAY 2007
Standard Detail No.	3.1

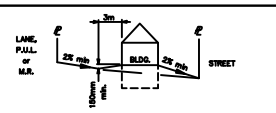
Building Grade Certificate

Standard Detail No. 3.2

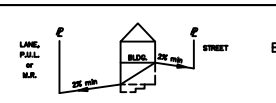
1. When excavating in a right-of-way (easement), check for utilities.
2. Standing at the water shut-off and facing the building, the sanitary service is on the left side of the water service.
3. All dimensions are in metres and decimals thereof. The elevations are in meters above geodetic mean sea level.
4. Elevations noted on the Certificate are within 100mm of actual.
5. The builder must construct to within 100mm of the design landscape elevation and illustrated drainage patterns unless otherwise approved by the Development Officer.
6. If the information on this Certificate has been prepared by a private developer or their agent, the M.D. accepts no responsibility for its accuracy.



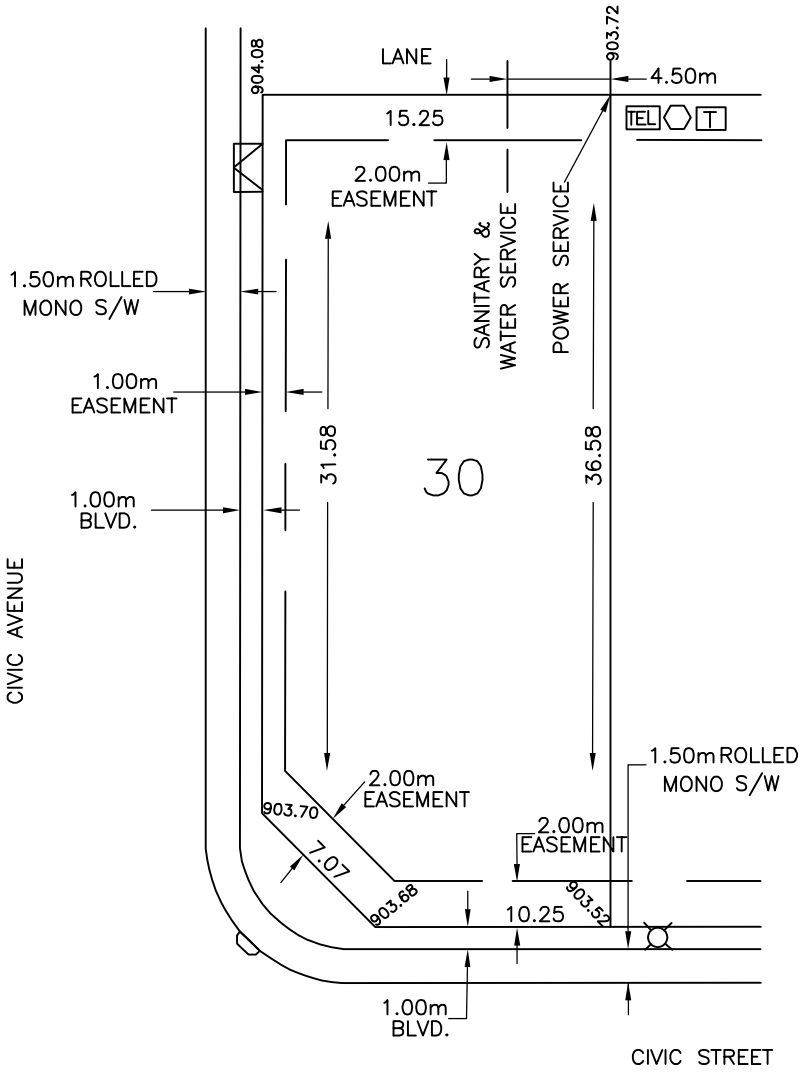
SPLIT DRAINAGE

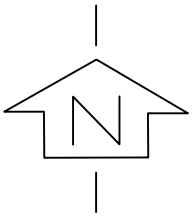


BACK TO FRONT DRAINAGE



REARYARD BASEMENT WALKOUT SPLIT DRAINAGE





- TRANSFORMER
- ELECTRICAL BOX
- TELUS PEDESTRAL
- CA.T.V. PEDESTAL
- MAIL BOX
- LIGHT STANDARD
- HYDRANT
- CATCH BASINS
- DRAINAGE PATTERN

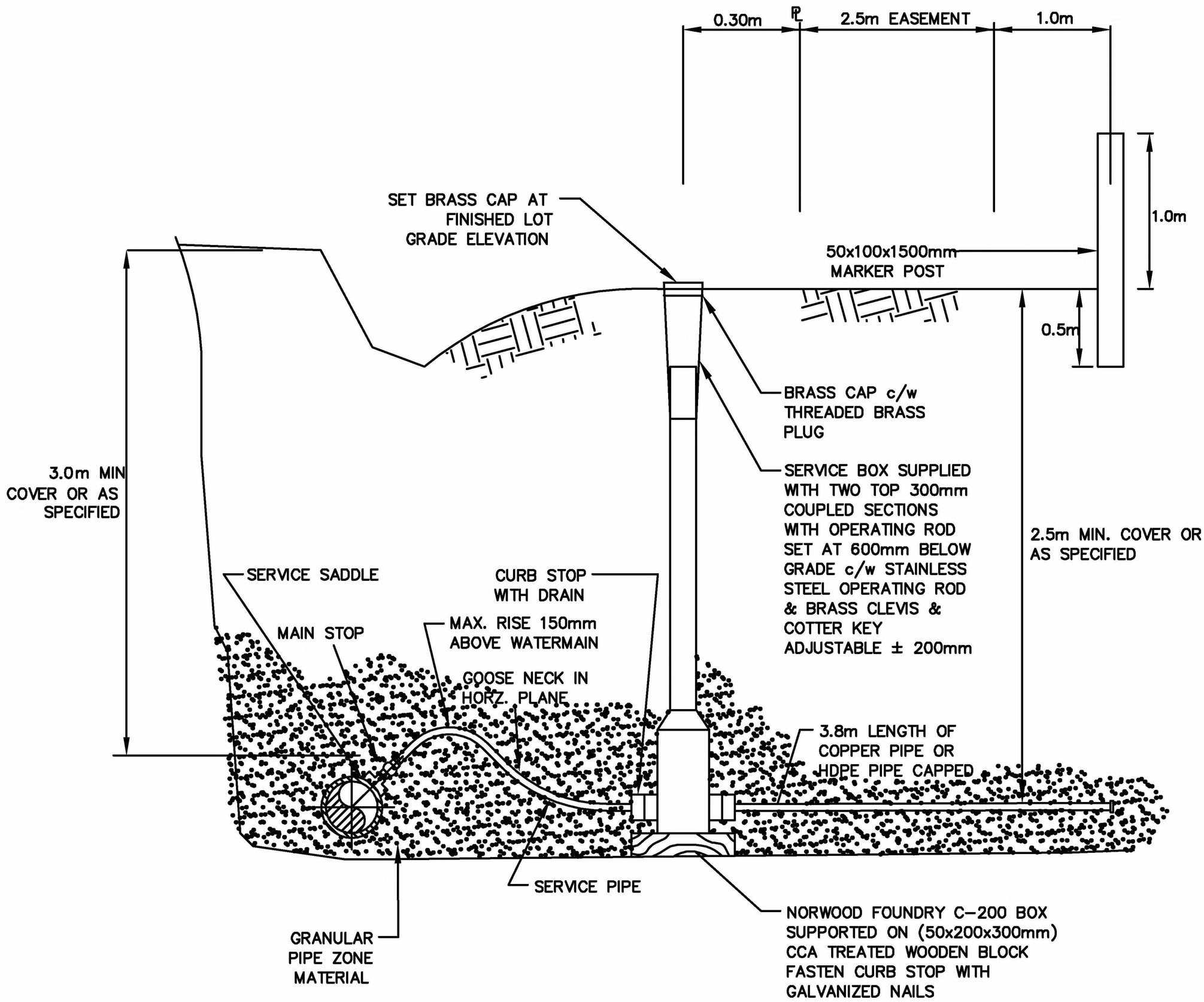
TOP OF FOOTING ELEVATIONS:
Max. depth below average sidewalk= DEPTH
Lowest elevation= LTF

AS-BUILT SEWER INVERT ELEVATIONS:
Sanitary at right-of-way line= SANI
Storm at right-of-way lline= STM

DESIGN LANDSCAPE ELEVATIONS:
Elevation at the front of house= GRADE
Elevation at the rear of house= GRADE

Civic Address: CIVIC
Lot: LOT Block: BLOCK Plan No.: PLAN
Developer: DEV Scale: SCALE
Drawn By: XYZ ENGINEERING SERVICES LTD. Date: DATE
Approved By: Date:
Received By: Date:

I certify that the final landscape grade will be (front) (rear)
Signature of owner or representative
Print full name



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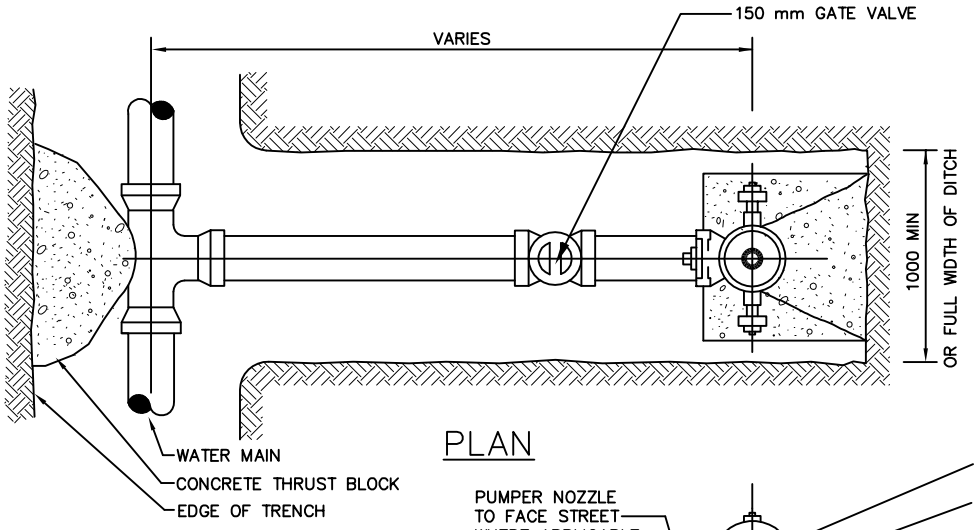
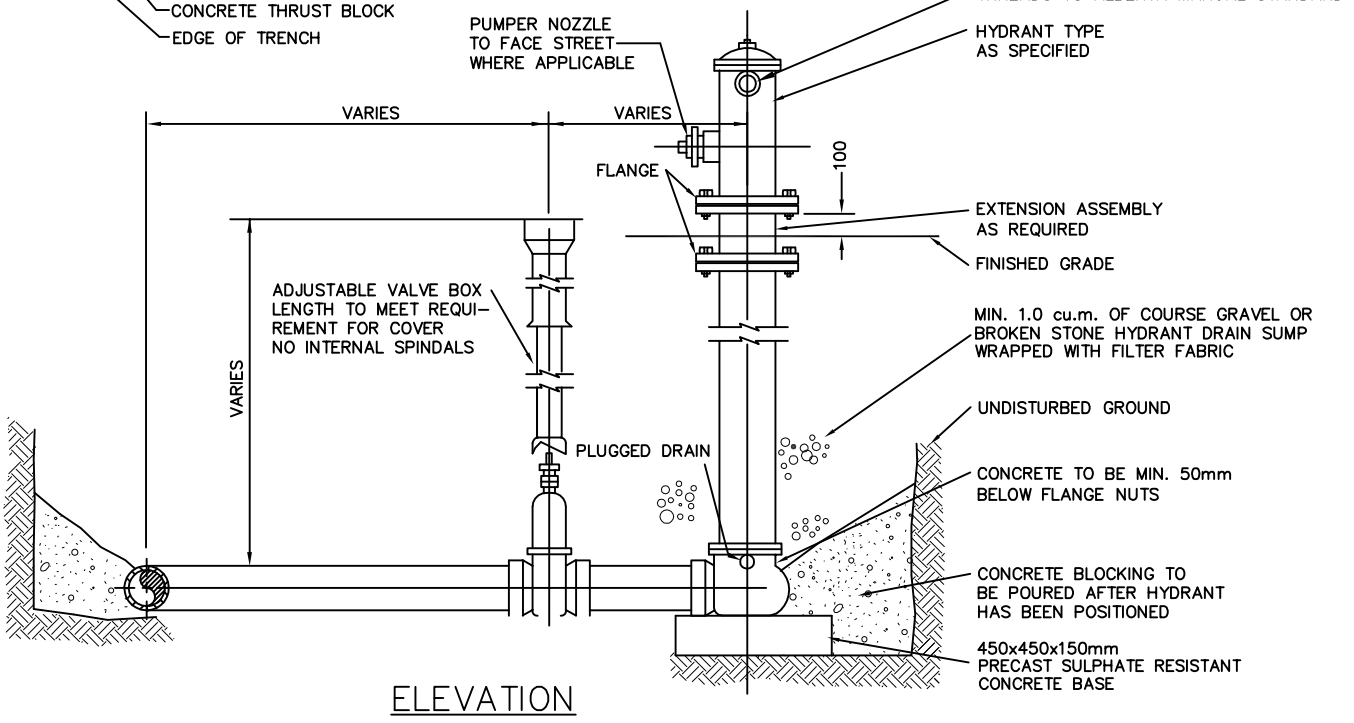
MUNICIPAL DISTRICT OF LESSER SLAVE RIVER
M.D. No. 124

TYPICAL WATER SERVICE CONNECTION

Project No.	4006035
Scale	N.T.S
Date	MAY 2007
Standard Detail No.	4.1



PLAN



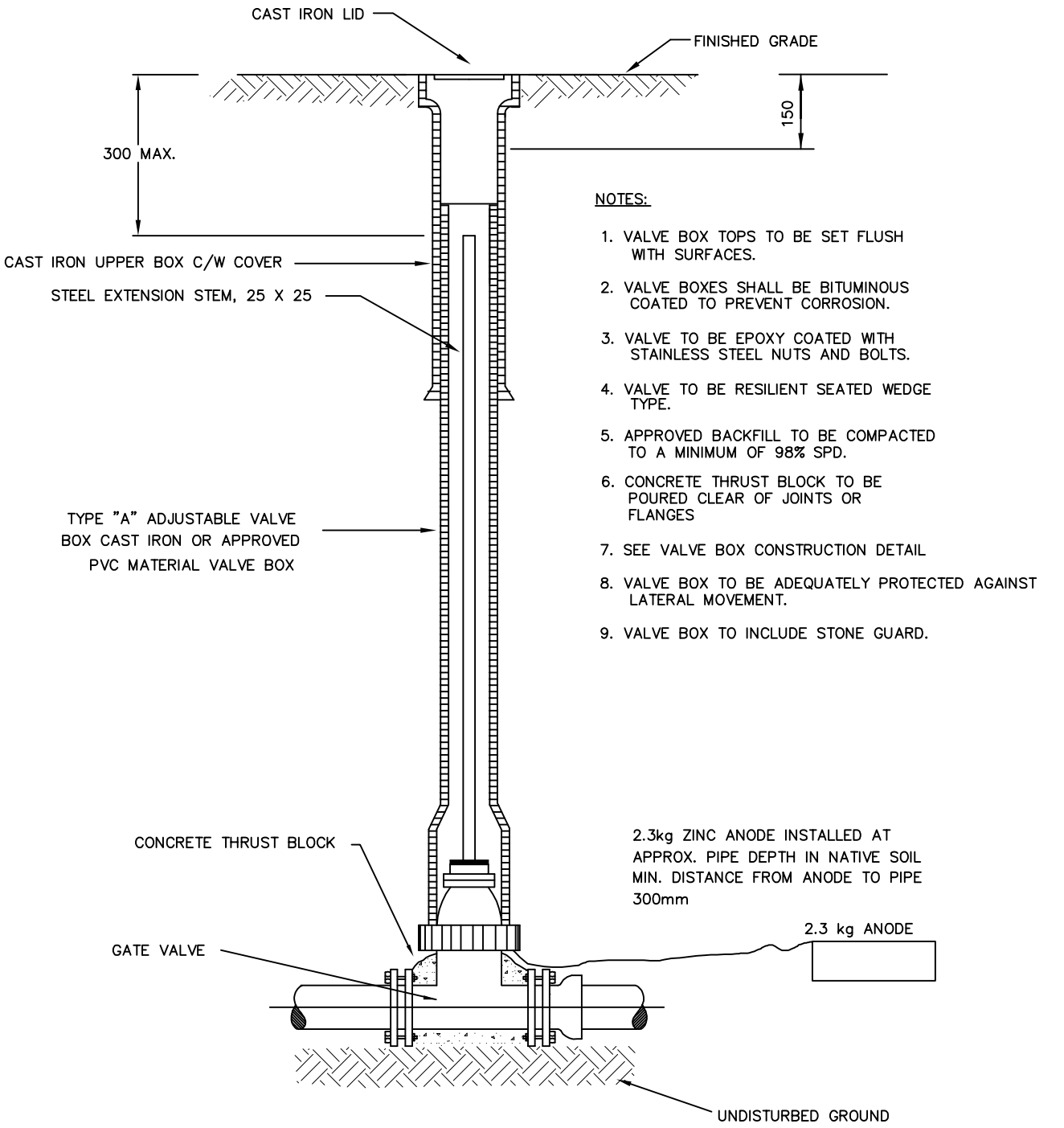
ELEVATION

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE STATED.
2. CONCRETE TO BE 25 MPa @ 28 DAYS.
3. HYDRANTS SHALL BE COMPRESSION TYPE CONFORMING TO AWWA C502 COMPLETE WITH PLUGGED DRAINS, STAINLESS STEEL BOLTS AND ASPHALTIC COATED HYDRANT COMPONENTS.
4. PROVIDE CATHODIC PROTECTION AS SHOWN ON STD. DWG. NO. 4.9
5. THRUST BLOCKS TO BE PLACED AGAINST UNDISTURBED GROUND HAVING A MINIMUM BEARING OF 7300 kg/m^2
6. CONCRETE TO BE POURED CLEAR OF ALL FLANGES, JOINTS, AND HYDRANT DRAIN.
7. APPROVED BACKFILL TO BE COMPACTED TO A MINIMUM OF 98% SPD.
8. DO NOT ALLOW PONDING OR STANDING WATER AROUND HYDRANT
9. PLACEMENT OF HYDRANT AND ORIENTATION OF PUMPER NOZZLE TO BE APPROVED.
10. HYDRANT TO BE PLUGGED OR DRAINING AS DICTATED BY SITE CONDITIONS.

TYPICAL HYDRANT & VALVE DETAIL

Project No.	4006035
Scale	N.T.S
Date	MAY 2007
Standard Detail No.	4.2



NOTES:

1. VALVE BOX TOPS TO BE SET FLUSH WITH SURFACES.
2. VALVE BOXES SHALL BE BITUMINOUS COATED TO PREVENT CORROSION.
3. VALVE TO BE EPOXY COATED WITH STAINLESS STEEL NUTS AND BOLTS.
4. VALVE TO BE RESILIENT SEATED WEDGE TYPE.
5. APPROVED BACKFILL TO BE COMPACTED TO A MINIMUM OF 98% SPD.
6. CONCRETE THRUST BLOCK TO BE POURED CLEAR OF JOINTS OR FLANGES
7. SEE VALVE BOX CONSTRUCTION DETAIL
8. VALVE BOX TO BE ADEQUATELY PROTECTED AGAINST LATERAL MOVEMENT.
9. VALVE BOX TO INCLUDE STONE GUARD.

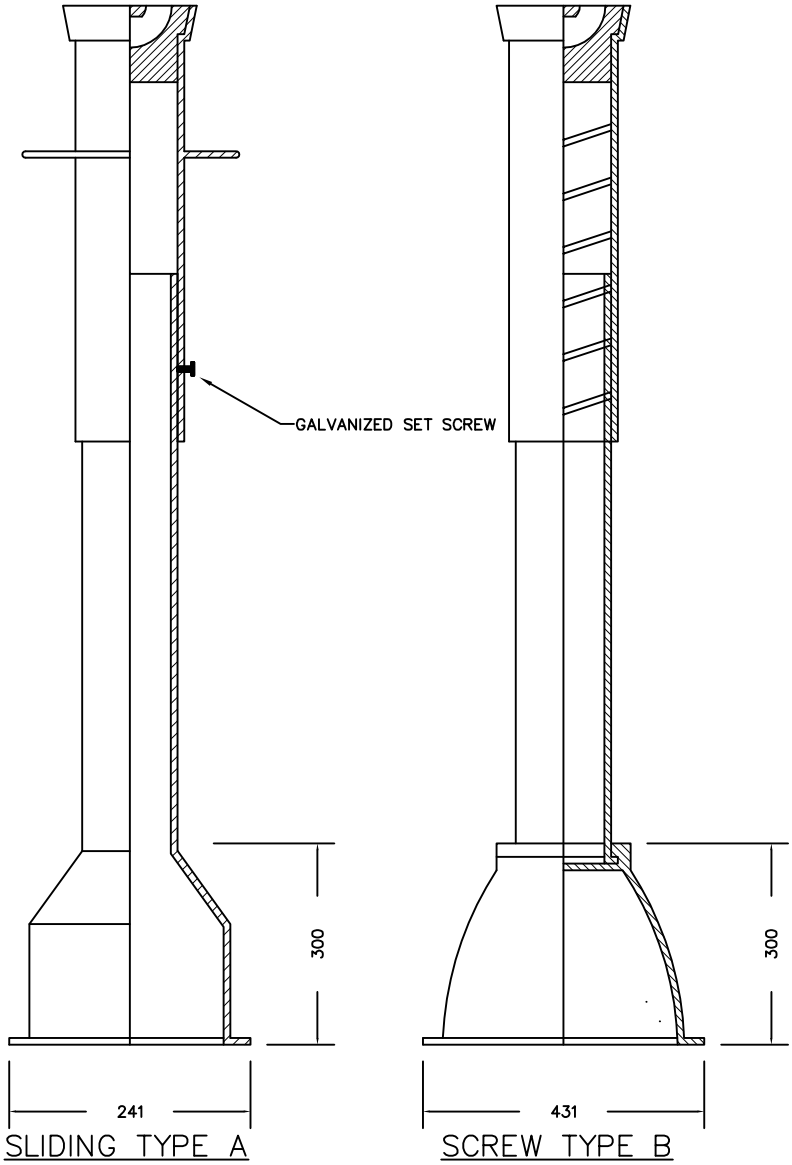
MAIN VALVE CASING DETAIL

Project No.	4006035
Scale	N.T.S
Date	MAY 2007
Standard Detail No.	4.3

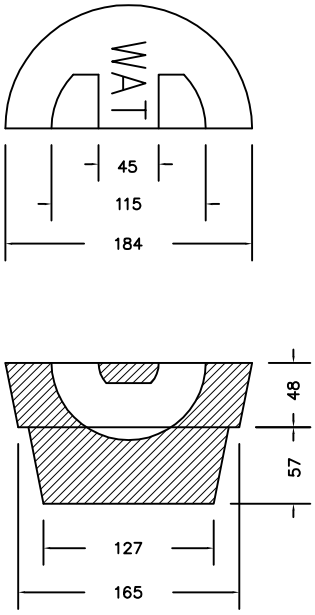
STANDARD VALVE PLUG

NOTES:

1. VALVE BOXES SHALL BE EXTERNALLY AND INTERNALLY COATED WITH ASPHALTIC OR EPOXY COATING.
2. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE NOTED.



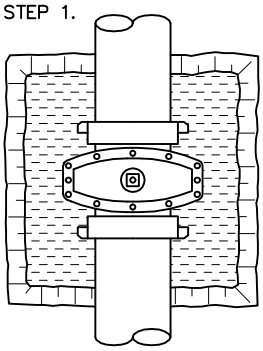
PLUG C/W CORED HANDHOLES AND MARKED 'WATER'



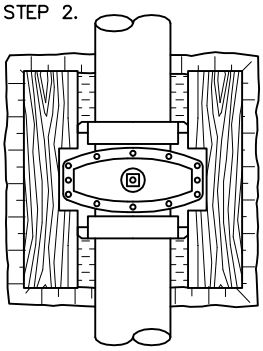
VALVE BOX DETAIL
SLIDING TYPE A AND SCREW TYPE B

Project No.	4006035
Scale	N.T.S
Date	MAY 2007
Standard Detail No.	4.4

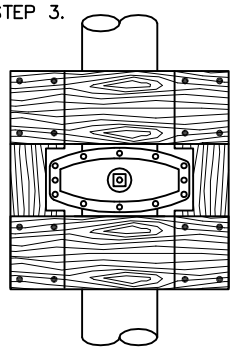
STEP 1.



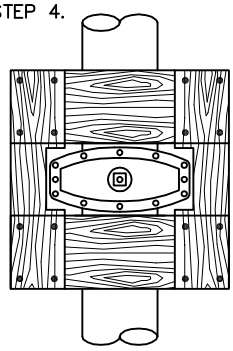
STEP 2.



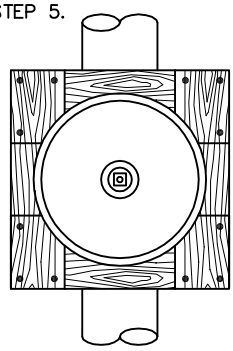
STEP 3.



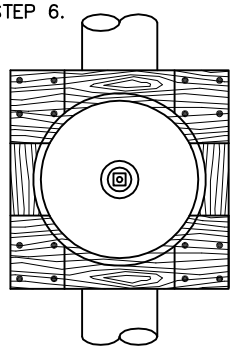
STEP 4.



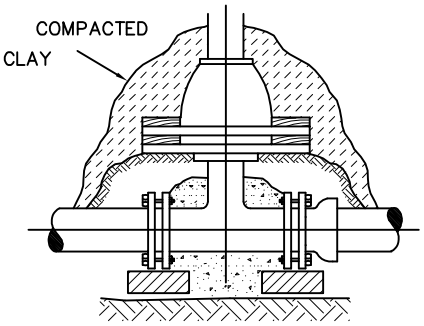
STEP 5.



STEP 6.



STEP 7.



PROCEDURE:

STEP 1. BUILD A 609 mm X 609 mm LEVEL FLAT BASE OF COMPACTED CLAY USING A FLAT TAMPER UP TO WITHIN 12 mm OF THE TOP OF THE TOP FLANGE.

STEP 2. CUT OR NOTCH OUT TWO OF THE 50X200X600 TREATED BOARDS THE WIDTH OF VALVE FLANGE AND LAY ON BASE PARALLEL TO PIPE.

STEP 3. INSTALL TWO 50x200x600 TREATED BOARDS TRANSVERSELY OR AT RIGHT ANGLES TO THE FIRST SET AND NO CLOSER TO THE FLANGE THAN THE CUTOUT SO THAT THEY DO NOT PROTRUDE OVER THE FLANGE. NAIL WITH GALVANIZED COATED NAILS AS ILLUSTRATED. APPROX. 6mm CLEARANCE TO FLANGE.

STEP 4. ADD AND NAIL ALTERNATE LAYERS OF BOARDS MAKING SURE EDGES ARE NO CLOSER TO VALVE THAN CUTOUT, CONTINUE UNTIL MINIMUM REQUIRED CLEARANCE (100 mm) FROM TOP OF VALVE BONNET TO VALVE NUT IS OBTAINED.

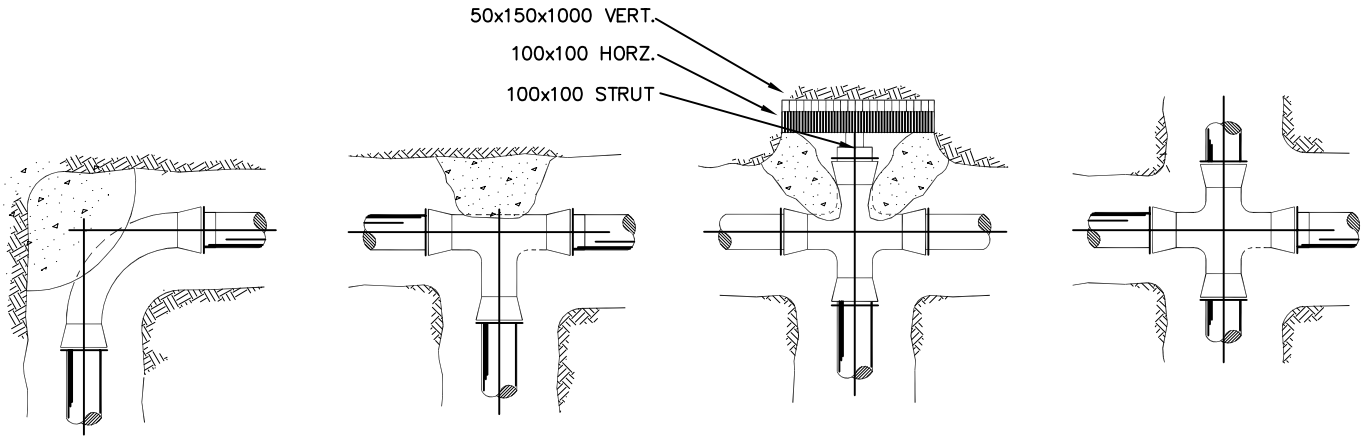
STEP 5. CENTER VALVE BONNET SECTION OVER OPERATING NUT AND FASTEN WITH FOUR NAILS WITH THE TOP 19 mm BENT OVER TO SECURE IN PLACE.

STEP 6. TWO PIECES OF BOARD ARE NOW CUT OUT TO OUTSIDE CIRCUMFERENCE OF BONNET AND UNDERCUT TO ACCOMODATE BONNET THICKNESS. THESE ARE NOW NAILED TRANSVERSELY TO LAST LAYER OF BOARDS.

STEP 7. APPROPRIATE LENGTHS OF BOTTOM AND TOP SECTION OF CASING ARE NOW INSTALLED AND BACKFILLED WITH COMPACTED CLAY TO ABOVE JOINT.

VALVE BOX CONSTRUCTION DETAIL

Project No.	4006035
Scale	N.T.S
Date	MAY 2007
Standard Detail No.	4.5

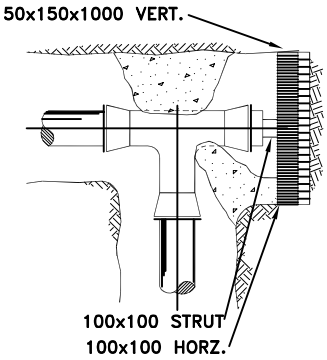


HORIZONTAL 90° BEND

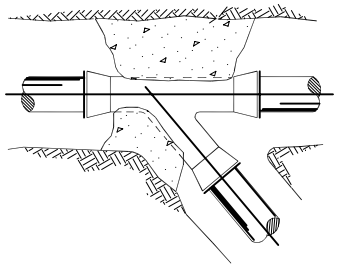
TEE

CROSS WITH PLUG

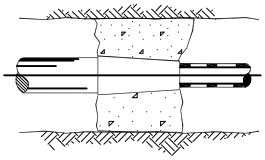
CROSS



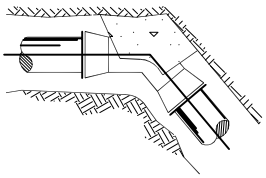
TEE WITH PLUG



WYE



REDUCER



HORIZONTAL BENDS

NOTE:

1. ALL DIMENSIONS IN MILLIMETRES.
2. ALL FITTINGS TO BE WRAPPED IN 6 ML POLYETHYLENE PRIOR TO POURING CONCRETE.
3. ALL CONCRETE TO BE MIN. 28 MPa @ 28 DAYS.
4. THE REQUIRED BEARING AREA SHALL BE DETERMINED BY THE CONTRACTOR TO SUIT SOIL CONDITIONS.

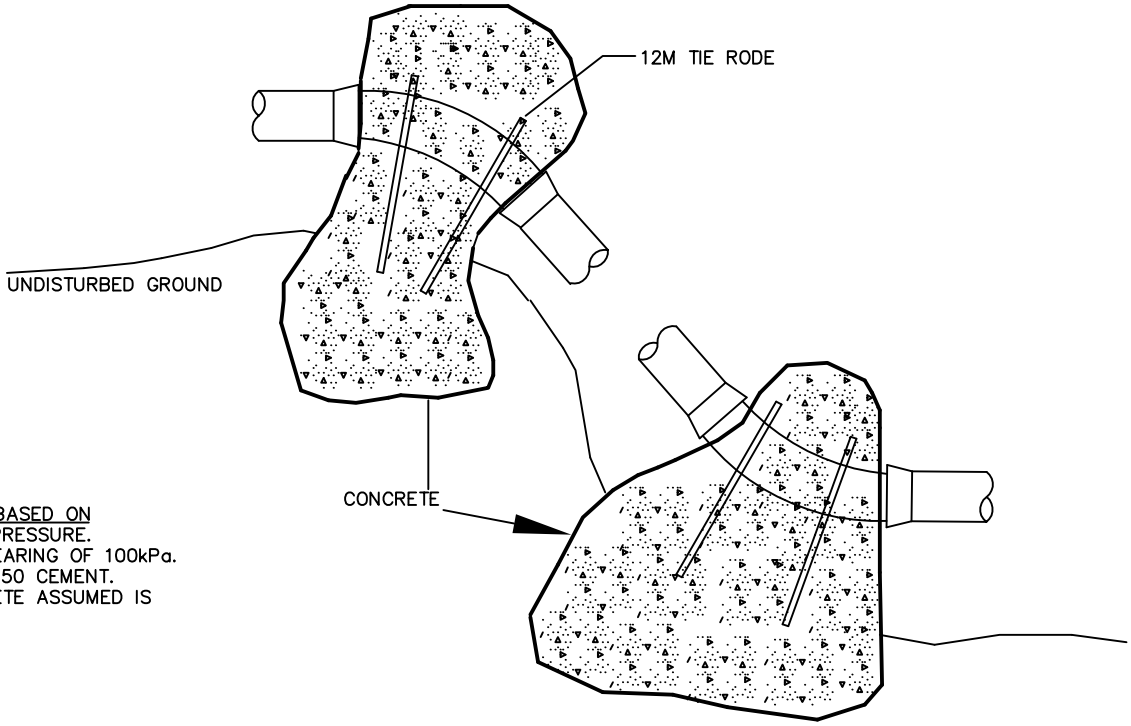
HORIZONTAL THRUST BLOCK BEARING AREA						
MINIMUM CONCRETE AREA IN CONTACT WITH UNDISTURBED SOIL (sq. m)						
FITTING	SIZE OF MAIN (mm)					
	150	200	250	300	400	500
Dead End Main & Tee	0.35	0.62	0.97	1.40	2.49	3.90
11 1/4 Degree Bend	0.07	0.12	0.20	0.28	0.50	0.78
22 1/2 Degree Bend	0.14	0.24	0.38	0.55	0.97	1.52
45 Degree Bend	0.27	0.48	0.75	1.07	1.91	2.98
90 Degree Bend	0.50	0.88	1.38	1.98	3.53	5.51
Valve & Reducer	0.35	0.62	0.97	1.40	2.49	3.90

NOTE:

- BEARING AREA CALCULATED USING THE FOLLOWING:
  (a) HYDRAULIC PRESSURE 1380 kPa.
  (b) SOIL BEARING CAPACITY 72 Kpa.
- CONCRETE STRENGTH TO BE 20MPa.
- CONCRETE TO BE CLEAR OF BELLS & PIPE.
- PLACE 6mL POLYETHYLENE BETWEEN CONCRETE AND PIPE.
- SEE DWG. DET-03 FOR "CLASS B BEDDING DETAILS" FOR "d" DEPTH.
- BOLD LINE REPRESENTS THE BEARING SURFACE.
- THE REQUIRED BEARING AREA SHALL BE DETERMINED BY THE CONTRACTOR TO SUIT THE SOIL CONDITIONS.

THRUST BLOCK DETAILS

Project No.	4006035
Scale	N.T.S
Date	MAY 2007
Standard Detail No.	4.6



THRUST BLOCK DESIGN IS BASED ON
1. 1035kPa MAX. SYSTEM PRESSURE.
2. A MIN VERTICAL SOIL BEARING OF 100kPa.
3. CONCRETE 20MPa TYPE 50 CEMENT.
4. UNIT WEIGHT OF CONCRETE ASSUMED IS 2400kb/m3

UPWARD THRUST (GRAVITY) TABLE

FOR CALCULATION OF BASIC THRUST
BLOCK BEARING AREA (IN SQUARE METERS)

PIPE SIZE / BEND	150	200	250	300	350	400	450
11.25°	0.16	0.28	0.45	0.64	0.87	1.14	1.44
22.50°	0.32	0.57	0.88	1.27	1.73	2.26	2.82
30°	0.42	0.75	1.17	1.69	2.3	3.00	3.80
45°	0.62	1.11	1.73	2.50	3.40	4.44	5.62

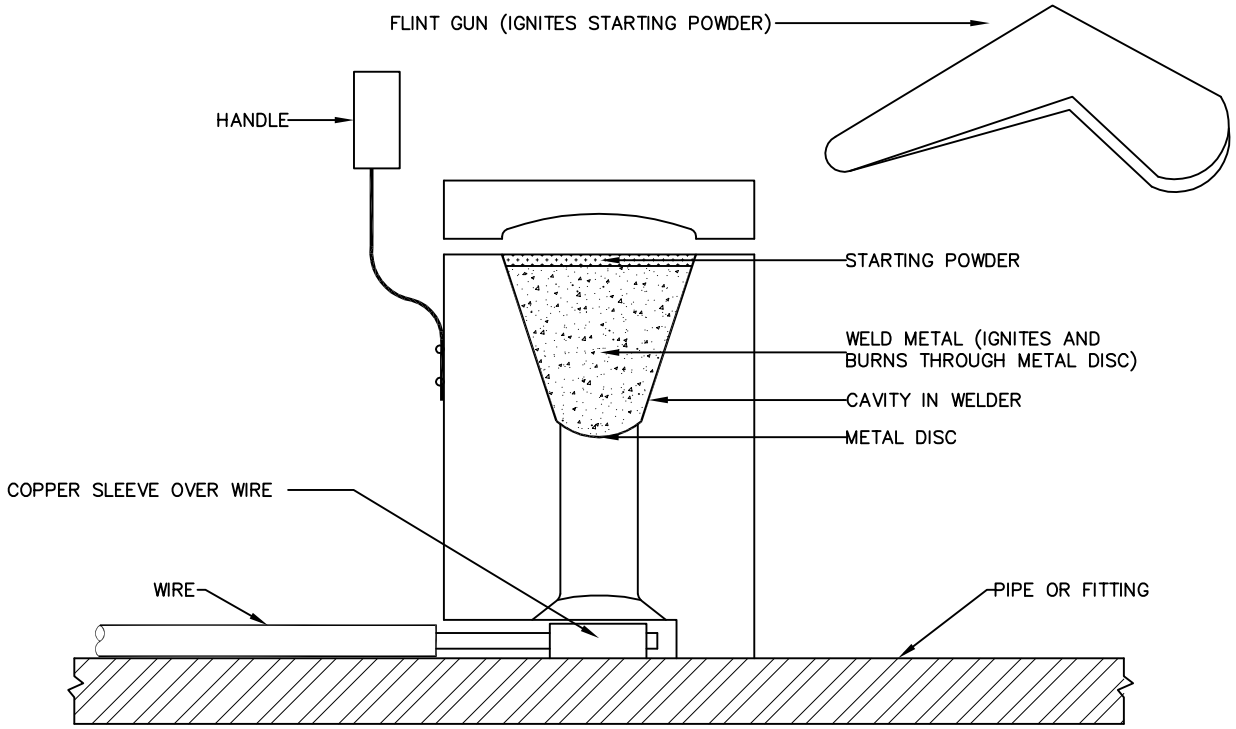
DOWNWARD THRUST TABLE

FOR CALCULATION OF BASIC THRUST
BEARING AREA (IN SQUARE METERS)

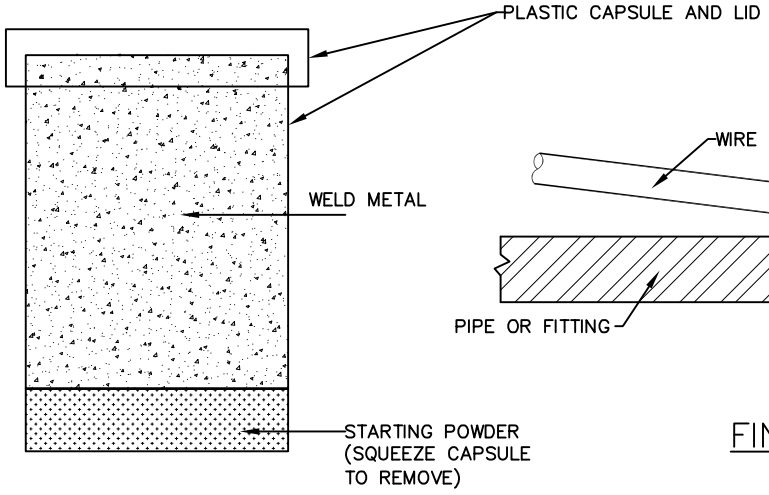
PIPE SIZE / BEND	150	200	250	300	350	400	450
11.25°	0.04	0.07	0.11	0.15	0.21	0.27	0.34
22.50°	0.08	0.13	0.21	0.30	0.41	0.53	0.67
30°	0.10	0.18	0.28	0.40	0.54	0.71	0.89
45°	0.15	0.26	0.41	0.59	0.80	1.05	1.32

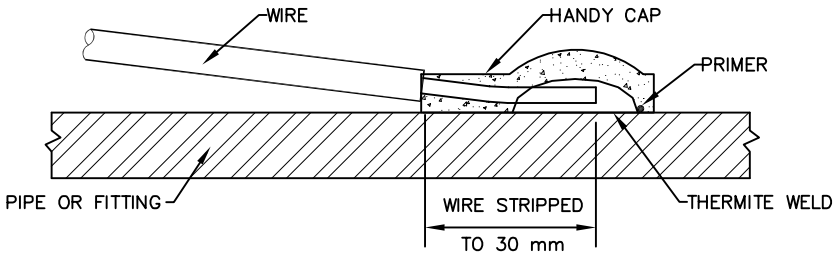
VERTICAL BEND
THRUST BLOCK DETAIL

Project No. 4006035
Scale N.T.S
Date MAY 2007
Standard Detail No. 4.7



CADWELD





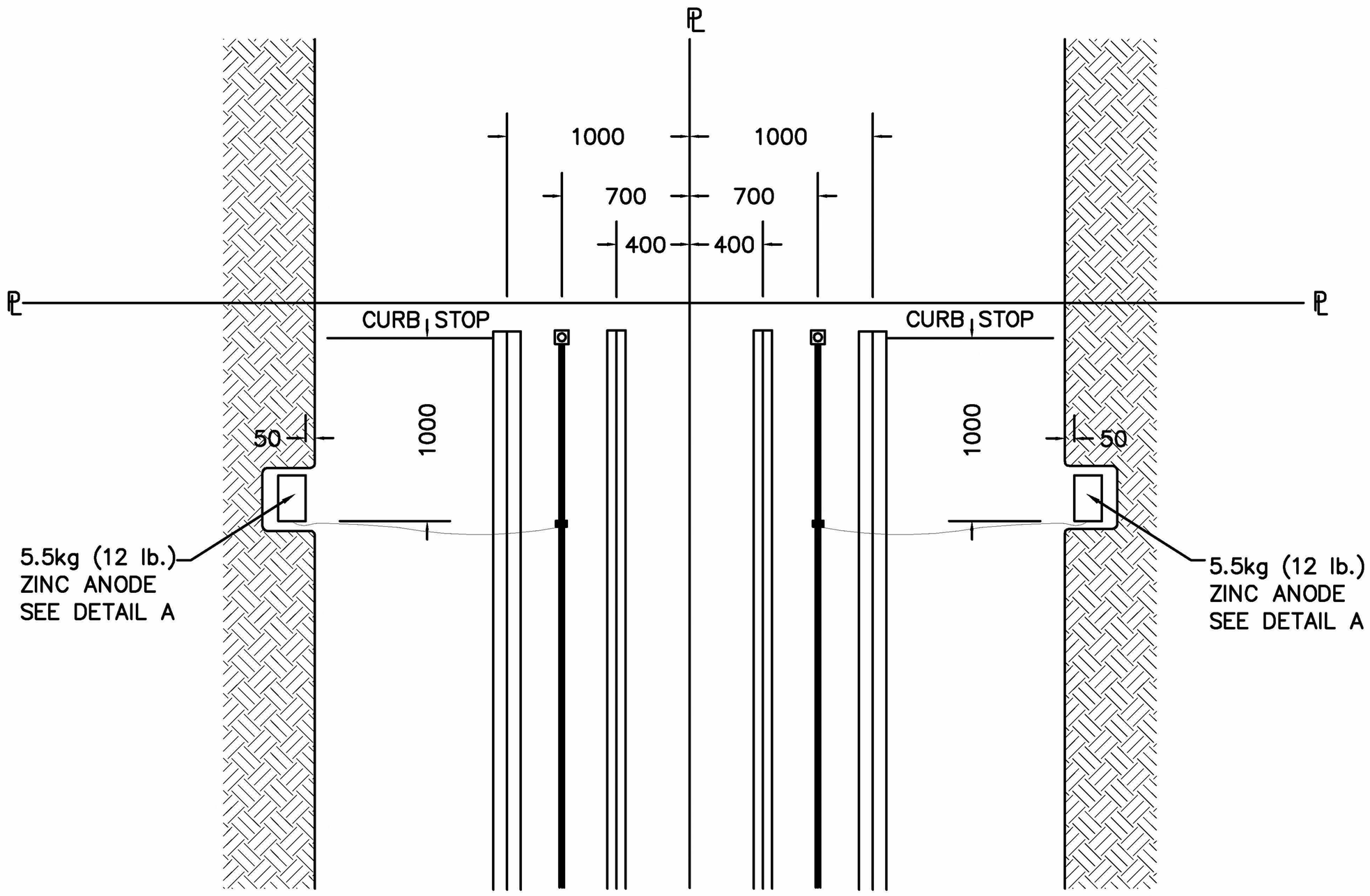
FINISHED WELD

WELD METAL CAPSULE

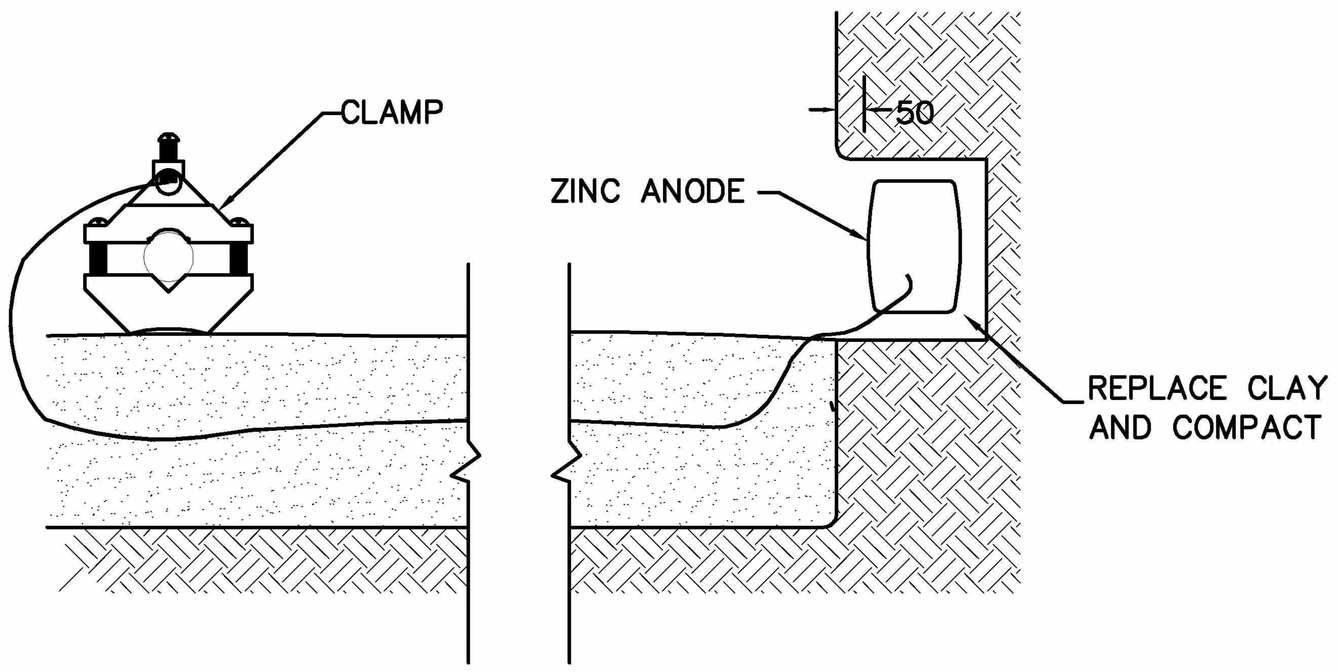
NOTES:

1. CADWELD TO BE PERFORMED AS PER MANUFACTURERS SPECIFICATIONS

	ANODE INSTALLATION CADWELD	Project No. 4006035
		Scale N.T.S / Date MAY 2007
		Standard Detail No. 4.8



PLAN VIEW
SCALE: 1:50



DETAIL A

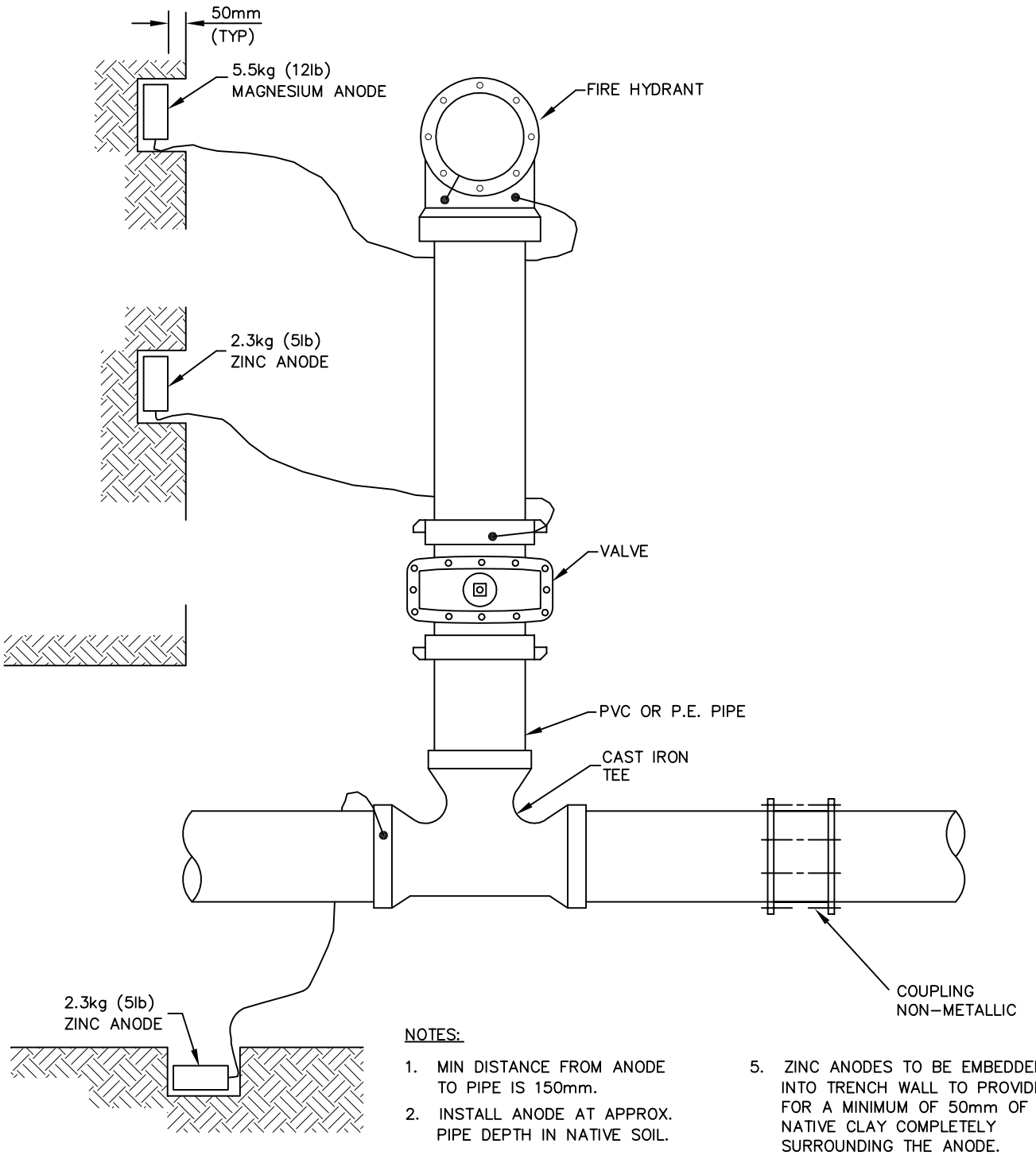
NOTES:

1. PIPE CLAMP TO BE ALL BRASS OR APPROVED EQUIVALENT
2. ZINC ANODES TO BE EMBEDDED INTO TRENCH WALL TO PROVIDE FOR A MINIMUM OF 50mm COMPACTED SOIL COMPLETELY AROUND ANODES.
3. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.

MUNICIPAL DISTRICT OF LESSER SLAVE RIVER
M.D. No. 124

ANODE ON 50 mm AND SMALLER COPPER WATER SERVICE

Project No.	4006035
Scale	N.T.S
Date	MAY 2007
Standard Detail No.	4.9

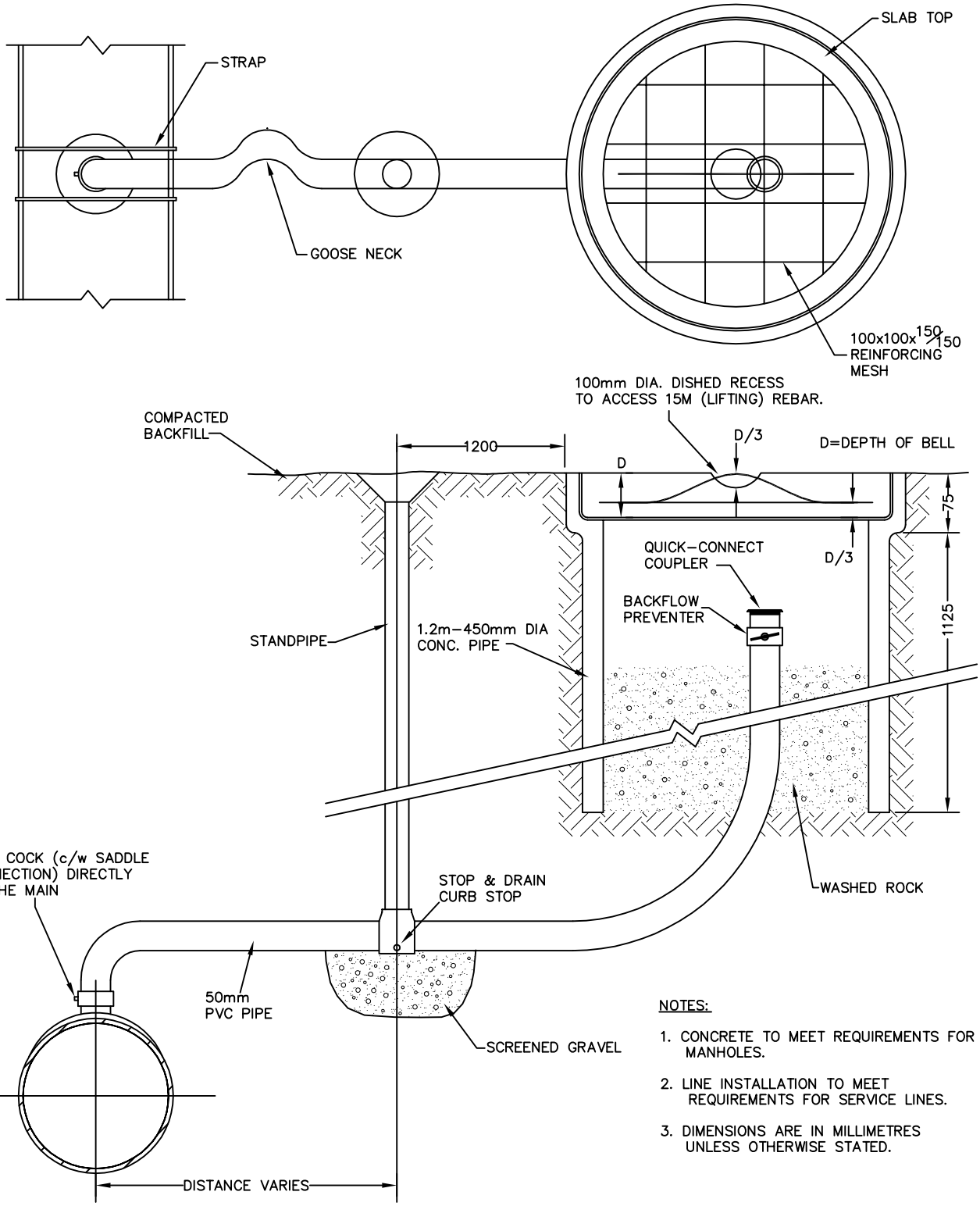


NOTES:

1. MIN DISTANCE FROM ANODE TO PIPE IS 150mm.
2. INSTALL ANODE AT APPROX. PIPE DEPTH IN NATIVE SOIL.
3. ALL ZINC ANODES ON FITTINGS AND VALVES ARE 2.3 kg (5lb).
4. ALL ZINC ANODES ON HYDRANTS ARE 5.5 kg (12lb).
5. ZINC ANODES TO BE EMBEDDED INTO TRENCH WALL TO PROVIDE FOR A MINIMUM OF 50mm OF NATIVE CLAY COMPLETELY SURROUNDING THE ANODE.
6. ANODES TO BE AT LEAST 300mm CLEAR OF THRUST BLOCK.
7. REPLACE CLAY OVER ANODES AND COMPACT.

TYPICAL ANODE INSTALLATION AT VALVE IRON FITTINGS & HYDRANTS

Project No.	4006035
Scale	N.T.S
Date	MAY 2007
Standard Detail No.	4.10

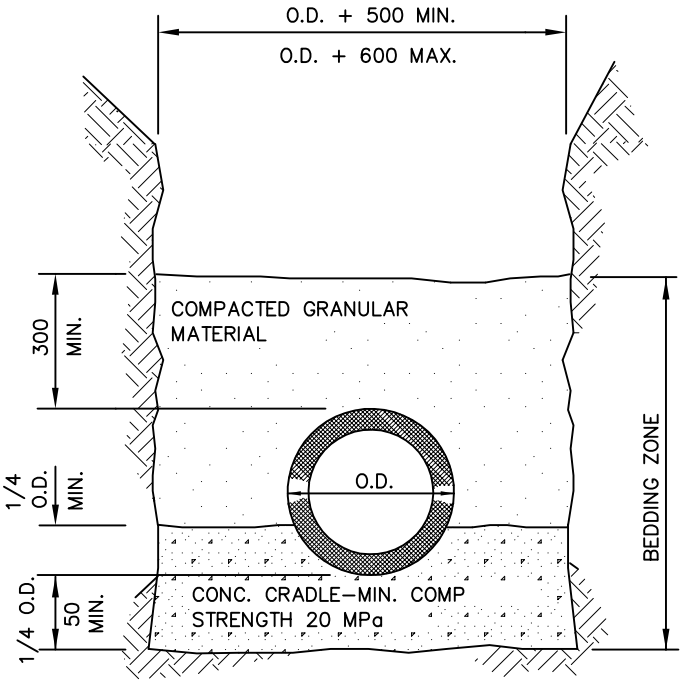


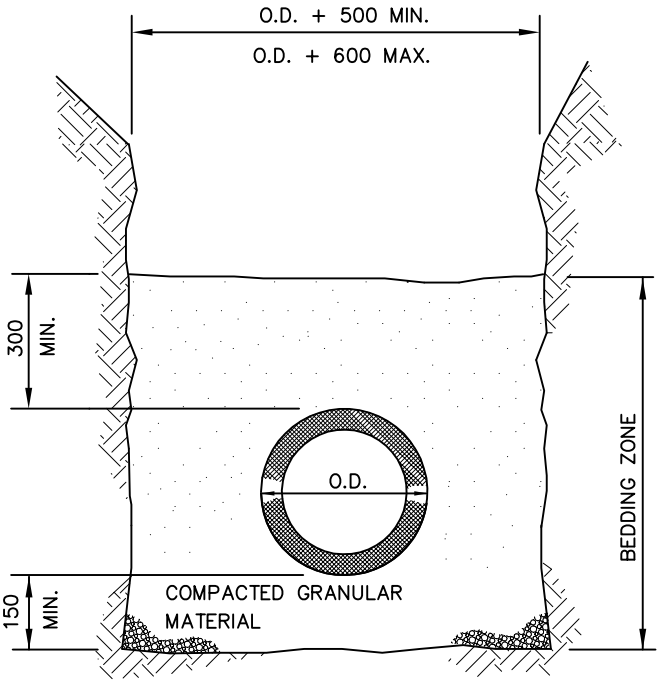
NOTES:

1. CONCRETE TO MEET REQUIREMENTS FOR MANHOLES.
2. LINE INSTALLATION TO MEET REQUIREMENTS FOR SERVICE LINES.
3. DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE STATED.

AIR RELIEF VALVE AND FLUSHING CHAMBER

Project No.	4006035
Scale	N.T.S
Date	MAY 2007
Standard Detail No.	5.1

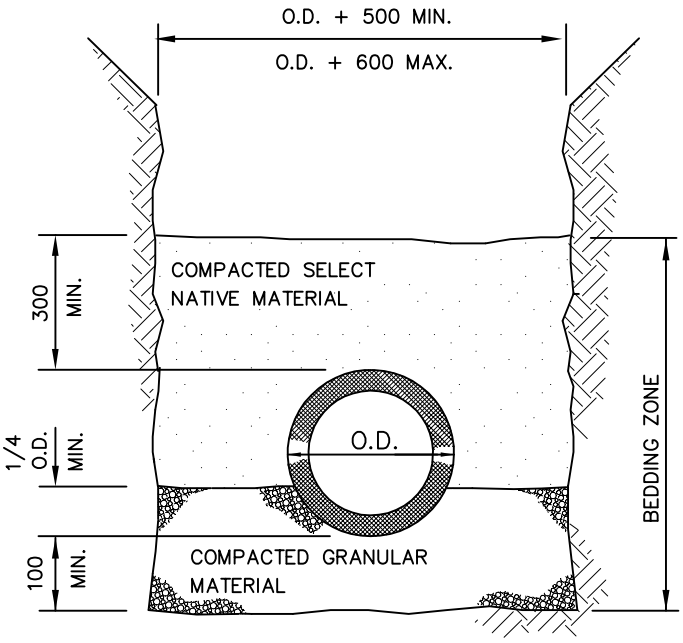




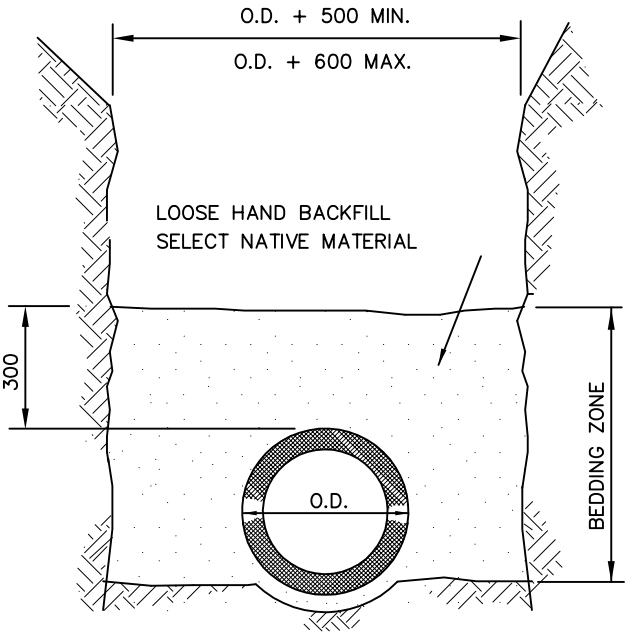
NOTE:

1. COMPACTION OF BEDDING ZONE SHALL BE AS PER SPECIFICATIONS. (MIN. 95% S.P.D.)
2. ALL DIMENSIONS ARE GIVEN IN MILLIMETRES UNLESS OTHERWISE STATED.
3. BACKFILL COMPACTION REQUIREMENTS WILL VARY. BACKFILL ABOVE PIPE ZONE TO BE APPROVED MATERIAL.
4. TRENCH SIDE SLOPES TO BE CONSISTENT WITH OCCUPATIONAL HEALTH AND SAFETY REQUIREMENTS

CLASS 'C' BEDDING

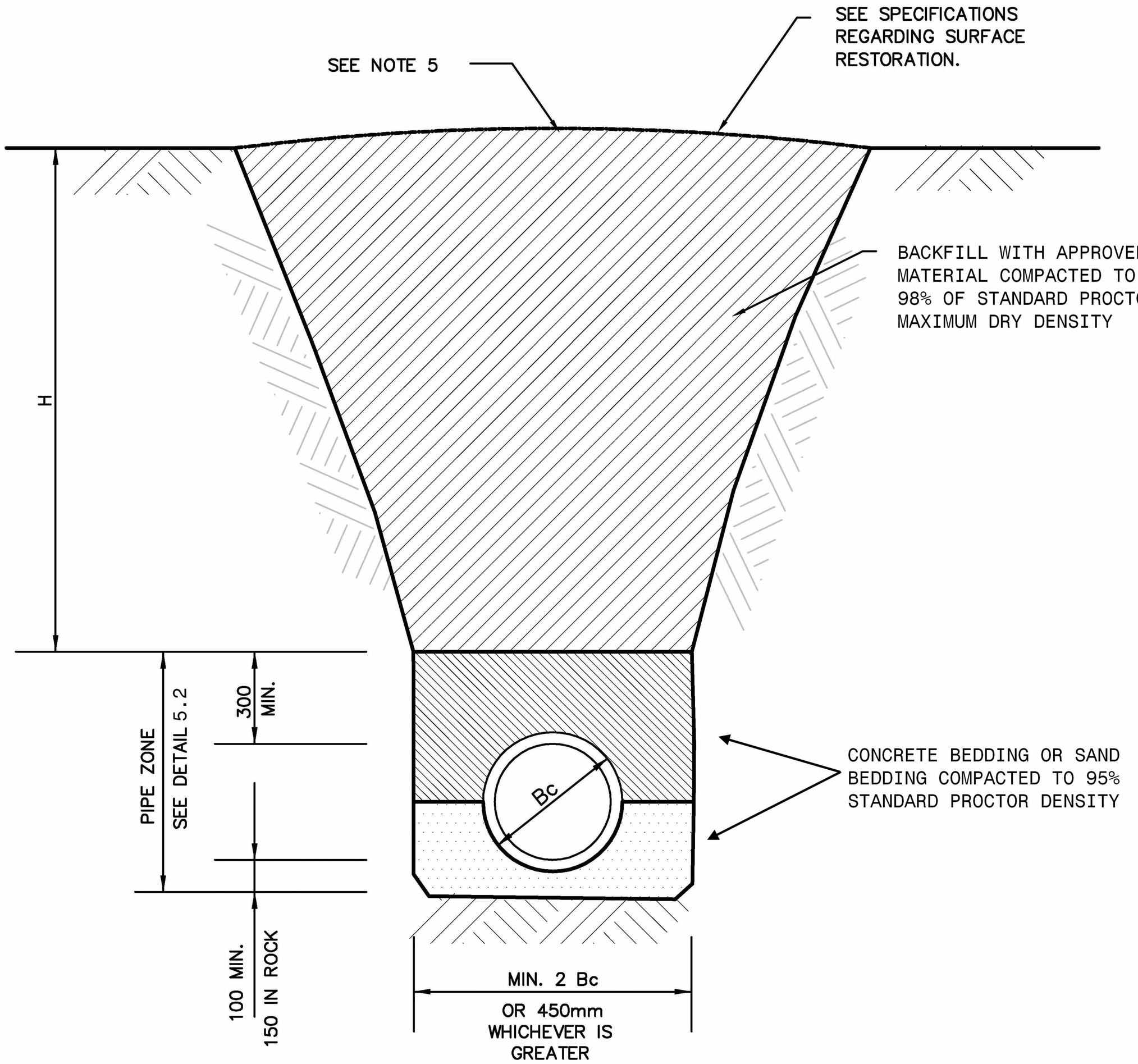


CLASS 'D' BEDDING



PIPE BEDDING DETAILS

Project No.	4006035
Scale	N.T.S
Date	MAY 2007
Standard Detail No.	5.2



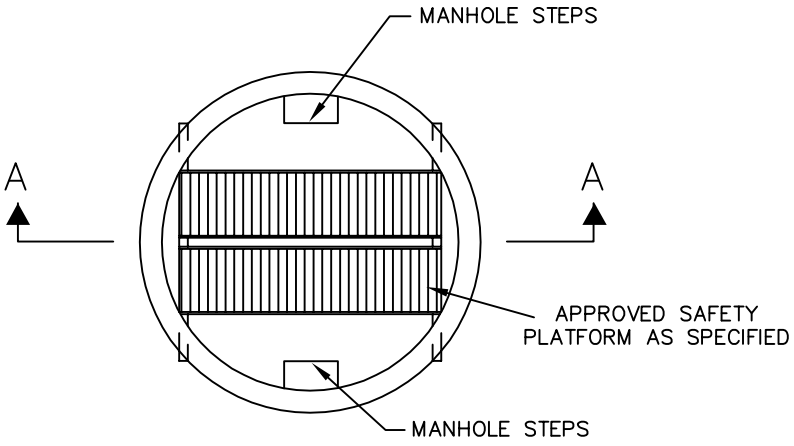
NOTES:

1. WHEN CUT BACK SLOPES ARE TO BE USED IN LIEU OF CAGES AND SHORING, THESE SLOPES ARE TO MEET REQUIREMENTS OF LOCAL CODES.
2. SEE SPECIFICATIONS FOR MINIMUM COVER ABOVE PIPE.
3. MIN. PIPE ZONE WIDTH IS SPECIFIED TO ALLOW PROPER PIPE ZONE COMPACTION.
4. Bc = OUTSIDE PIPE DIAMETER.
5. FOR UNCOMPACTED BACKFILL, CROWN TRENCH BY 0.1 x H.

MUNICIPAL DISTRICT OF LESSER SLAVE RIVER M.D. No. 124

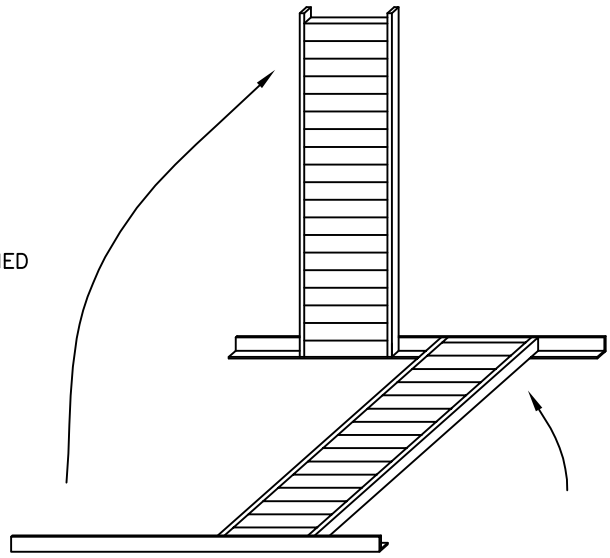
TYPICAL TRENCH DETAIL

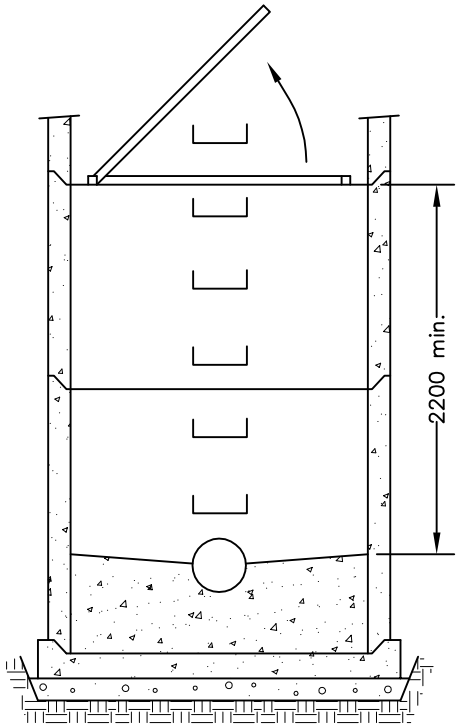
Project No.	4006035
Scale	N.T.S
Date	MAY 2007
Standard Detail No.	5.3



PLAN VIEW

N.T.S





SECTION 'A–A'

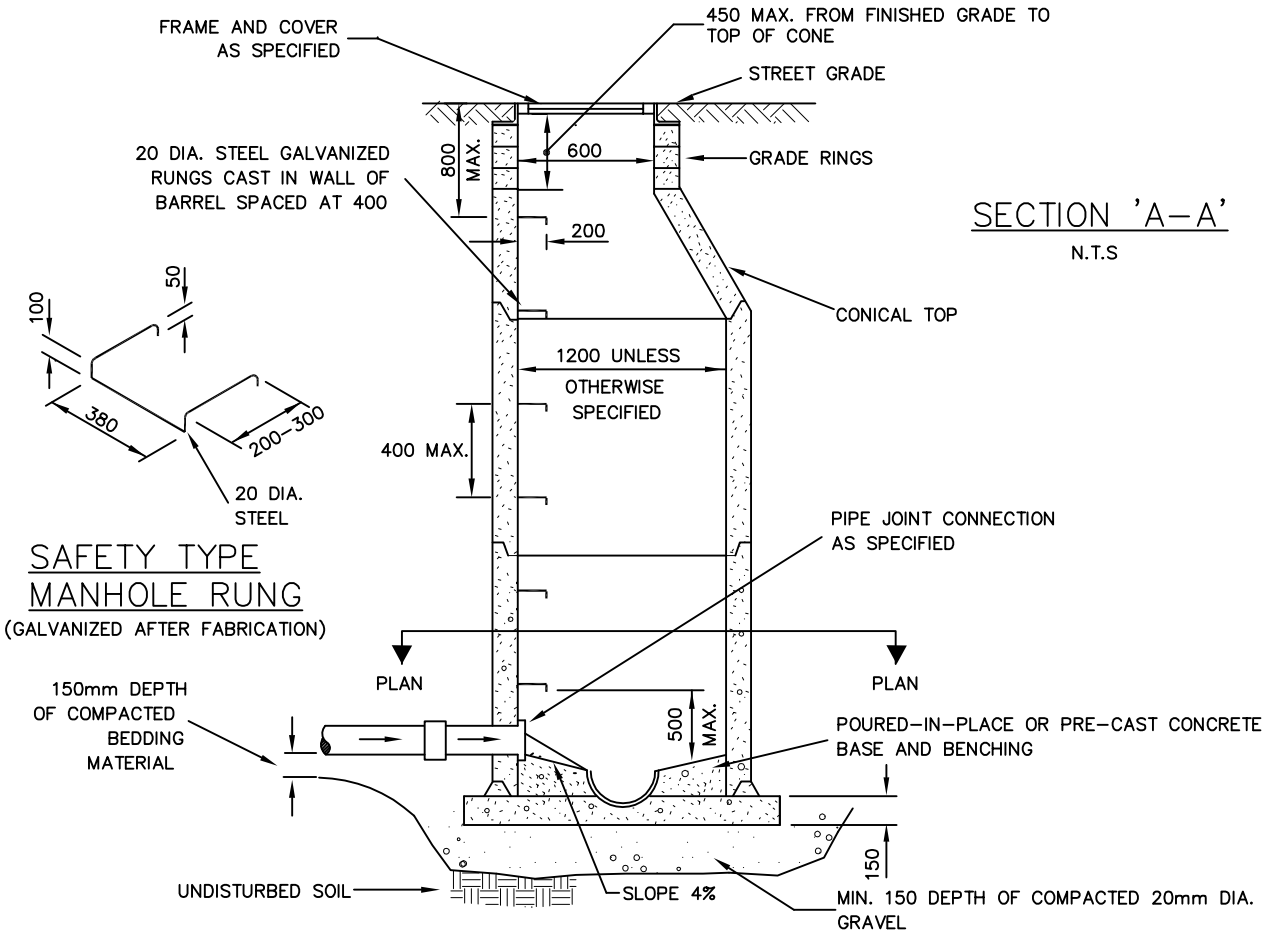
N.T.S

NOTES:

1. TO BE INSTALLED ON MANHOLES GREATER THAN 5.0m DEEP.
2. MAXIMUM SPACING BETWEEN PLATFORMS TO BE 5.0m.
3. ALUMINUM GRATES TO BE MSU MISSISSAUGA OR APPROVED EQUAL.
4. TO BE INSTALLED ACCORDING TO MANUFACTURER'S RECOMMENDATIONS.

MANHOLE SAFETY PLATFORM

Project No.	4006035
Scale	N.T.S
Date	MAY 2007
Standard Detail No.	6.1

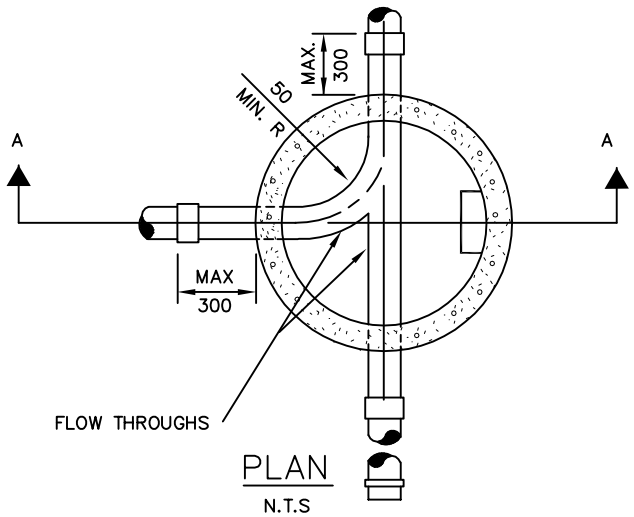


SECTION 'A-A'

N.T.S

SAFETY TYPE MANHOLE RUNG

(GALVANIZED AFTER FABRICATION)



PLAN

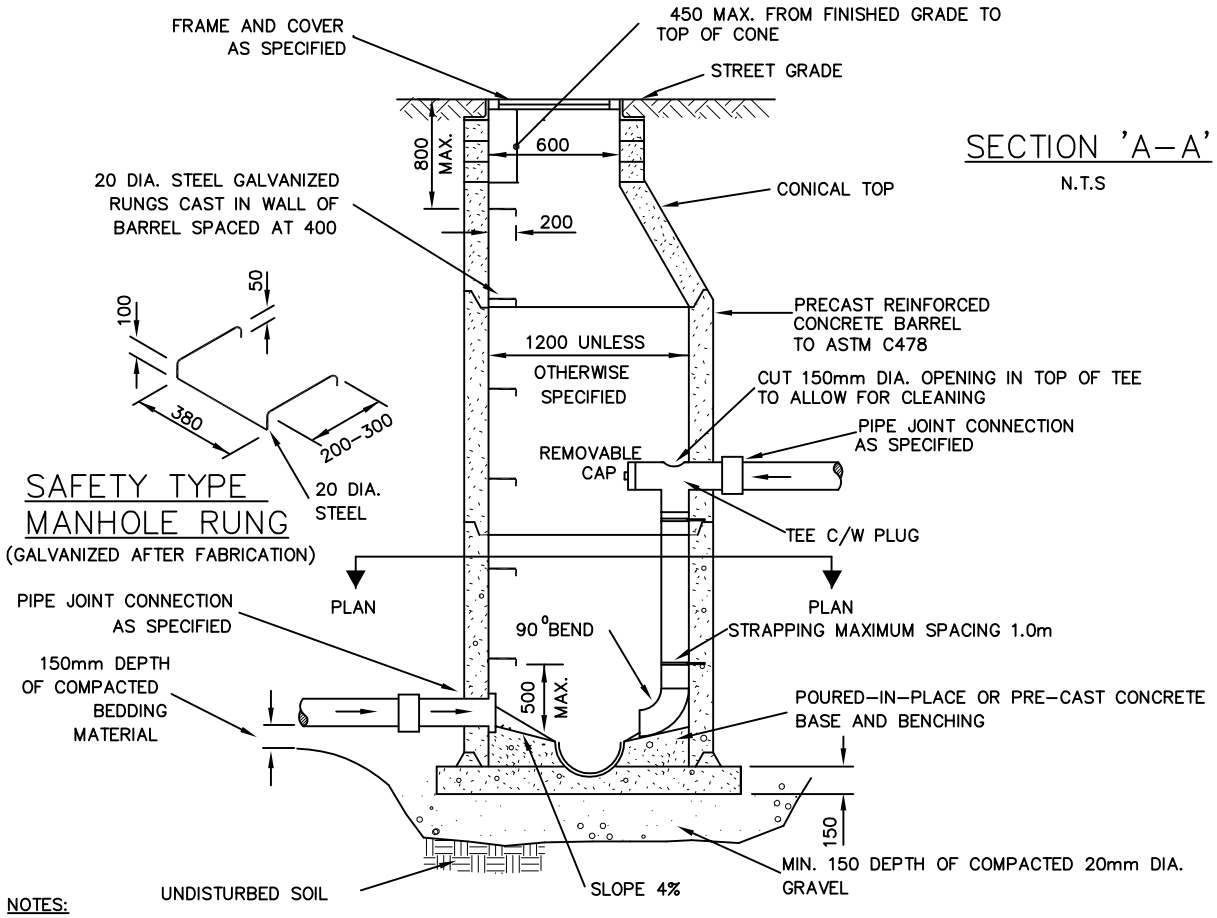
N.T.S

NOTES:

1. ALL PRE-CAST MANHOLES MUST CONFORM TO A.S.T.M. SPECIFICATIONS C478.
2. POURED-IN-PLACE CONCRETE SHALL HAVE 28 DAYS COMPRESSIVE STRENGTH OF AT LEAST 25 MPa.
3. ALL JOINTS TO BE SET WITH RUBBER GASKET AND SET WITH NON-SHRINK GROUT, INSIDE AND OUT, FOR THE FULL CIRCUMFERENCE.
4. FORM FLOW TROUGH IN PARTIALLY SET CONCRETE AND TROWEL SMOOTH.
5. ALL DIMENSIONS GIVEN IN MILLIMETRES UNLESS OTHERWISE STATED.
6. MAX. DIST. FROM RIM TO TOP RUNG IS 800 mm.
7. BACKFILL AROUND MH. WITH SELECT NATIVE MATERIAL. COMPACT TO 98% S.P.D.
8. FLAT TOP SECTION TO BE USED FOR MANHOLES UP TO 1.8 m BURY.
9. ALL JOINTS TO BE WATERTIGHT. METHODS TO BE CONSISTENT WITH SITE CONDITIONS.
10. FOR MANHOLES 5.0 m IN DEPTH OR GREATER, A SAFETY PLATFORM SHALL BE INSTALLED.
11. MANHOLES TO MEET REQUIREMENTS OF MANHOLE DETAILS AND SPECIFICATIONS.
12. SAFETY STEPS TO BE PROVIDED, SPACED AT 400 MAX. FIRST STEP 150 MAX. BELOW FRAME, LAST STEP 300 MAX. ABOVE BASE.

MANHOLE DETAIL
TYPE 5A PRE-CAST

Project No.	4006035
Scale	N.T.S
Date	MAY 2007
Standard Detail No.	6.2



SECTION 'A-A'

N.T.S

SAFETY TYPE MANHOLE RUNG

(GALVANIZED AFTER FABRICATION)

NOTES:

1. ALL PRE-CAST MANHOLES MUST CONFORM TO A.S.T.M. SPECIFICATIONS C478.

2. POURED-IN-PLACE CONCRETE SHALL HAVE 28 DAYS COMPRESSIVE STRENGTH OF AT LEAST 25 MPa.

3. ALL JOINTS TO BE SET WITH RUBBER GASKET AND SET WITH NON-SHRINK GROUT, INSIDE AND OUT, FOR THE FULL CIRCUMFERENCE.

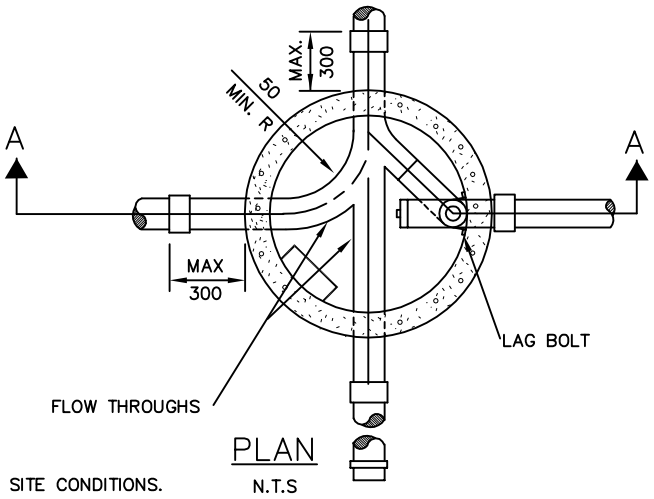
4. FORM FLOW THROUGH IN PARTIALLY SET CONCRETE AND TROWEL SMOOTH.

5. ALL DIMENSIONS ARE GIVEN IN MILLIMETRES UNLESS OTHERWISE STATED.

6. MAX. DIST. FROM RIM TO TOP RUNG IS 800 mm.

7. BACKFILL AROUND MH. WITH SELECT NATIVE MATERIAL AND COMPACT TO 98 % S.P.D.

8. FLAT TOP SECTION TO BE USED FOR MANHOLES UP TO 1.8 m BURY.



PLAN

N.T.S

9. ALL JOINTS TO BE WATERTIGHT. METHODS TO BE CONSISTENT WITH SITE CONDITIONS.

10. FOR MANHOLES 5.0 m IN DEPTH AND GREATER, A SAFETY PLATFORM SHALL BE INSTALLED.

11. MANHOLES TO MEET REQUIREMENTS OF MANHOLE DETAILS AND SPECIFICATIONS.

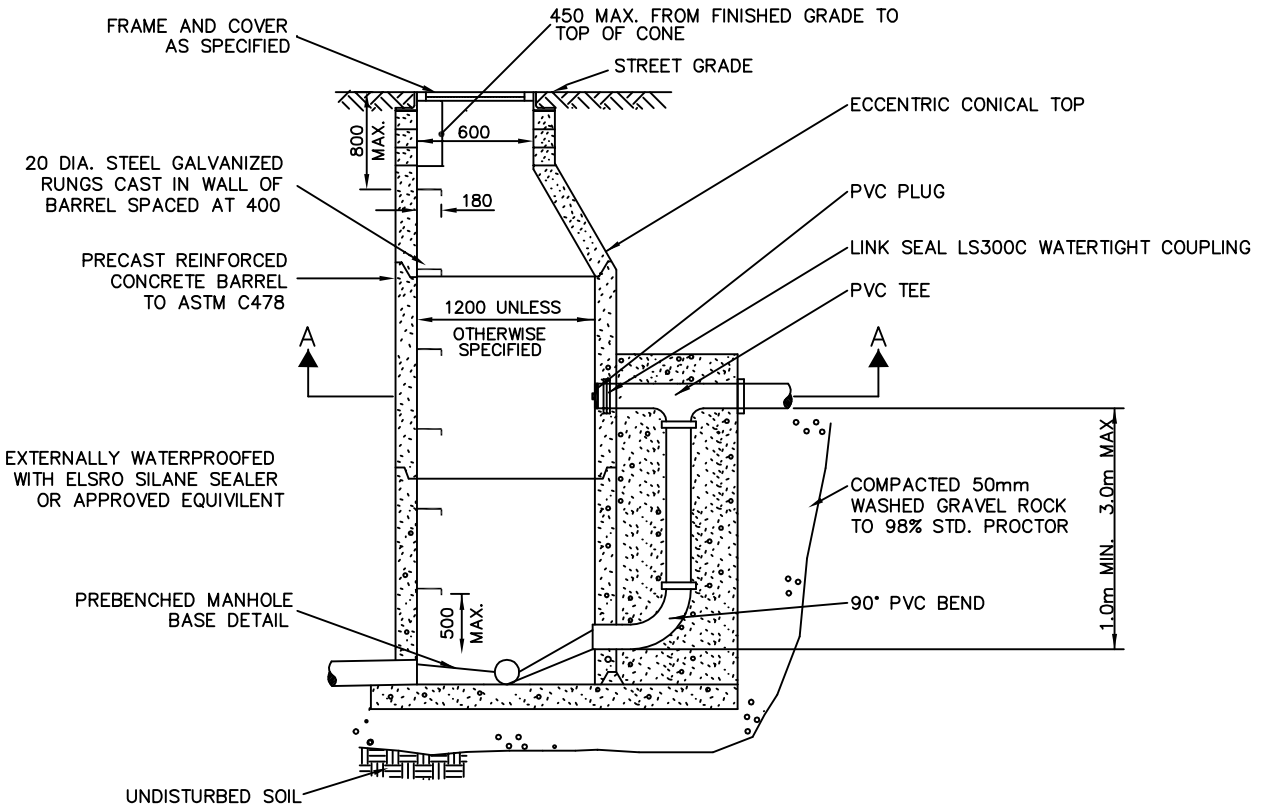
12. LAG BOLTS AND STRAPPING ARE TO BE INSTALLED IMMEDIATELY BELOW THE TEE AND A CONTINUAL 1.0 m VERTICAL SPACING TO THE BASE.

13. DIAMETER, SIZE, AND TYPE OF VERTICAL PIPE TO MATCH INLET PIPE.

14. SAFETY STEPS TO BE PROVIDED, SPACED AT 400 MAX. FIRST STEP 150 MAX. BELOW FRAME, LAST STEP 300 MAX. ABOVE BASE.

INTERIOR DROP MANHOLE DETAIL

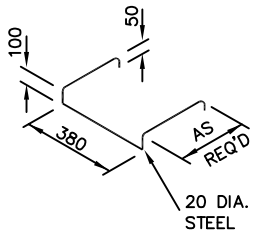
Project No.	4006035
Scale	N.T.S
Date	MAY 2007
Standard Detail No.	6.3



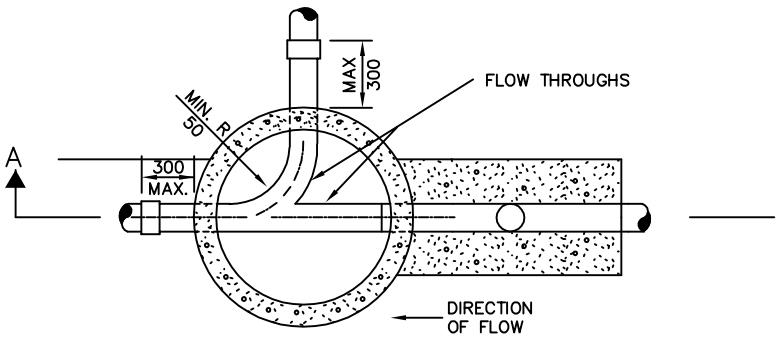
NOTES:

1. ALL PRE–CAST MANHOLES MUST CONFORM TO A.S.T.M. SPECIFICATIONS C478
2. POURED–IN–PLACE CONCRETE SHALL HAVE A 28 DAY COMPRESSIVE STRENGTH OF AT LEAST 25 MPa.
3. ALL JOINTS TO BE SET WITH RUBBER GASKET AND SET WITH NON–SHRINK GROUT, INSIDE AND OUT, AROUND FULL CIRCUMFERENCE.
4. FORM FLOW TROUGH IN PARTIALLY SET CONCRETE AND TROWEL SMOOTH.
5. ALL DIMENSIONS GIVEN IN MILLIMETRES.
6. MAX. DIST. FROM RIM TO TOP RUNG IS 800 mm.
7. BACKFILL AROUND MH. WITH SELECT NATIVE MATERIAL COMPACT TO 98 % S.P.D.
8. FLAT TOP SECTION TO BE USED FOR MANHOLES UP TO 1.8 m BURY.
9. ALL JOINTS TO BE WATERTIGHT. METHODS TO BE CONSISTENT WITH SITE CONDITIONS.
10. FOR MANHOLES 5.0 m IN DEPTH OR GREATER, A SAFETY PLATFORM SHALL BE INSTALLED.
11. MANHOLES TO MEET REQUIREMENTS OF MANHOLE DETAILS AND SPECIFICATIONS.
12. SAFETY STEPS TO BE PROVIDED, SPACED AT 400 MAX. FIRST STEP 150 MAX. BELOW FRAME, LAST STEP 300 MAX. ABOVE BASE.
13. CHANNELING AND BENCHING TO BE FINISHED TO TROWEL SMOOTHNESS.

SAFETY TYPE MANHOLE RUNG
(GALVANIZED AFTER FABRICATION)

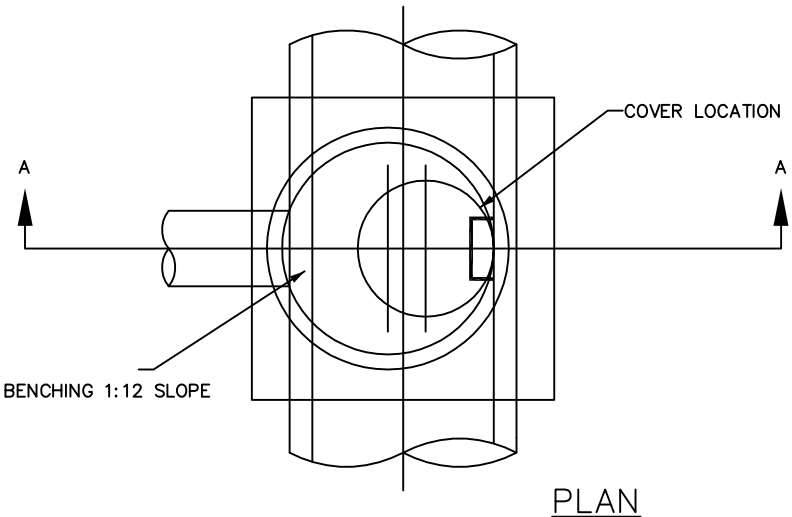


SECTION 'A–A'

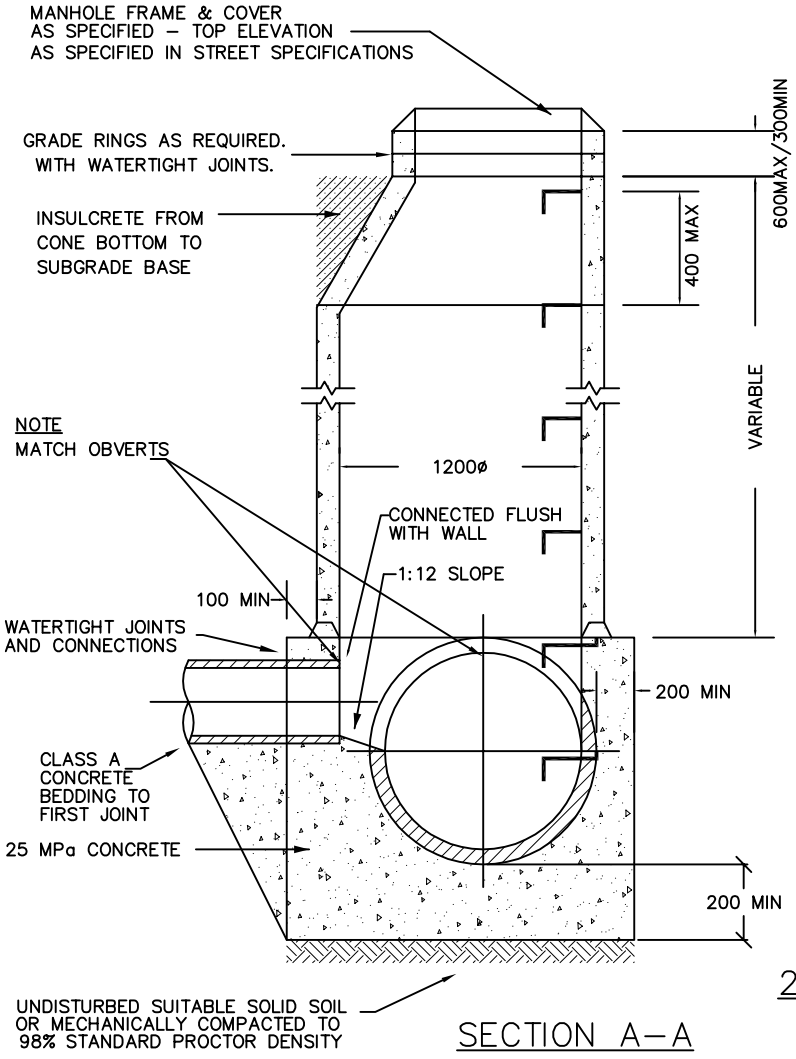


EXTERIOR DROP MANHOLE DETAIL

Project No.	4006035
Scale	N.T.S
Date	MAY 2007
Standard Detail No.	6.4



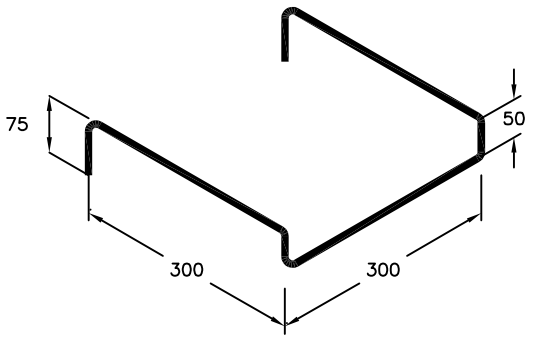
PLAN



SECTION A–A

NOTES:

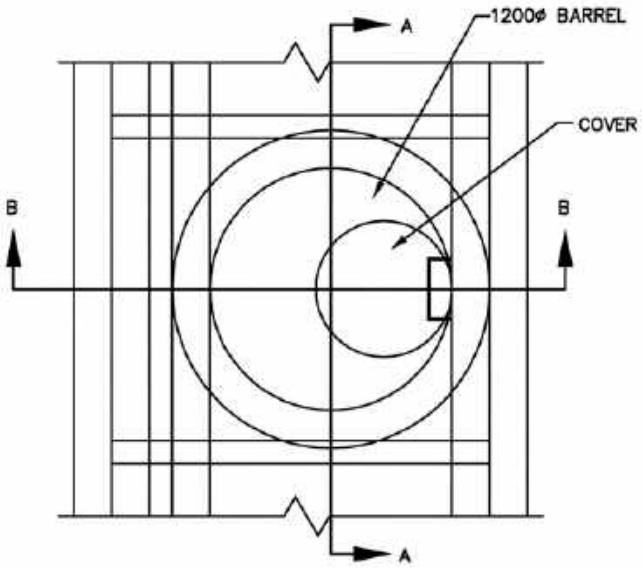
1. PRE–CAST CONCRETE COMPONENTS MUST CONFORM TO A.S.T.M. SPECIFICATIONS C478.
2. POURED–IN–PLACE CONCRETE TO HAVE 28 DAYS COMPRESSIVE STRENGTH OF AT LEAST 25 MPa.
3. ALL JOINTS TO BE SET WITH RUBBER GASKET AND FINISHED WITH NON–SHRINK GROUT, INSIDE AND OUTSIDE, FOR THE FULL CIRCUMFERENCE.
4. FORM FLOW TROUGH IN PARTIALLY SET CONCRETE AND TROWEL SMOOTH.
5. ALL DIMENSIONS GIVEN IN MILLIMETRES UNLESS OTHERWISE STATED.
6. MAX. DIST. FROM RIM TO TOP RUNG IS 800 mm.
7. BACKFILL AROUND MH. WITH SELECT NATIVE MATERIAL COMPACT TO 98 % S.P.D.
8. FLAT TOP SECTION TO BE USED FOR MANHOLES UP TO 1.8 m BURY.
9. ALL JOINTS TO BE WATERTIGHT. METHODS TO BE CONSISTENT WITH SITE CONDITIONS.
10. FOR MANHOLES 5.0 m IN DEPTH OR GREATER, A SAFETY PLATFORM SHALL BE INSTALLED.
11. MANHOLES TO MEET REQUIREMENTS OF MANHOLE DETAILS AND SPECIFICATIONS.
12. SAFETY STEPS TO BE SPACED AT 400 MAX. DISTANCE. FIRST STEP TO BE 150 MAX. BELOW FRAME, LAST STEP TO BE 300 MAX. ABOVE BENCHING.
13. CHANNELLING AND BENCHING TO BE FINISHED TO TROWEL SMOOTHNESS.



20ø GALVANIZED IRON MANHOLE SAFETY STEPS

TYPICAL PERCHED MANHOLE FOR 600 TO 1050 mm DIAMETER PIPES

Project No.	4006035
Scale	N.T.S
Date	MAY 2007
Standard Detail No.	6.5



PLAN

NOTES:

1. THIS TYPE OF MANHOLE IS TO BE BUILT ONLY ON MAINS OF 1200 mm DIAMETER OR LARGER AND WHERE THERE IS NO CHANGE IN DIRECTION OF FLOW.

2. ALL PRE-CAST MANHOLES MUST CONFORM TO A.S.T.M. SPECIFICATIONS C478.

3. POURED-IN-PLACE CONCRETE SHALL HAVE A 28 DAYS COMPRESSIVE STRENGTH OF AT LEAST 25 MPa.

4. ALL JOINTS TO BE SET WITH RUBBER GASKETS AND SET WITH NON-SHRINK GROUT, INSIDE AND OUT, FOR THE FULL CIRCUMFERENCE.

5. FORM FLOW TROUGH IN PARTIALLY SET CONCRETE AND TROWEL SMOOTH.

6. ALL DIMENSIONS GIVEN IN MILLIMETRES UNLESS OTHERWISE STATED.

7. MAX. DIST. FROM RIM TO TOP RUNG IS 800 mm.

8. BACKFILL AROUND MH. WITH SELECT NATIVE MATERIALS AND COMPACT TO 98% S.P.D.

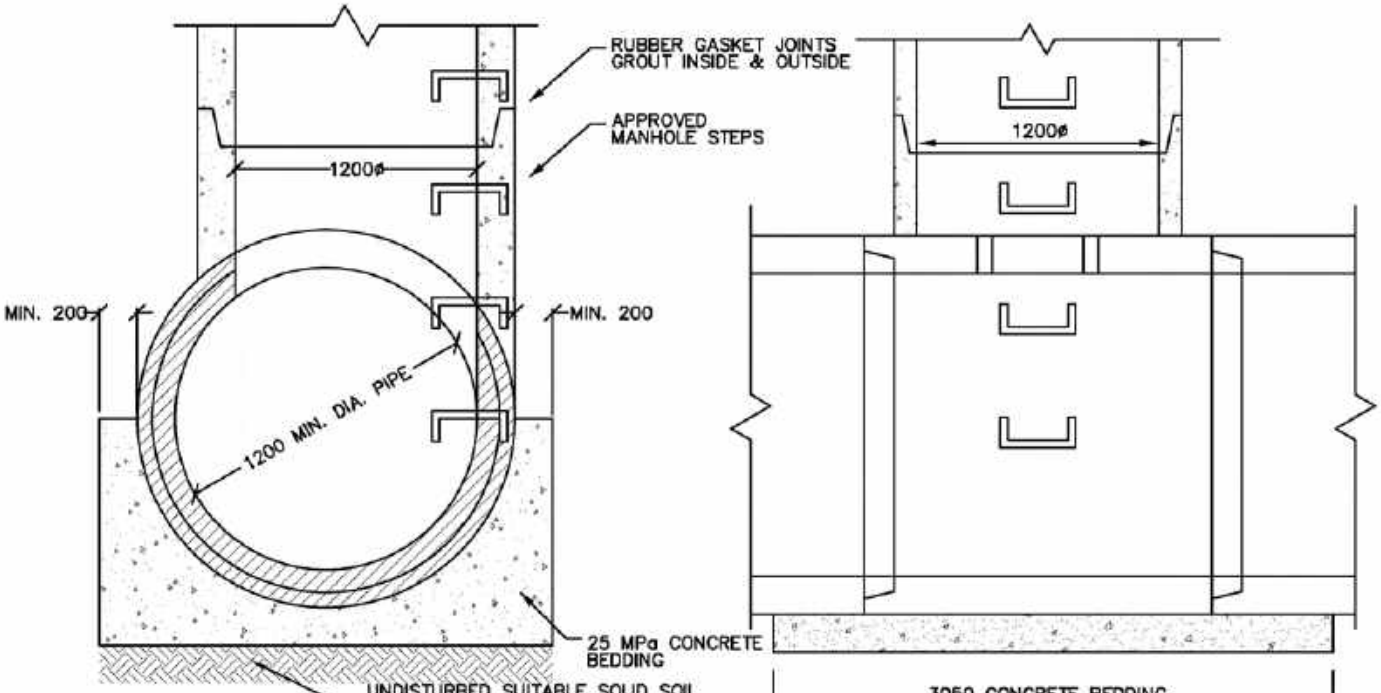
9. ALL JOINTS TO BE WATERTIGHT. METHODS TO BE CONSISTENT WITH SITE CONDITIONS.

10. FOR MANHOLES 5.0 m IN DEPTH OR GREATER, A SAFETY PLATFORM SHALL BE INSTALLED.

11. MANHOLES TO MEET REQUIREMENTS OF MANHOLE DETAILS AND SPECIFICATIONS.

12. SEE DETAIL 6.5 FOR TOP OF MANHOLE AND STEP DETAILS.

13. SAFETY STEPS TO BE SPACED AT 400 MAX. DISTANCE. FIRST STEP TO BE 150 MAX. BELOW FRAME, LAST STEP TO BE MAX. 300 ABOVE BENCHING.



SECTION B-B

SECTION A-A

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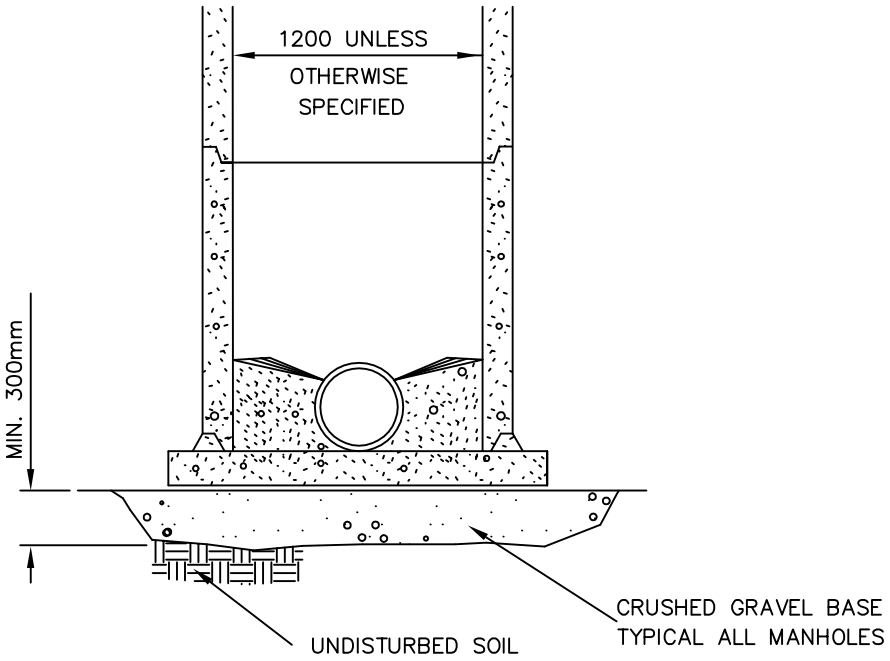
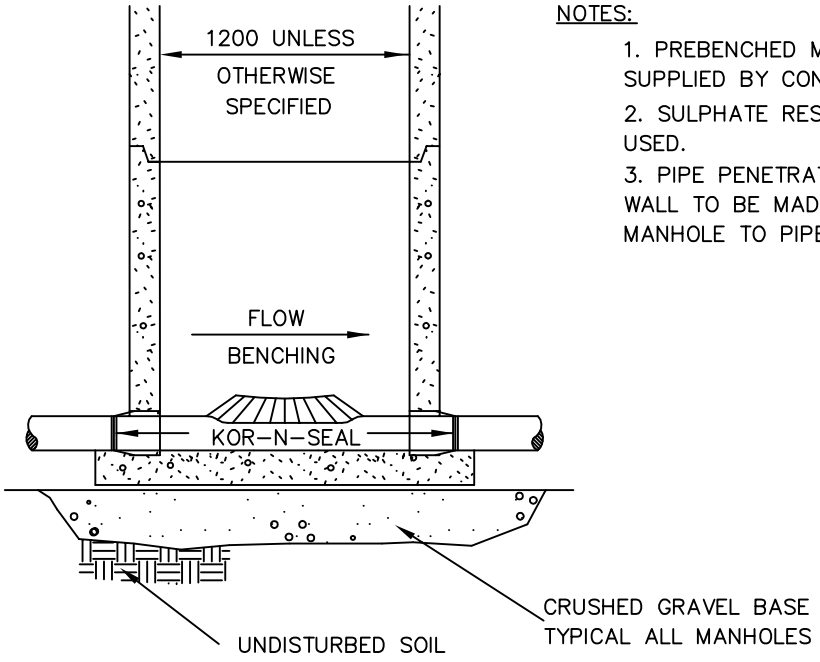
T-RISER MANHOLE FOR PIPES 1200 mm AND LARGER

Project No.	4006035
Scale	N.T.S
Date	MAY 2007
Standard Detail No.	6.6



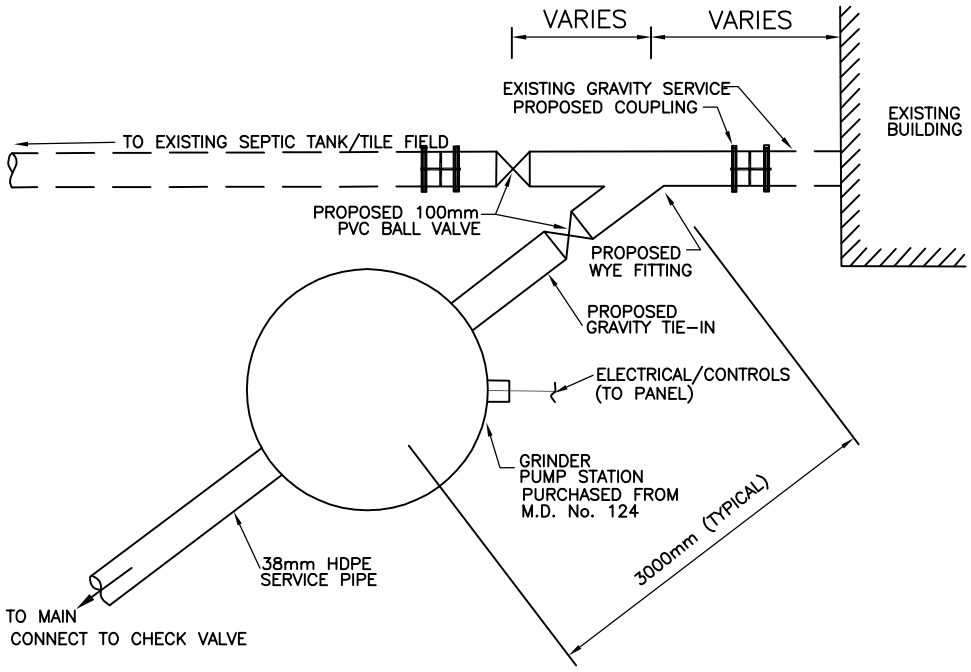


NOTES:

1. PREBENCHED MANHOLE BASES AS SUPPLIED BY CONCRETE MANUFACTURER.
2. SULPHATE RESISTANT CEMENT TO BE USED.
3. PIPE PENETRATIONS THROUGH MANHOLE WALL TO BE MADE USING KOR–N–SEAL MANHOLE TO PIPE SEALS.

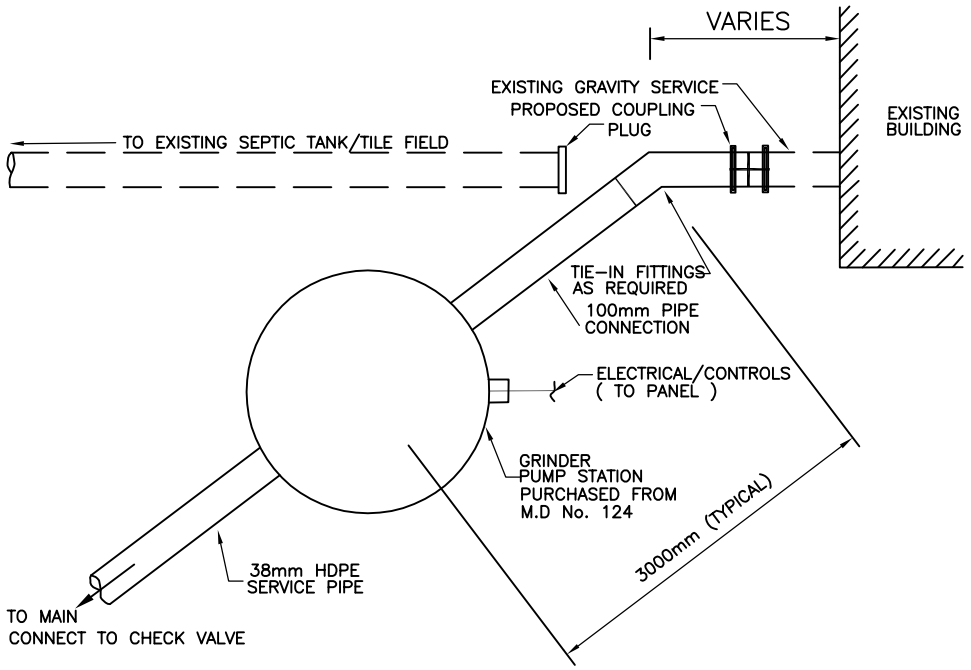
PREBENCHED MANHOLE BASE

Project No.	4006035
Scale	N.T.S
Date	MAY 2007
Standard Detail No.	6.7



TYPICAL GRINDER PUMP STATION INSTALLATION – BEFORE TREATMENT PLANT OPERATION

SCALE : NOT TO SCALE



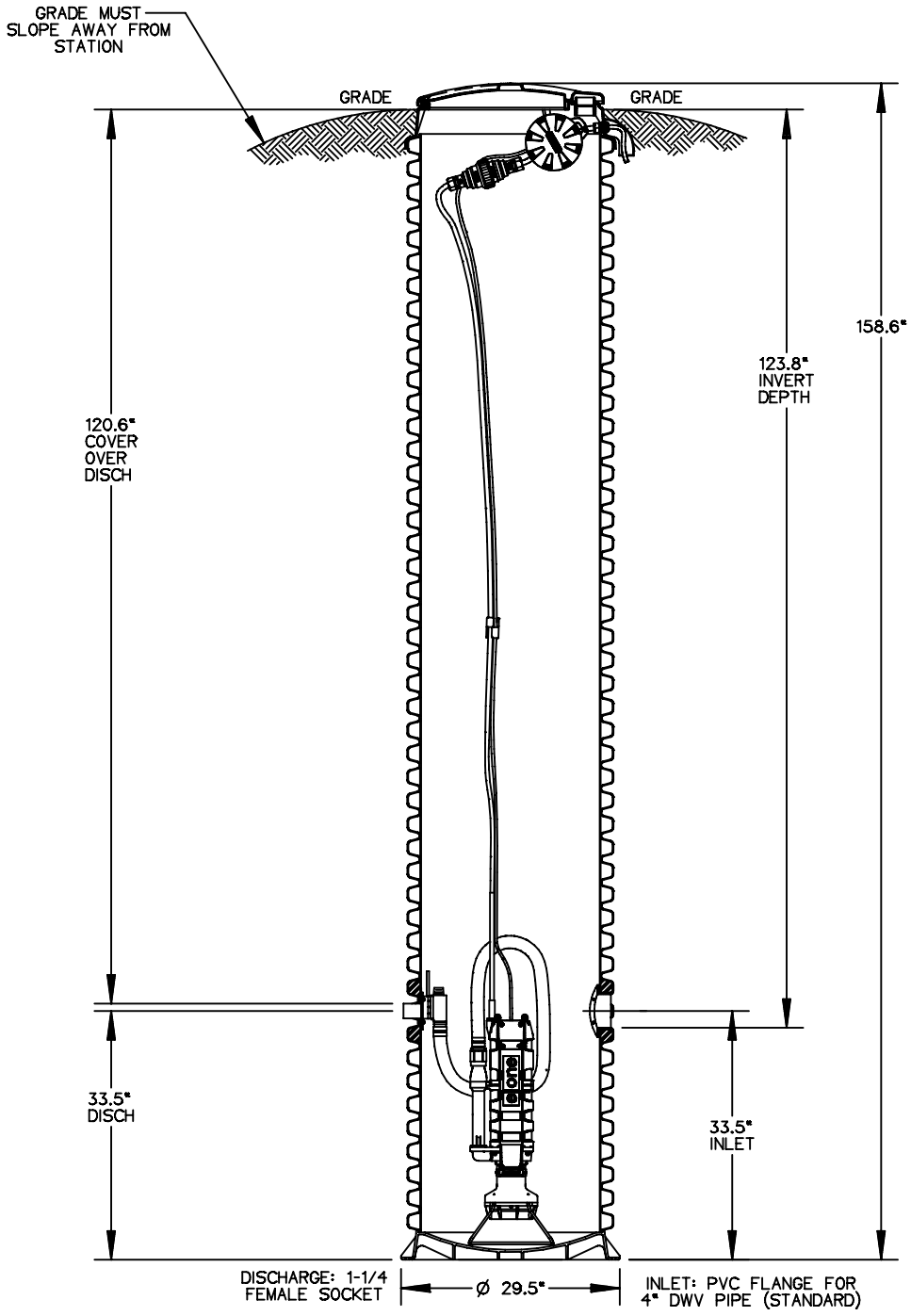
TYPICAL GRINDER PUMP STATION INSTALLATION – AFTER TREATMENT PLANT OPERATION

SCALE : NOT TO SCALE

GRINDER PUMP STATION INSTALLATION

Project No.	4006035
Scale	N.T.S
Date	MAY 2007
Standard Detail No.	6.8

OPTIONS : ☐ WH101-159 (HARD WIRED LEVEL CONTROLS)
☐ WR101-159 (WIRELESS LEVEL CONTROLS)



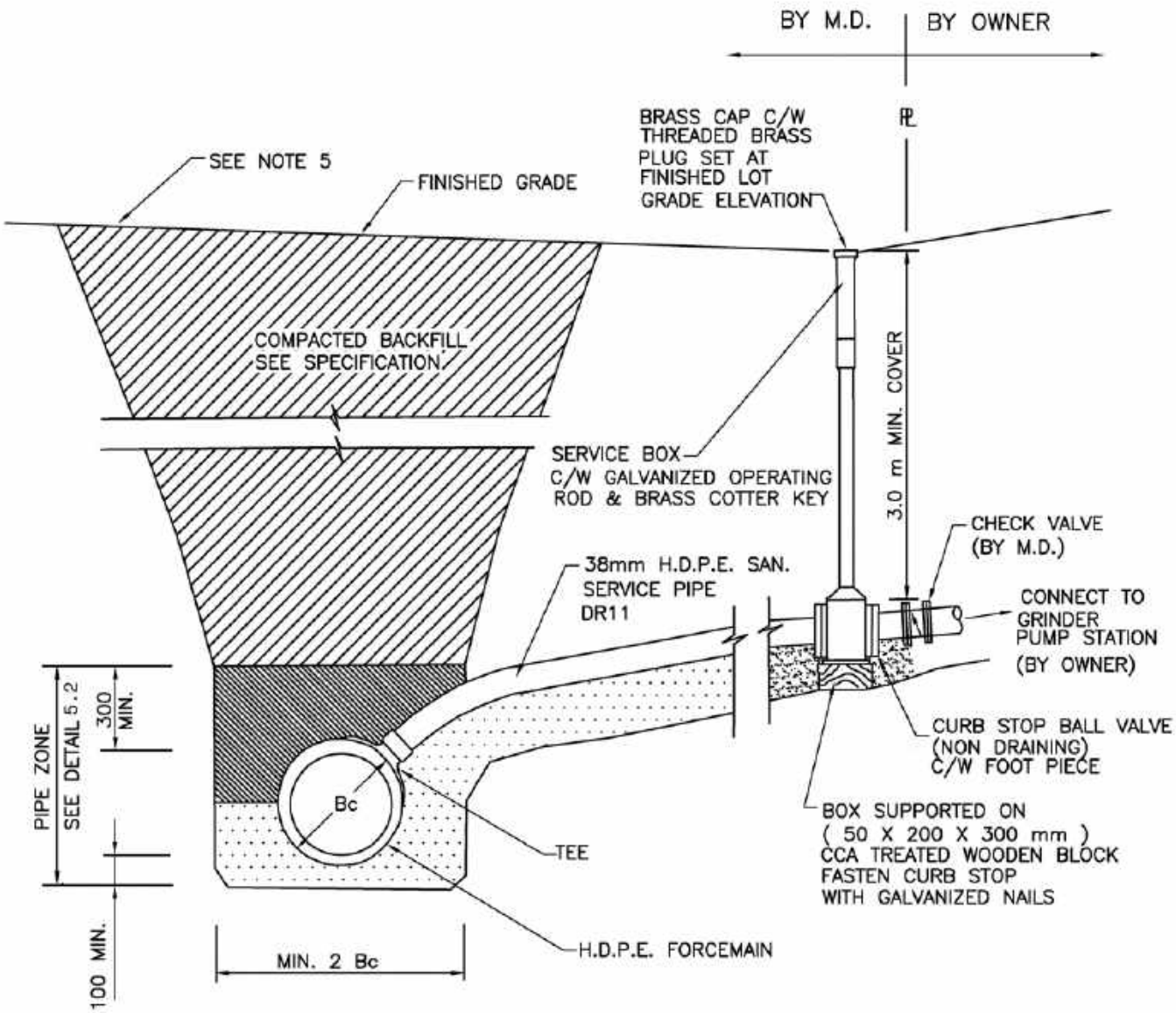
CONCRETE BALLAST MAY BE REQUIRED
SEE INSTALLATION INSTRUCTIONS
FOR DETAILS

AD	CH	07/16/07	B	
DR BY	CHK'D	DATE	ISSUE	SCALE

SEWER SYSTEMS

MODEL WH101-159 / WR101-159

NA0057P07

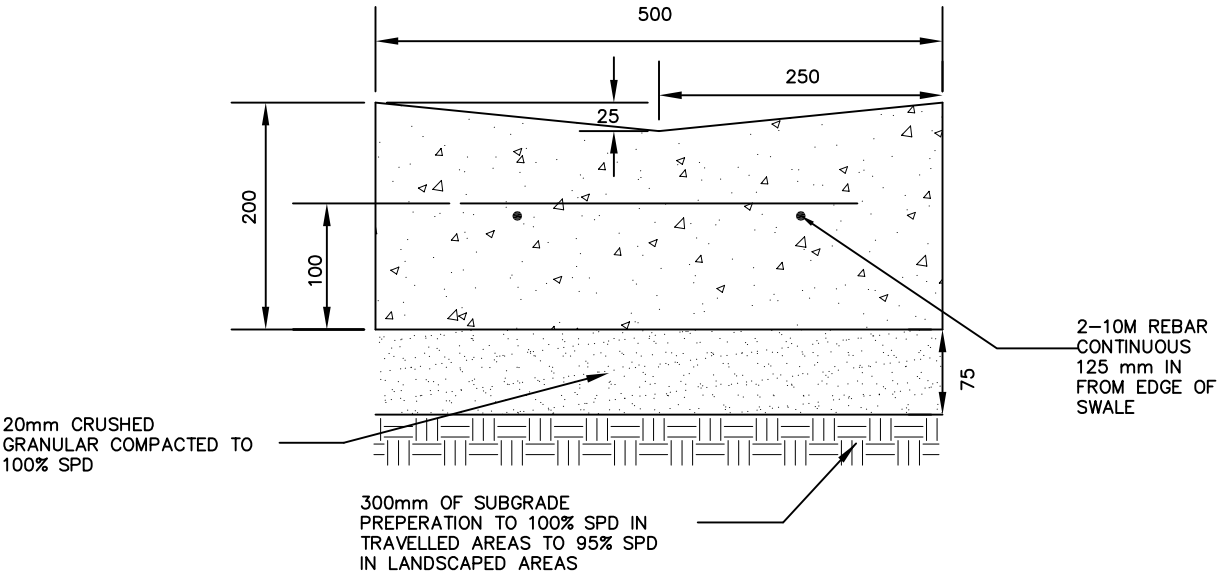


NOTES

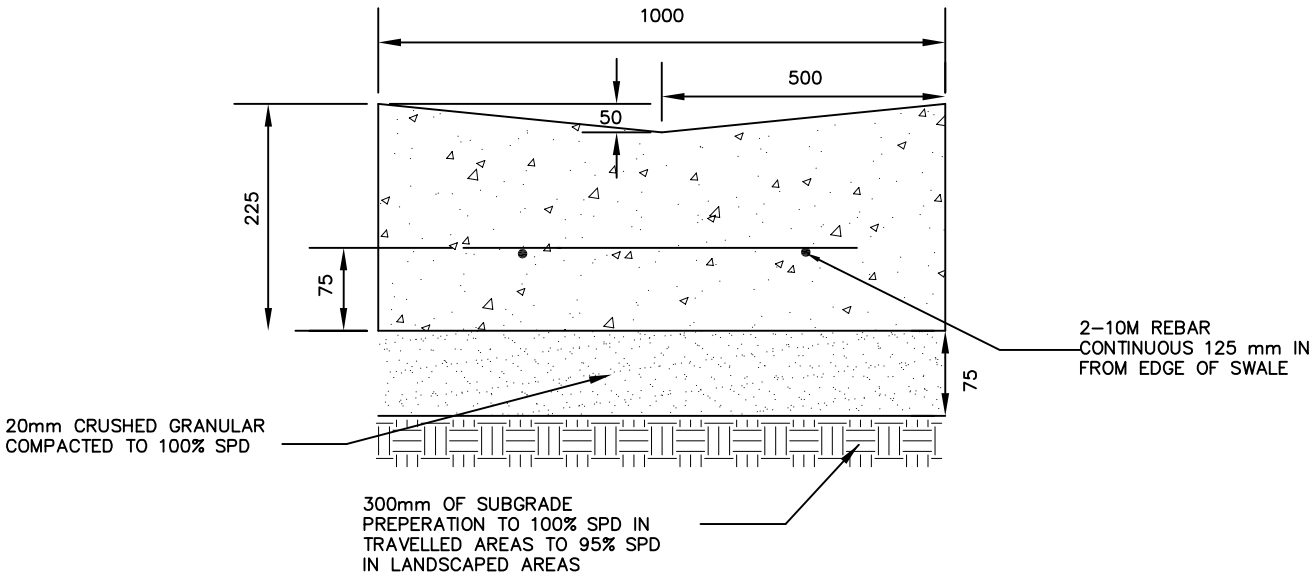
1. WHEN CUT BACK SLOPES ARE TO USED IN LIEU OF CAGES AND SHORING THESE SLOPES ARE TO MEET REQUIREMENTS OF LOCAL CODES
2. MINIMUM COVER ABOVE SEWER MAIN 3.5 m
3. MIN. PIPE ZONE WIDTH IS SPECIFIED TO ALLOW PROPER PIPE ZONE COMPACTION
4. Bc = OUTSIDE PIPE DIAMETER.
5. FOR UNCOMPACTED BACKFILL, CROWN TRENCH BY "H X 0.1.
6. CURB STOP TOP TO BE MARKED 'SEWER'

SERVICE CONNECTION DETAIL

Project No.	4006035
Scale	N.T.S
Date	MAY 2007
Standard Detail No.	6.9



500mm CONCRETE SWALE

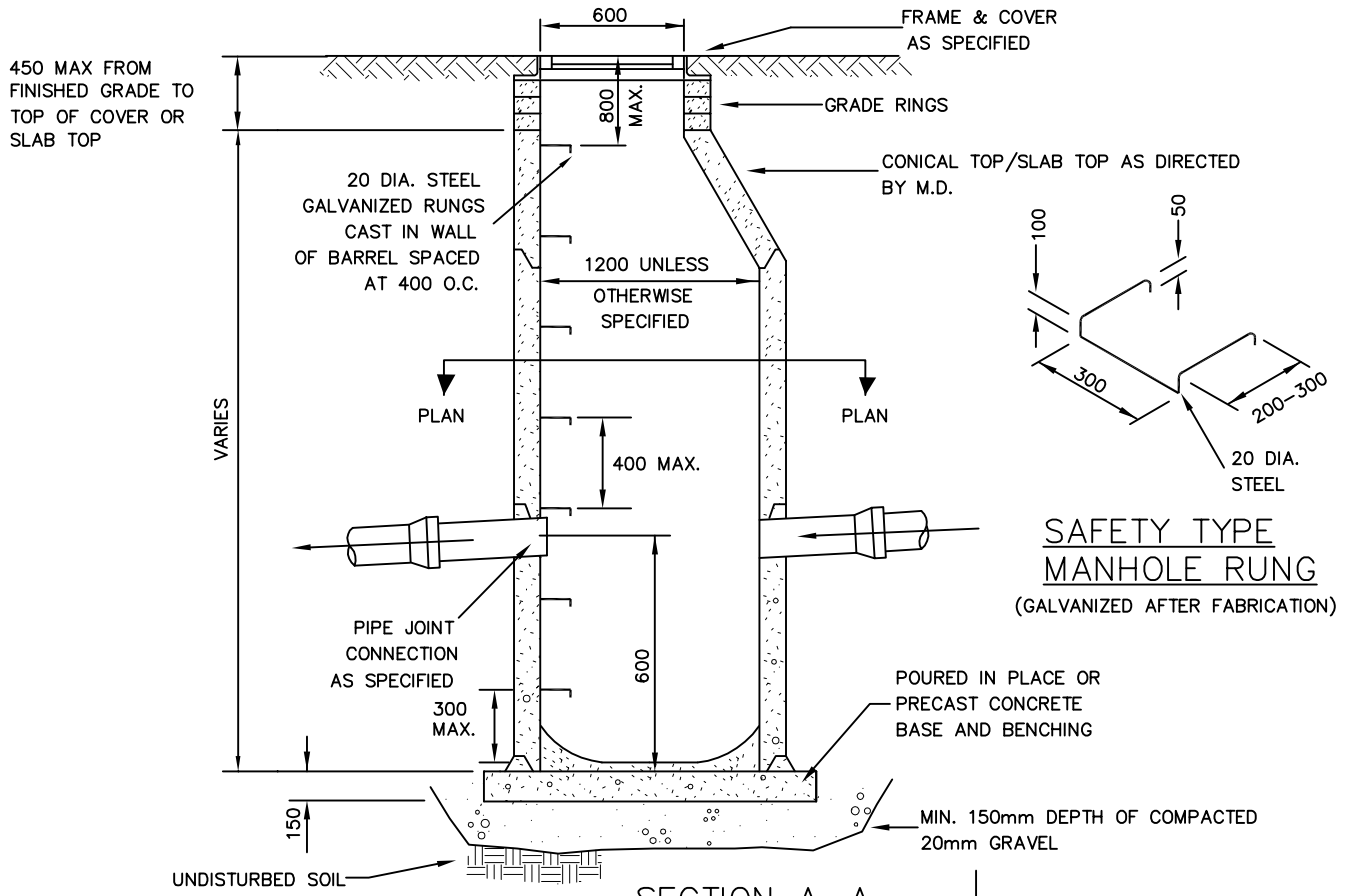


1000mm CONCRETE SWALE

NOTE:

1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE STATED.

	CONCRETE DRAINAGE SWALES	Project No. 4006035
		Scale N.T.S / Date MAY 2007
		Standard Detail No. 7.1

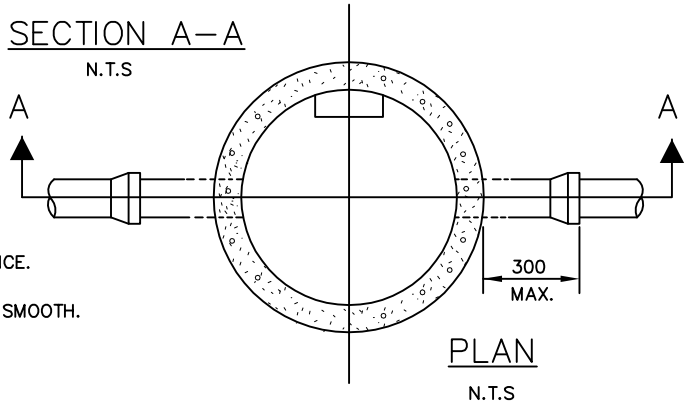


SAFETY TYPE MANHOLE RUNG

(GALVANIZED AFTER FABRICATION)

SECTION A–A

N.T.S



PLAN

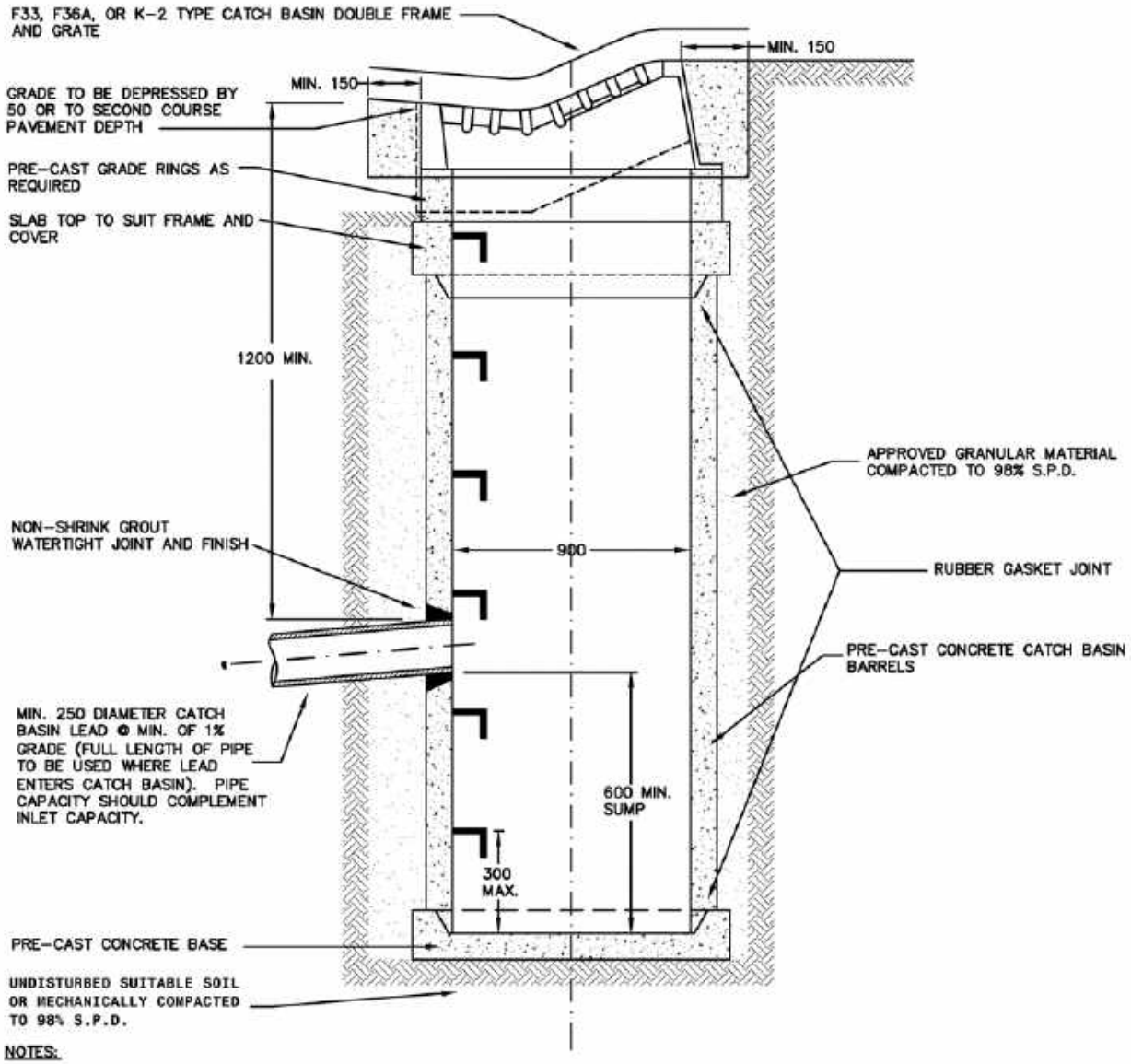
N.T.S

NOTES:

1. ALL PRE–CAST MANHOLES MUST CONFORM TO A.S.T.M. SPECIFICATIONS C478.
2. POURED–IN–PLACE CONCRETE SHALL HAVE A 28 DAYS COMPRESSIVE STRENGTH OF AT LEAST 25 MPa.
3. ALL JOINTS TO BE SET WITH RUBBER GASKETS AND SET WITH NON–SHRINK GROUT, INSIDE AND OUT, FOR THE FULL CIRCUMFERENCE.
4. FORM FLOW TROUGH IN PARTIALLY SET CONCRETE AND TROWEL SMOOTH.
5. PIPES TO BE FLUSH WITH WALL.
6. MAX. DIST. FROM RIM TO TOP RUNG IS 800 mm.
7. BACKFILL AROUND MH. WITH SELECT NATIVE MATERIAL AND COMPACT TO 98% S.P.D.
8. FLAT TOP SECTION TO BE USED FOR MANHOLES UP TO 1.8 m BURY.
9. ALL JOINTS TO BE WATERTIGHT. METHODS TO BE CONSISTENT WITH SITE CONDITIONS.
10. FOR MANHOLES 5.0 m IN DEPTH OR GREATER, A SAFETY PLATFORM SHALL BE INSTALLED.
11. MANHOLES TO MEET REQUIREMENTS OF MANHOLE DETAILS AND SPECIFICATIONS.
12. DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE STATED.
13. CHANNELING AND BENCHING TO BE FINISHED TO TROWEL SMOOTHNESS.
14. SAFETY STEPS TO BE PROVIDED, SPACED AT 400 MAX. FIRST STEP 150 MAX. BELOW FRAME, LAST STEP 300 MAX. ABOVE BASE.

CATCH BASIN MANHOLE

Project No.	4006035
Scale	N.T.S
Date	MAY 2007
Standard Detail No.	7.2

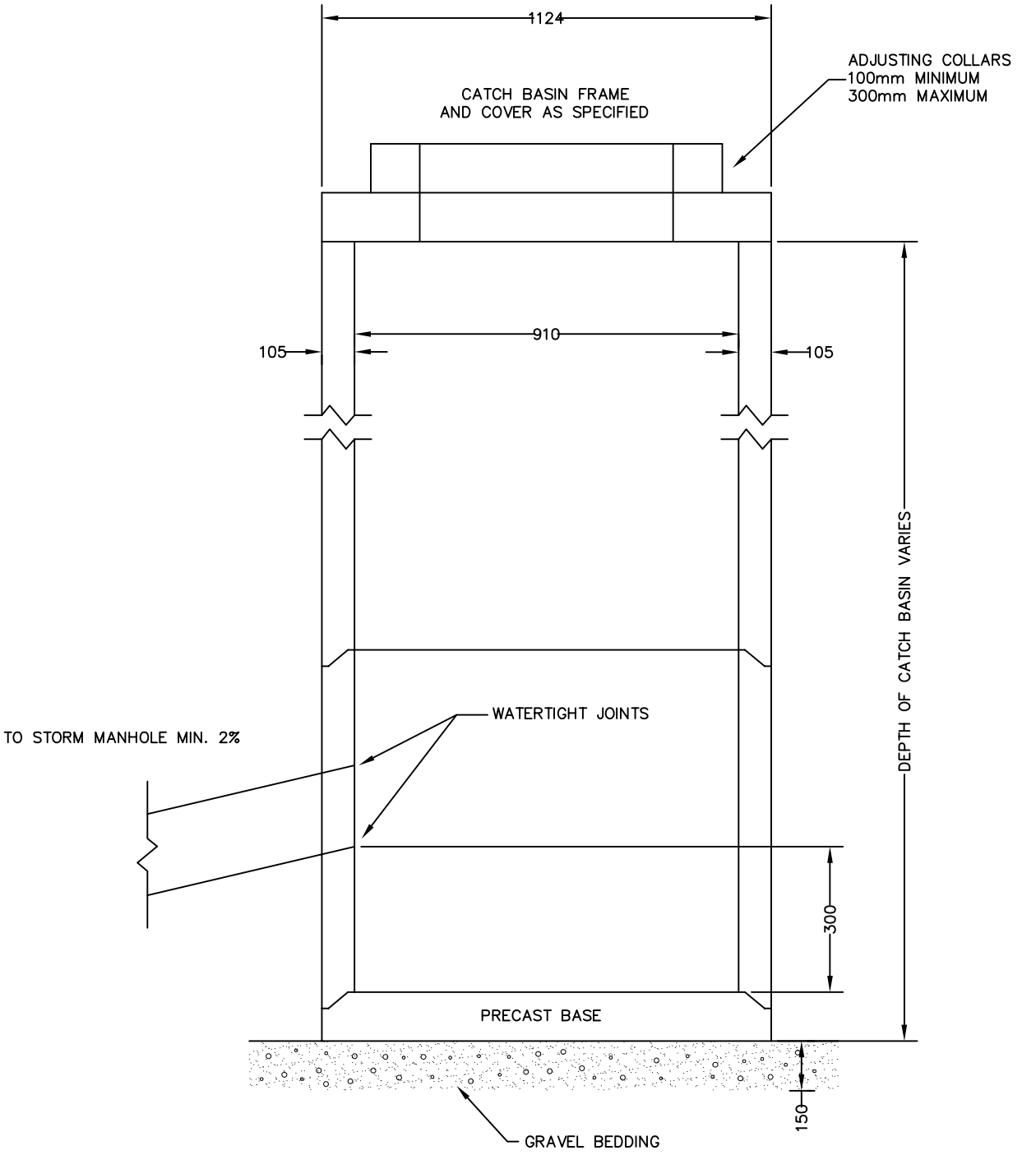


NOTES:

1. SAFETY STEPS TO BE SPACED AT 400 MAX. FIRST STEP 150 MAX. BELOW FRAME, LAST STEP 300 MAX. ABOVE BENCHING.
2. PRE-CAST CONCRETE COMPONENTS TO MEET CURRENT A.S.T.M. C478 STANDARDS.
3. CAST-IN-PLACE- CONCRETE TO BE 25 MPa AT 28 DAYS.
4. ALL JOINTS TO BE WATERTIGHT; SET WITH RUBBER GASKET WITH NON-SHRINK GROUT INSIDE AND OUTSIDE FOR THE FULL CIRCUMFERENCE. THIS INCLUDES JOINTS BETWEEN GRADE RINGS, GRADE RINGS AND FRAMES, AND BETWEEN GRADE RINGS AND SLAB TOPS.
5. PRE-CAST CONCRETE BASE THICKNESS AND REINFORCEMENT MUST BE DESIGNED FOR THE SPECIFIC CATCHBASIN DEPTH ANS SOIL CONDITIONS.
6. JOINTS BETWEEN GRADE RINGS, GRADE RINGS AND CONES, AND RINGS AND FRAMES MUST BE WATERTIGHT. RAM NECK MATERIAL FINISHED MATERIAL FINISHED WITH NON-SHRINK GROUT MAY BE USED IF WATERTIGHT JOINTS CAN BE ACHEIVED.
7. WICK DRAINS TO CONNECT TO CATCH BASIN SUCH AS TO ENSURE WATERTIGHT JOINTS.
8. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE STATED.

CATCH BASIN
TYPICAL 900 mm

Project No.	4006035
Scale	N.T.S
Date	MAY 2007
Standard Detail No.	7.3

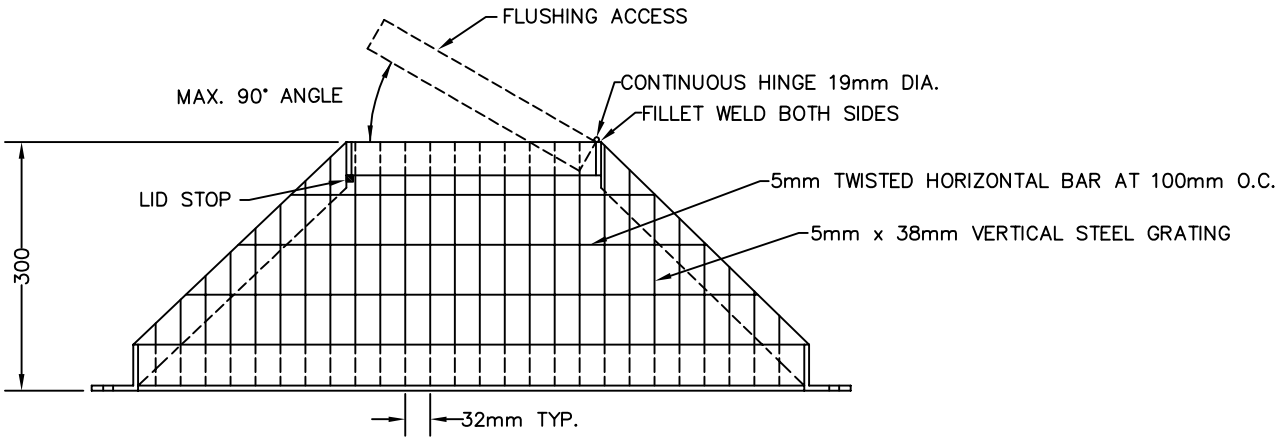


NOTES:

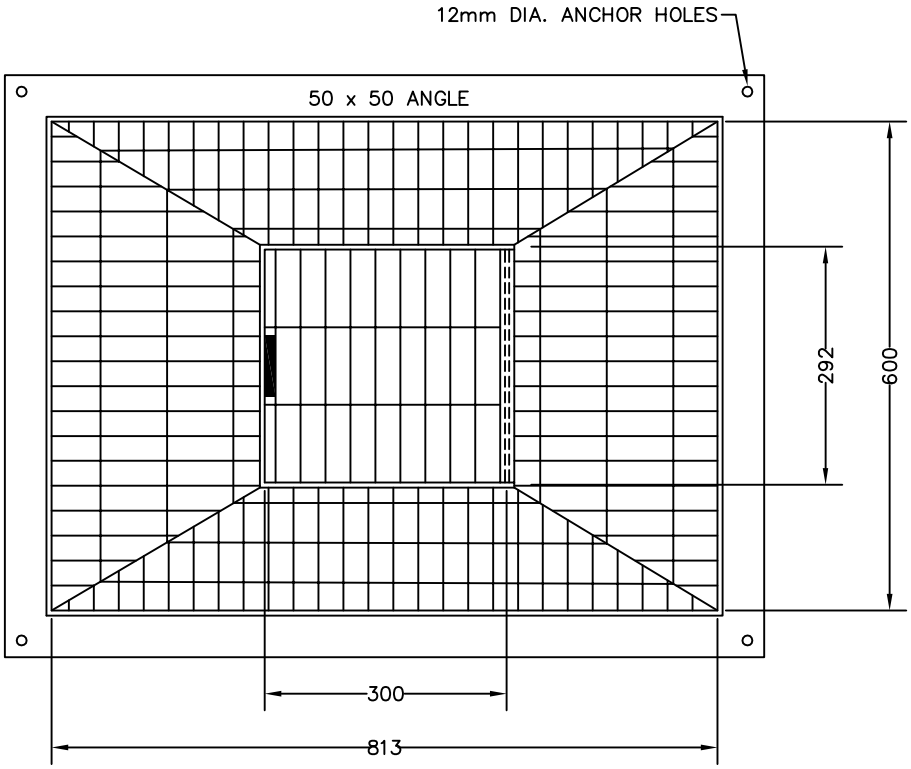
1. SAFETY STEPS TO BE PROVIDED, SPACED AT 400 MAX. FIRST STEP 150 MAX. BELOW FRAME; LAST STEP 300 MAX. ABOVE BASE.
2. PRE-CAST CONCRETE COMPONENTS MUST CONFORM TO A.S.T.M. SPECIFICATIONS C478.
3. POURED-IN-PLACE CONCRETE SHALL HAVE A 28 DAYS COMPRESSIVE STRENGTH OF AT LEAST 25 MPa.
4. ALL JOINTS TO BE SET WITH RUBBER GASKETS AND NON-SHRINK GROUT, INSIDE AND OUT, FOR THE FULL CIRCUMFERENCE.
5. ALL DIMENSIONS IN MILLIMETRES, UNLESS OTHERWISE STATED.
6. ALL JOINTS TO BE WATERTIGHT. METHODS TO BE CONSISTENT WITH SITE CONDITIONS.

STORM CATCH BASSIN ASSEMBLY c/W 300 mm SUMP

Project No.	4006035
Scale	N.T.S
Date	MAY 2007
Standard Detail No.	7.4



PROFILE

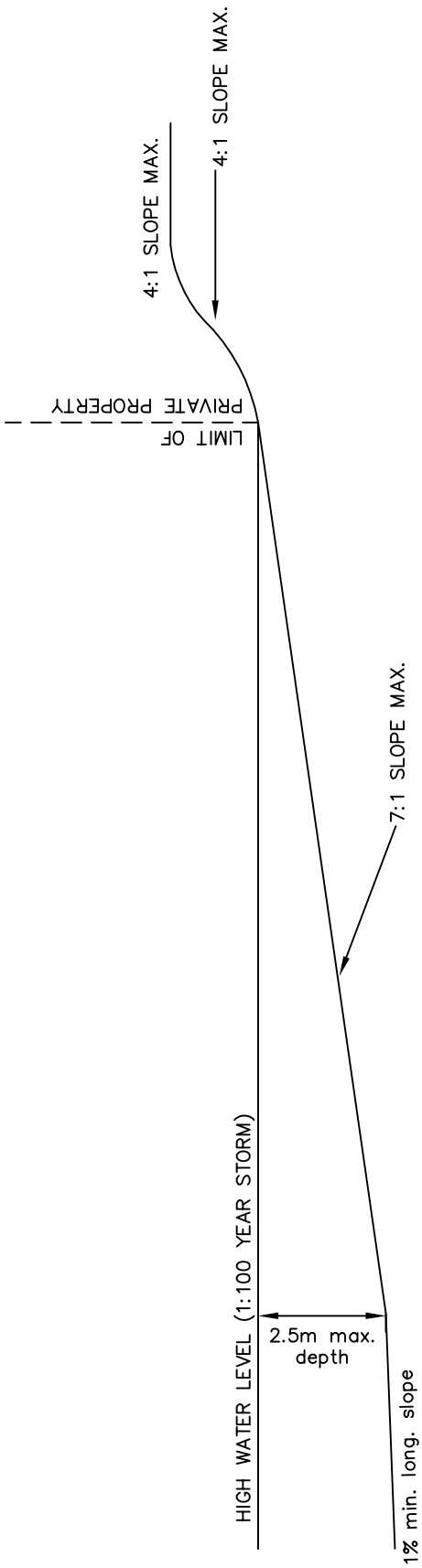


PLAN VIEW

NOTES:

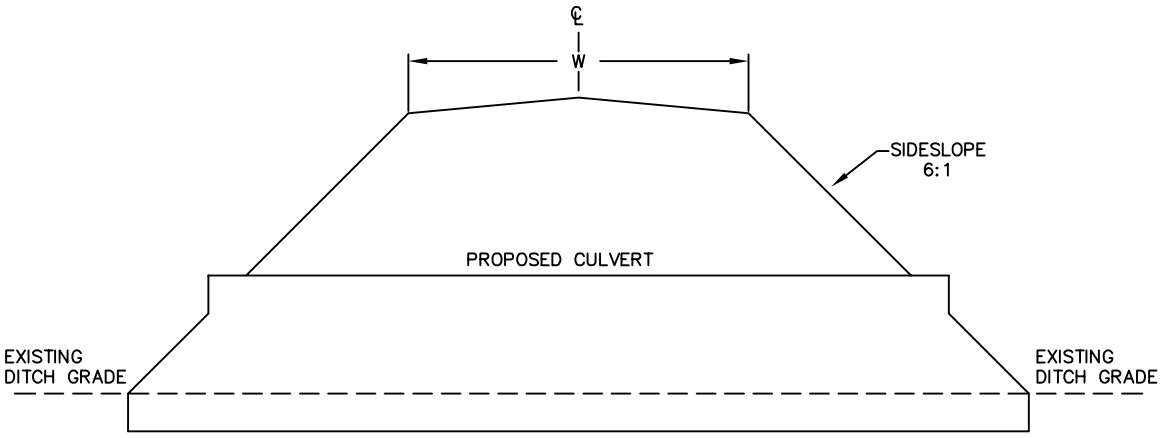
1. DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE STATED.

	TRASH GRATE INLET	Project No. 4006035
		Scale N.T.S / Date MAY 2007
		Standard Detail No. 7.5

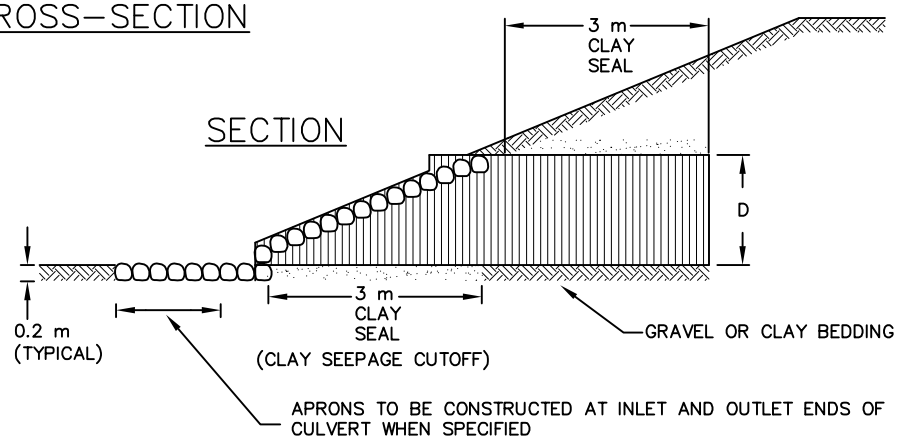


TYPICAL DRY POND DETAIL

Project No.	4006035
Scale	N.T.S
Date	MAY 2007
Standard Detail No.	7.6



APPROACH CROSS–SECTION



NOTES:

1. THE SIDE SLOPES OF THE APPROACH SHALL BE A MINIMUM OF 6:1 ON APPROACHES TO ALL COUNTY ROADS.

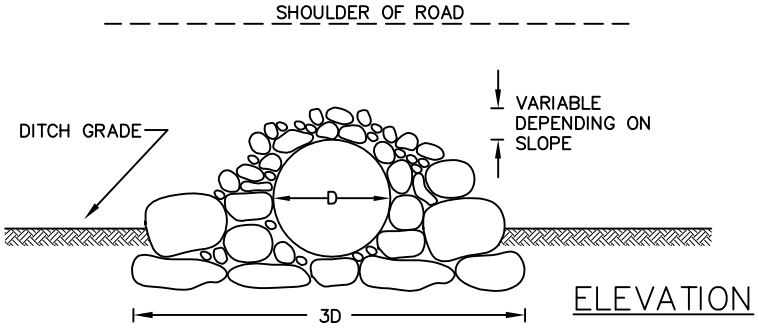
2. THE MINIMUM ALLOWABLE CULVERT DIAMETER IS 600 mm, UNLESS SPECIFIC WRITTEN APPROVAL FROM THE DIRECTOR OF PUBLIC WORKS, OR DESIGNATE.

3. THE CULVERT SHALL BE ALIGNED WITH THE BACK OF THE DITCH BOTTOM. THE CULVERT IS TO BE COUNTERSUNK 15% OF THE PIPE DIAMETER BELOW THE DITCH BOTTOM.

4. THE CULVERT SHALL BE OF SUCH LENGTH AS TO PROVIDE A NEAT, FINISHED APPEARANCE, WITHOUT EXCESS EXPOSED PIPE.

5. STRAIGHT END CULVERTS ARE NOT ACCEPTABLE. ALL CULVERTS SHALL HAVE A 3:1 SLOPE END UNLESS SPECIFIC WRITTEN APPROVAL IS OBTAINED FROM THE DIRECTOR OF PUBLIC WORKS, OR DESIGNATE.

6. ROCK RIP–RAP SHALL BE HAND LAID AT BOTH ENDS OF THE CULVERT IN ACCORDANCE WITH THE ACCOMPANYING DRAWING.



7. THE COUNTY USES THE EXPECTED TRAFFIC TYPE AND VOLUME TO DETERMINE THE MINIMUM WIDTH OF THE DRIVING SURFACE OF THE APPROACH.

8. 300 mm DEPTH OF COVER OVER C.S.P. IS PREFERRED.

9. APPROACH SURFACE TO BE AS DESIGNATED BY THE COUNTY.

10. RIP–RAP SHALL BE PLACED WITH THEIR BEDS AT RIGHT ANGLES TO THE SLOPE, THE LARGER STONES BEING USED IN THE BOTTOM COURSES AND THE SMALLER STONES AT TOP.

11. RIP–RAP SHALL BE LAID IN CLOSE CONTACT SO AS TO BREAK JOINTS AND IN SUCH A MANNER THAT THE WEIGHT OF THE STONE IS CARRIED BY THE EARTH AND NOT BY THE ADJACENT STONES.

ACCESS INSTALLATION

Project No.	4006035
Scale	N.T.S
Date	MAY 2007
Standard Detail No.	7.7

NOTES:

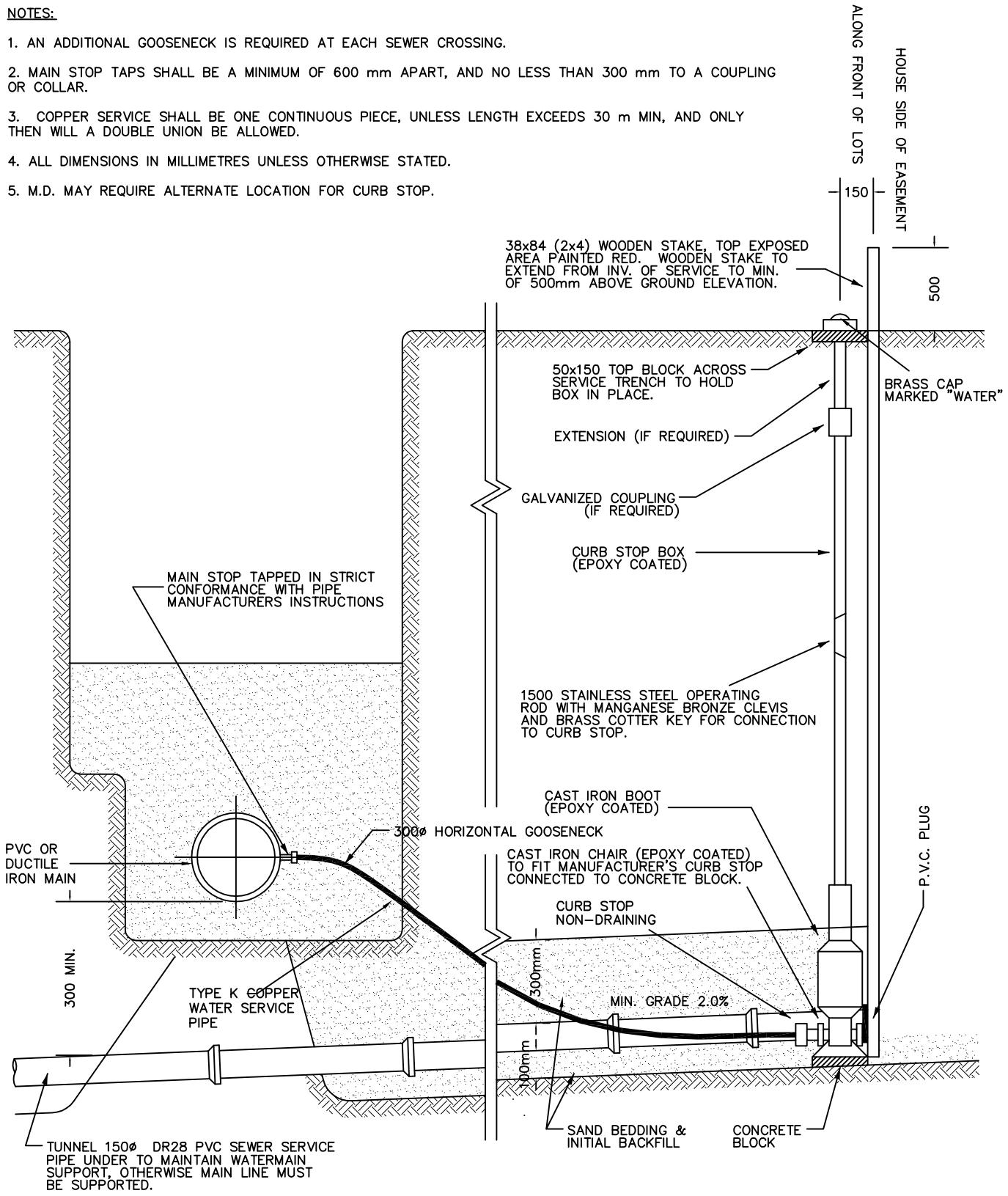
1. AN ADDITIONAL GOOSENECK IS REQUIRED AT EACH SEWER CROSSING.

2. MAIN STOP TAPS SHALL BE A MINIMUM OF 600 mm APART, AND NO LESS THAN 300 mm TO A COUPLING OR COLLAR.

3. COPPER SERVICE SHALL BE ONE CONTINUOUS PIECE, UNLESS LENGTH EXCEEDS 30 m MIN, AND ONLY THEN WILL A DOUBLE UNION BE ALLOWED.

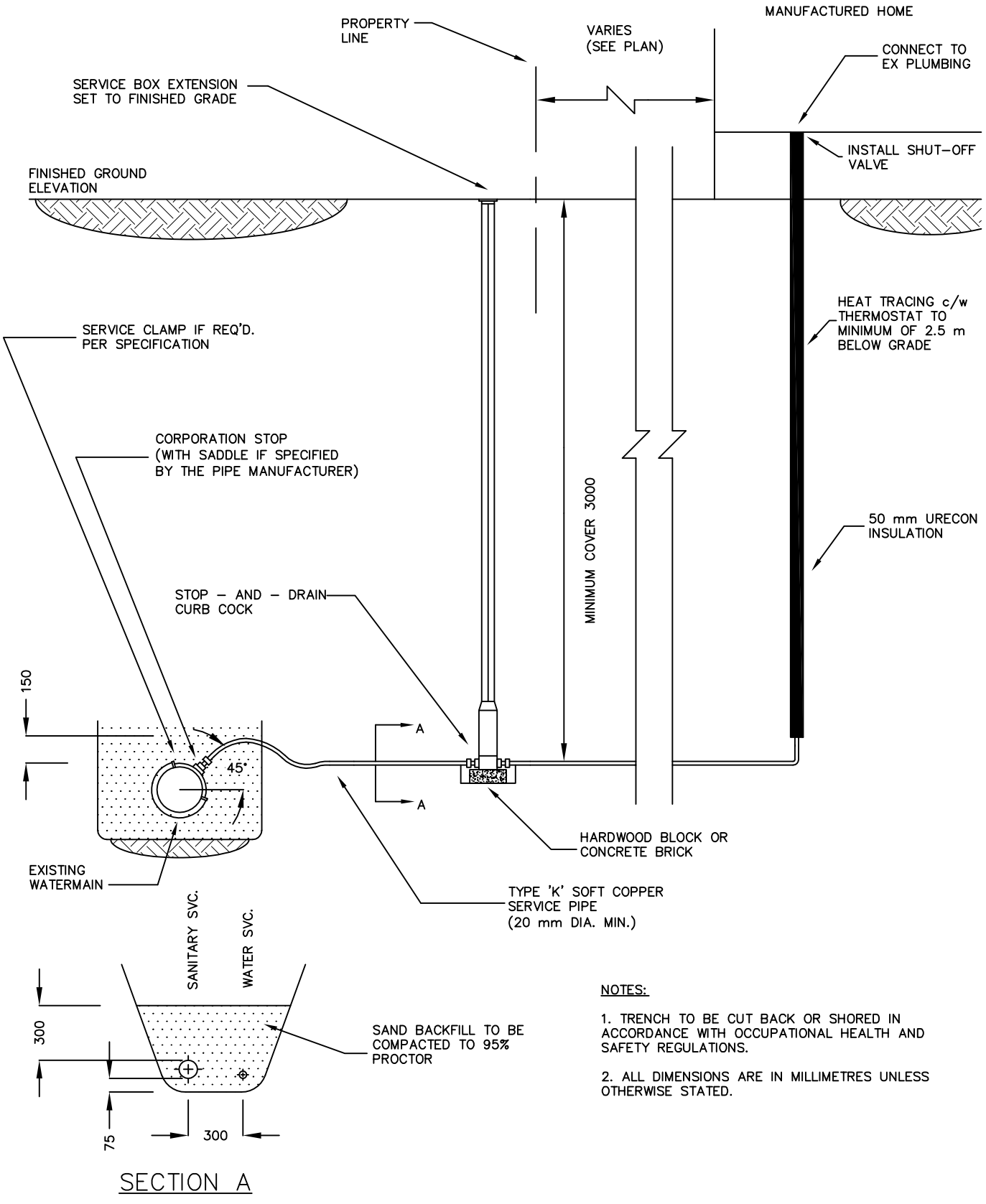
4. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE STATED.

5. M.D. MAY REQUIRE ALTERNATE LOCATION FOR CURB STOP.



TYPICAL 50 mm AND SMALLER RESIDENTIAL WATER AND 150 mm SANITARY SEWER

Project No.	4006035
Scale	N.T.S
Date	MAY 2007
Standard Detail No.	8.1



SECTION A

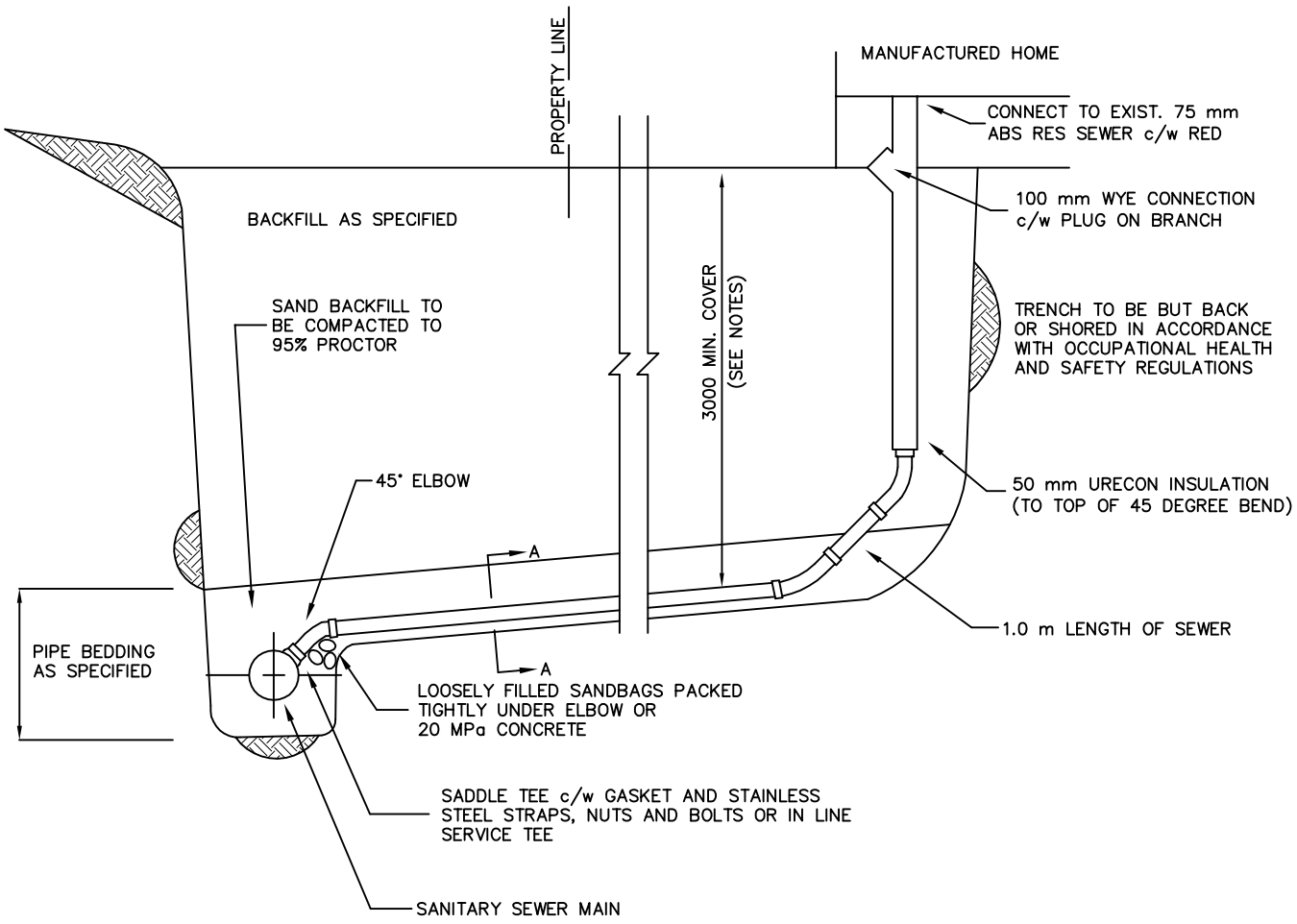
NOTES:

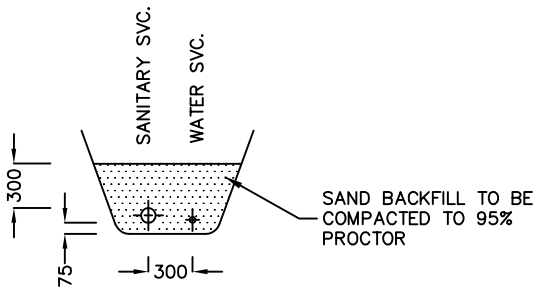
1. TRENCH TO BE CUT BACK OR SHORED IN ACCORDANCE WITH OCCUPATIONAL HEALTH AND SAFETY REGULATIONS.

2. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE STATED.

WATER SERVICE CONNECTION MANUFACTURED HOME

Project No.	4006035
Scale	N.T.S
Date	MAY 2007
Standard Detail No.	8.2





SECTION A

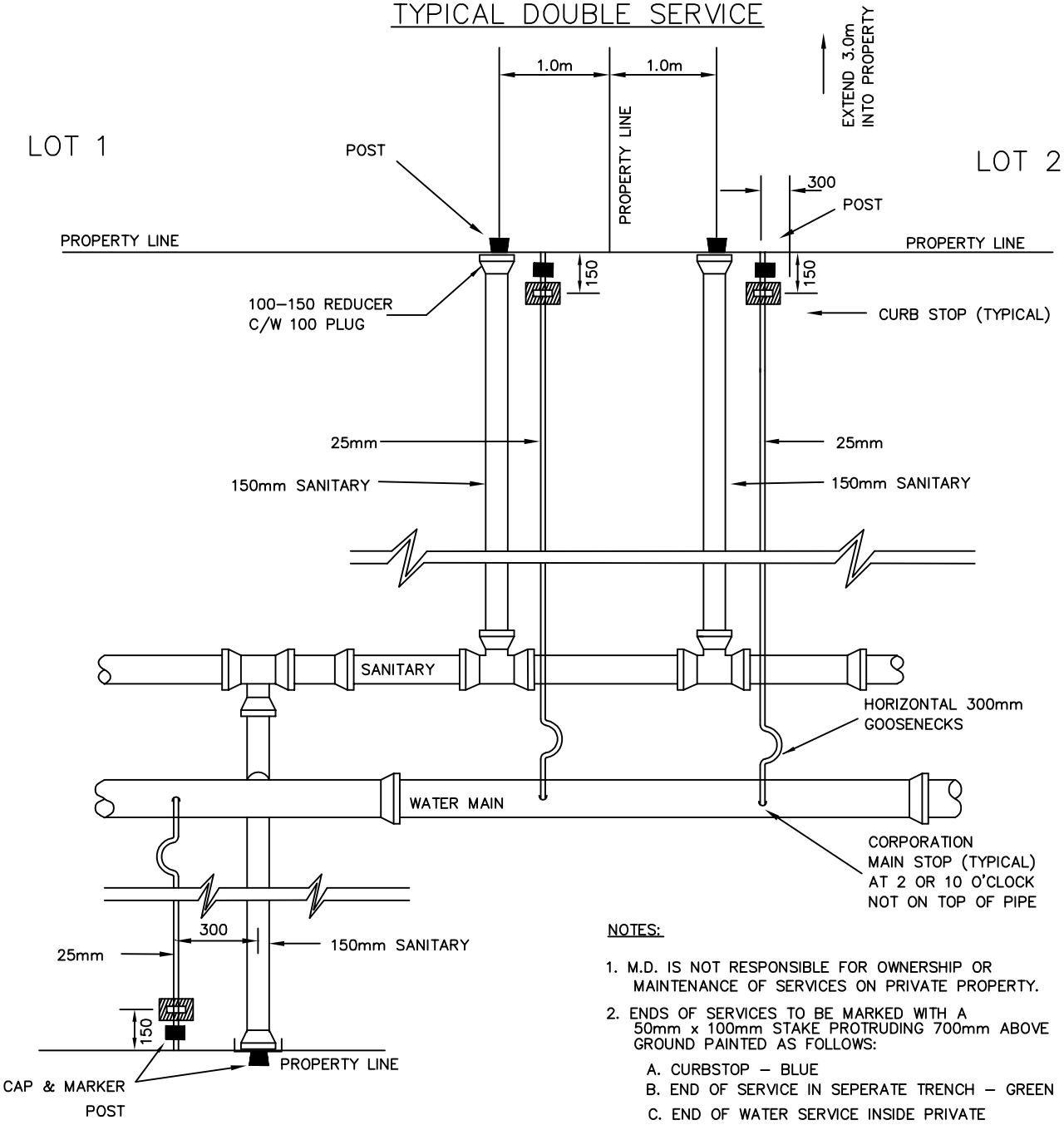
NOTES:

1. MIN. SLOPE FOR 100 mm DIA. PIPE IS 2%.
2. SERVICE CONNECTIONS SHALL BE 100 mm UNLESS SPECIFICALLY SHOWN ON THE DRAWINGS.
3. 50 mm URECON INSULATION WILL BE REQUIRED.
4. TRENCH TO BE CUT BACK OR SHORED IN ACCORDANCE WITH OCCUPATIONAL HEALTH AND SAFETY REGULATIONS.

SANITARY SERVICE CONNECTION MANUFACTURED HOME

Project No.	4006035
Scale	N.T.S
Date	MAY 2007
Standard Detail No.	8.3

TYPICAL DOUBLE SERVICE



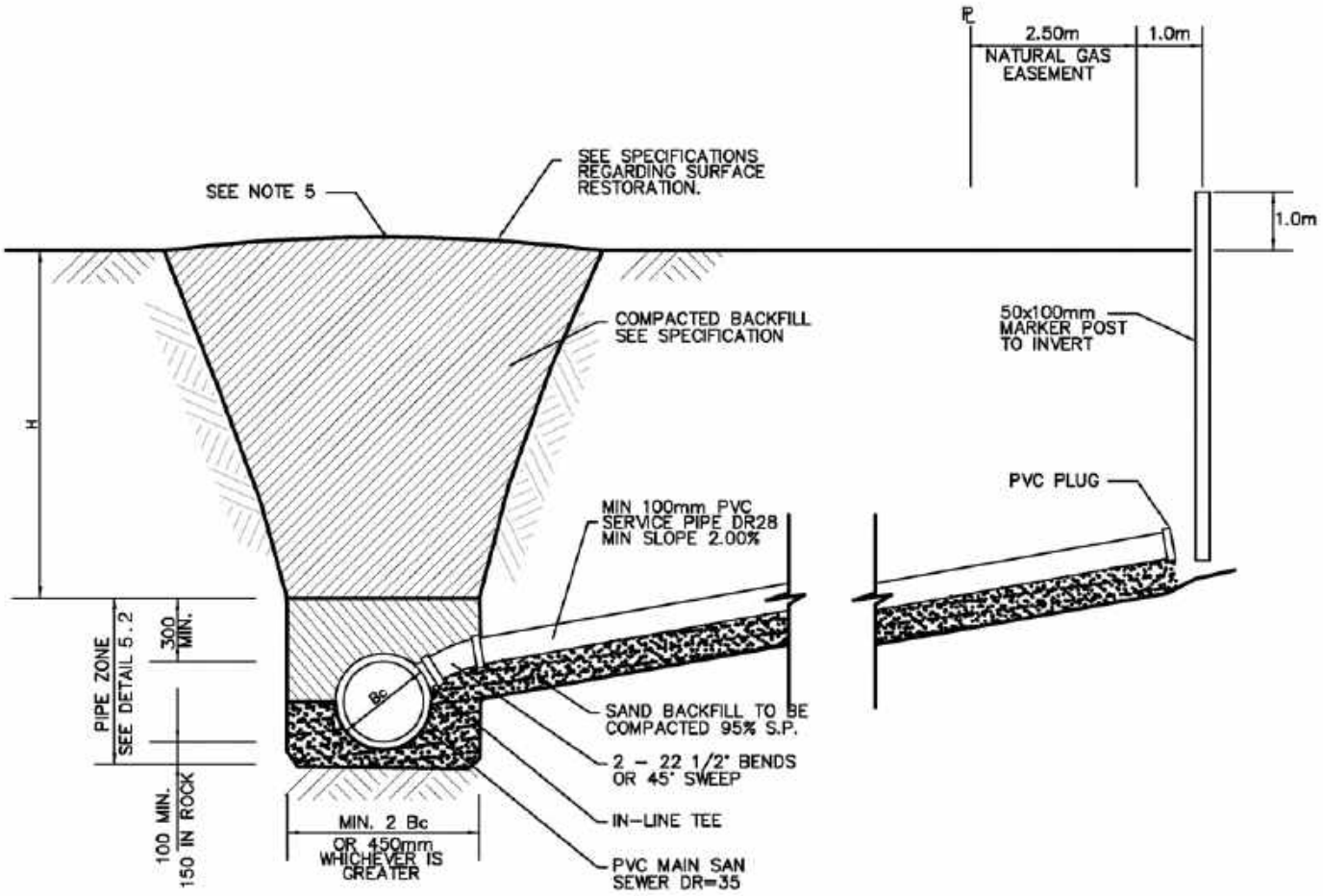
TYPICAL SINGLE SERVICE

NOTES:

1. M.D. IS NOT RESPONSIBLE FOR OWNERSHIP OR MAINTENANCE OF SERVICES ON PRIVATE PROPERTY.
2. ENDS OF SERVICES TO BE MARKED WITH A 50mm x 100mm STAKE PROTRUDING 700mm ABOVE GROUND PAINTED AS FOLLOWS:
   A. CURBSTOP – BLUE
   B. END OF SERVICE IN SEPERATE TRENCH – GREEN
   C. END OF WATER SERVICE INSIDE PRIVATE PROPERTY – BLUE
3. WHERE STORM SEWER SERVICE IS TO BE INSTALLED, PLACE 0.3m FROM SANITARY ON FAR SIDE FROM WATER.
4. SEWER SERVICES MUST BE PROPERLY CAPPED.
5. ALL DIMENSIONS GIVEN IN MILLIMETRES UNLESS OTHERWISE STATED.
6. M.D. MAY REQUIRE ALTERNATE PLACEMENT OF CURB STOP.
7. SINGLE SERVICE TO ENTER LOT WITHIN 2.25 m OF CENTER.

SINGLE AND DOUBLE SERVICE LAYOUT

Project No.	4006035
Scale	N.T.S
Date	MAY 2007
Standard Detail No.	8.4



NOTES:

1. WHEN CUT BACK SLOPES ARE TO BE USED IN LIEU OF CAGES AND SHORING, THESE SLOPES ARE TO MEET REQUIREMENTS OF LOCAL CODES.
2. SEE SPECIFICATIONS FOR MINIMUM COVER ABOVE PIPE.
3. MIN. PIPE ZONE WIDTH IS SPECIFIED TO ALLOW PROPER PIPE ZONE COMPACTION.
4. Bc = OUTSIDE PIPE DIAMETER.
5. FOR UNCOMPACTED BACKFILL, CROWN TRENCH BY 0.1 x H.

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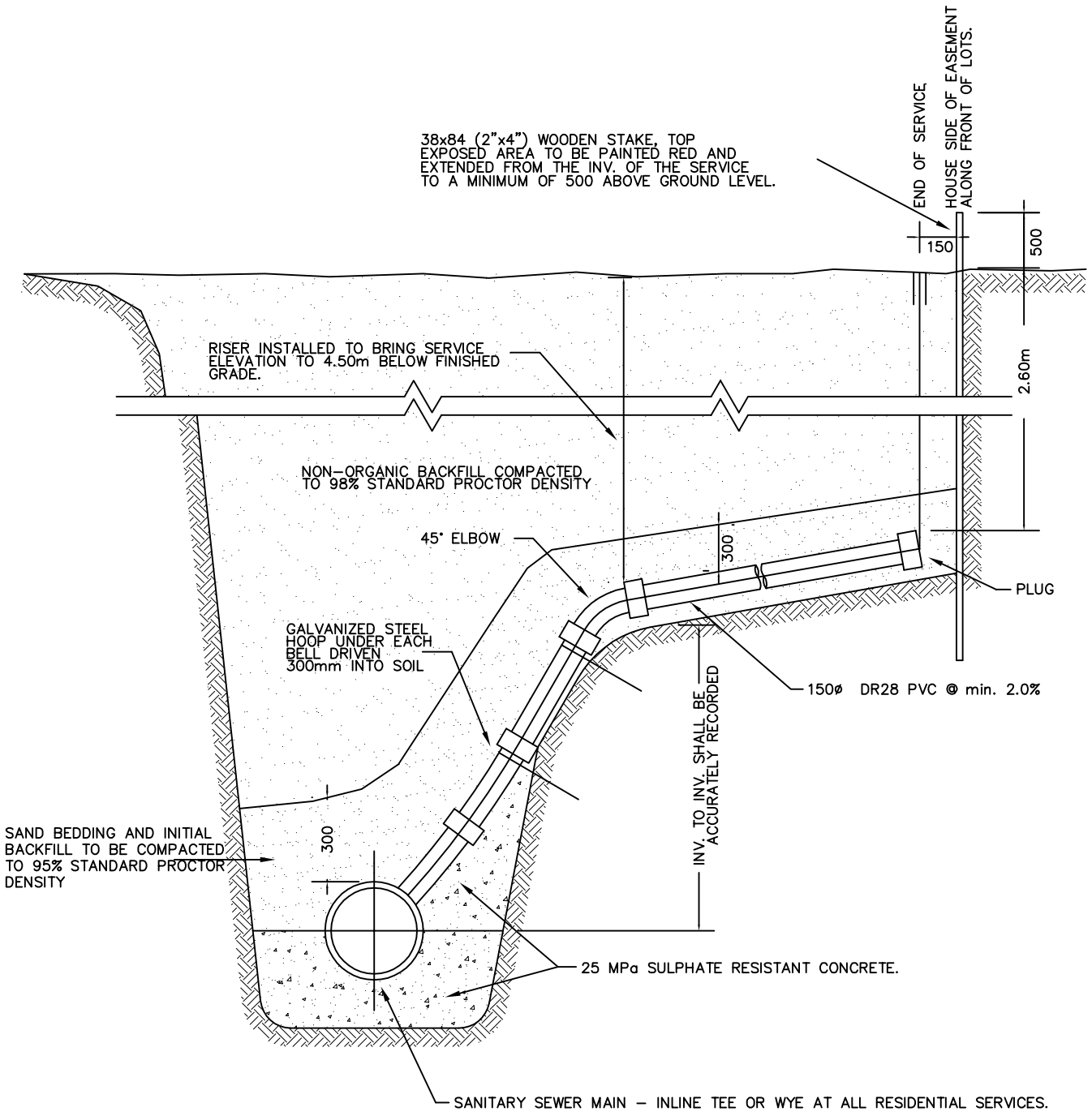
TYPICAL SANITARY SERVICE CONNECTION

Project No.	4006035
Scale	N.T.S
Date	MAY 2007
Standard Detail No.	8.5

NOTES:

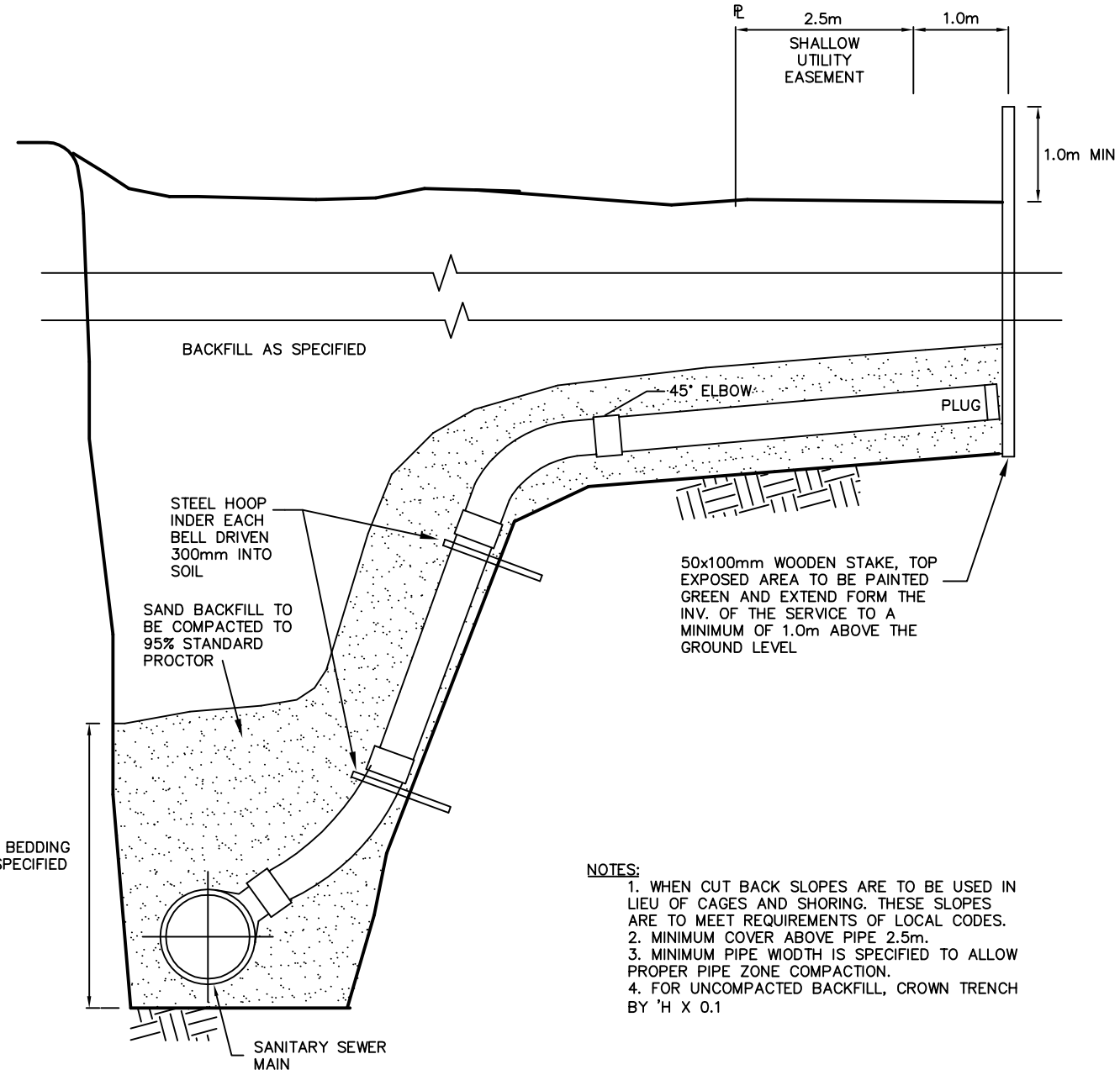
1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE STATED.



RESIDENTIAL SANITARY SEWER SERVICE RISER CONNECTION

Project No.	4006035
Scale	N.T.S
Date	MAY 2007
Standard Detail No.	8.6

M:\2006\4006035 - Lesser Slave River Spec\DRAWINGS\Standard Detail Drawings\8.6.dwg Tue, Aug 14 2007 16:28 - brunon

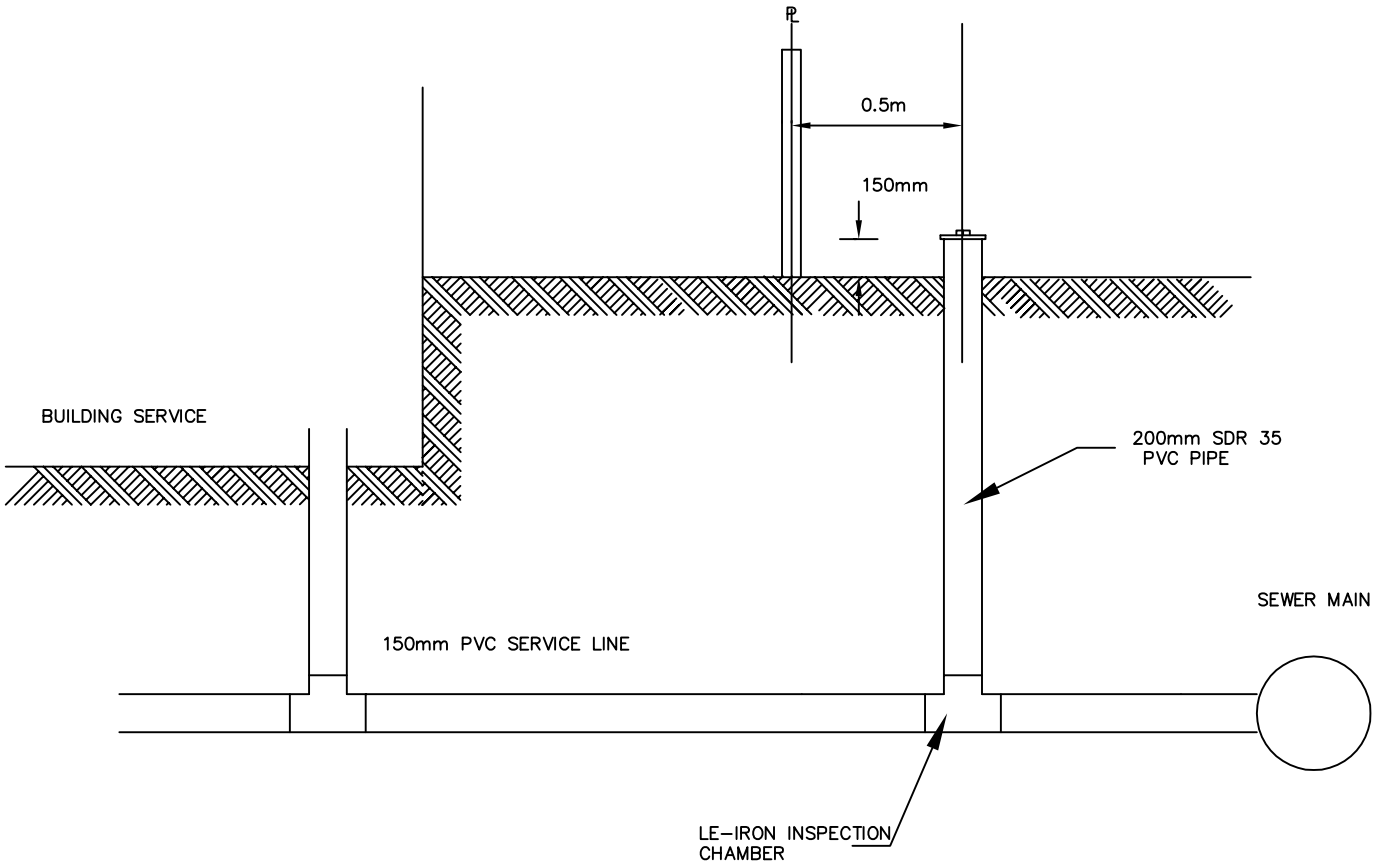


NOTES:

1. WHEN CUT BACK SLOPES ARE TO BE USED IN LIEU OF CAGES AND SHORING. THESE SLOPES ARE TO MEET REQUIREMENTS OF LOCAL CODES.
2. MINIMUM COVER ABOVE PIPE 2.5m.
3. MINIMUM PIPE WIODTH IS SPECIFIED TO ALLOW PROPER PIPE ZONE COMPACTION.
4. FOR UNCOMPACTED BACKFILL, CROWN TRENCH BY 'H X 0.1

TYPICAL STANDARD RISER DETAIL

Project No.	4006035
Scale	N.T.S
Date	MAY 2007
Standard Detail No.	8.7



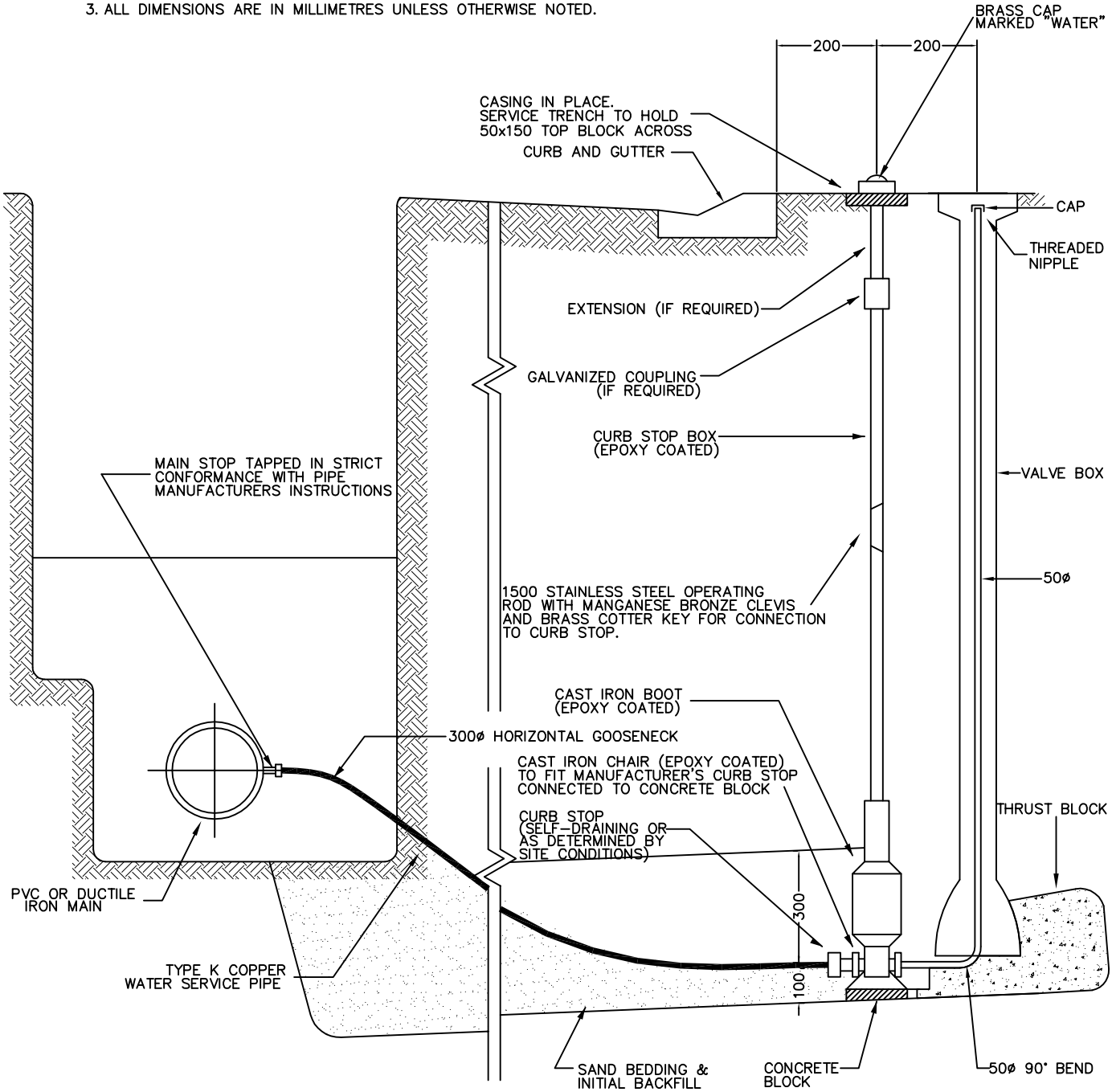
NOTE:
INSPECTION CHAMBER TO BE LOCATED IN A
NON-TRAFFIC AREA AND APPROPRIATELY MARKED

INSPECTION CHAMBER DETAIL

Project No.	4006035
Scale	N.T.S
Date	MAY 2007
Standard Detail No.	8.8

NOTES:

1. COPPER LINE SHALL BE ONE CONTINUOUS PIECE, UNLESS LENGTH EXCEEDS 30m MIN. AND ONLY THEN WILL A DOUBLE UNION BE ALLOWED.
2. INVERT ELEVATION SHALL BE 3.0m BELOW ESTABLISHED FINISHED GRADE,
3. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE NOTED.



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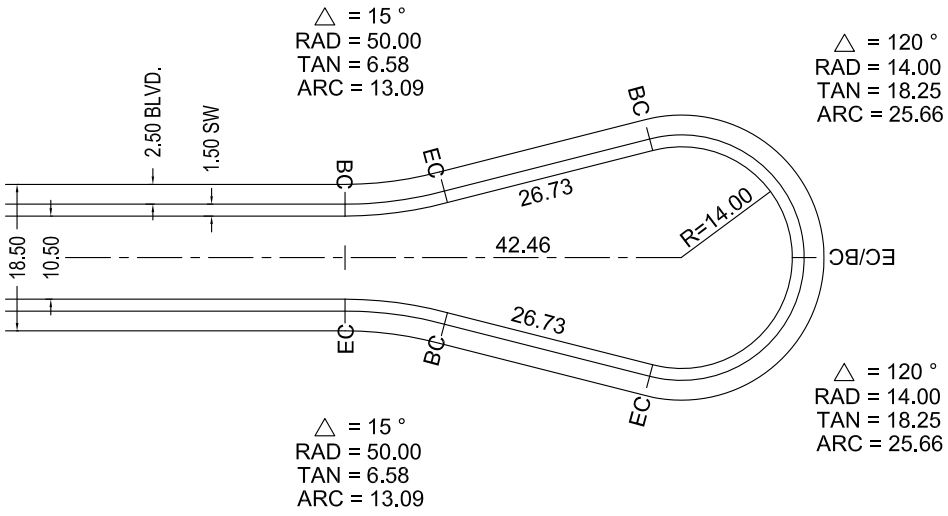
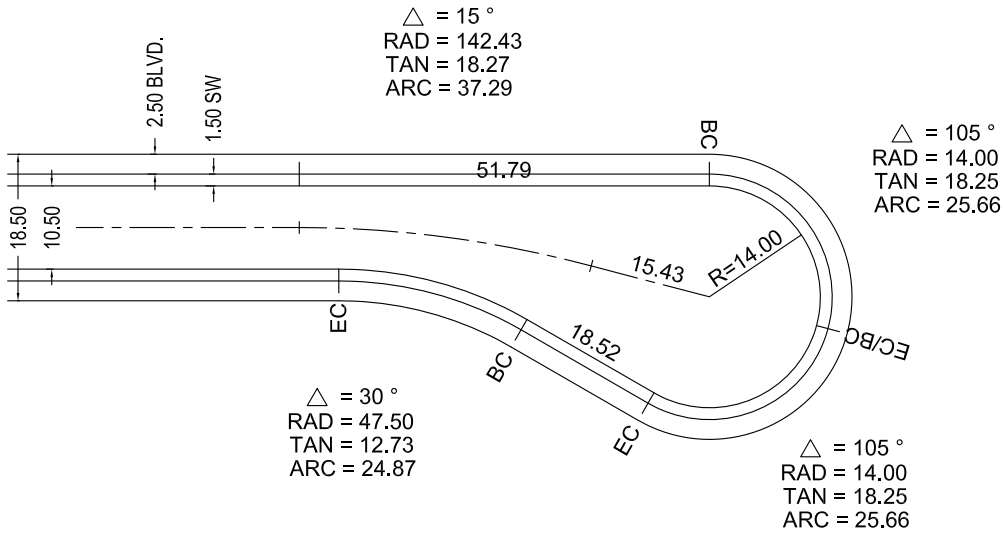
BLOW-OFF VALVE

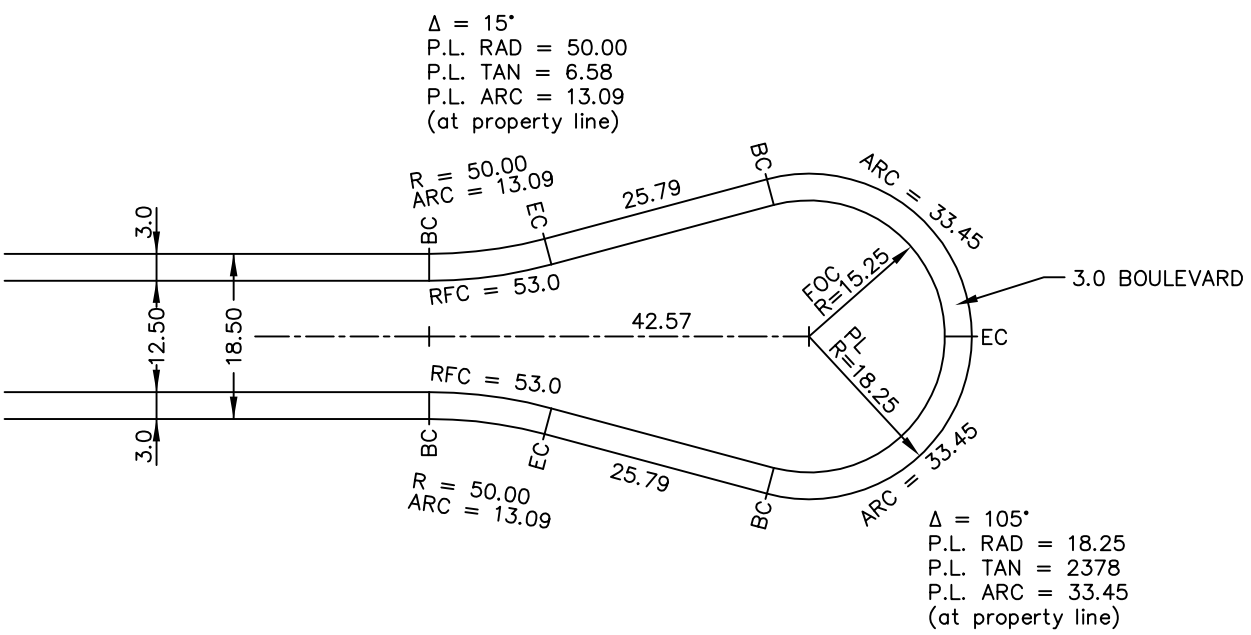
Project No.	4006035
Scale	N.T.S
Date	MAY 2007
Standard Detail No.	8.9

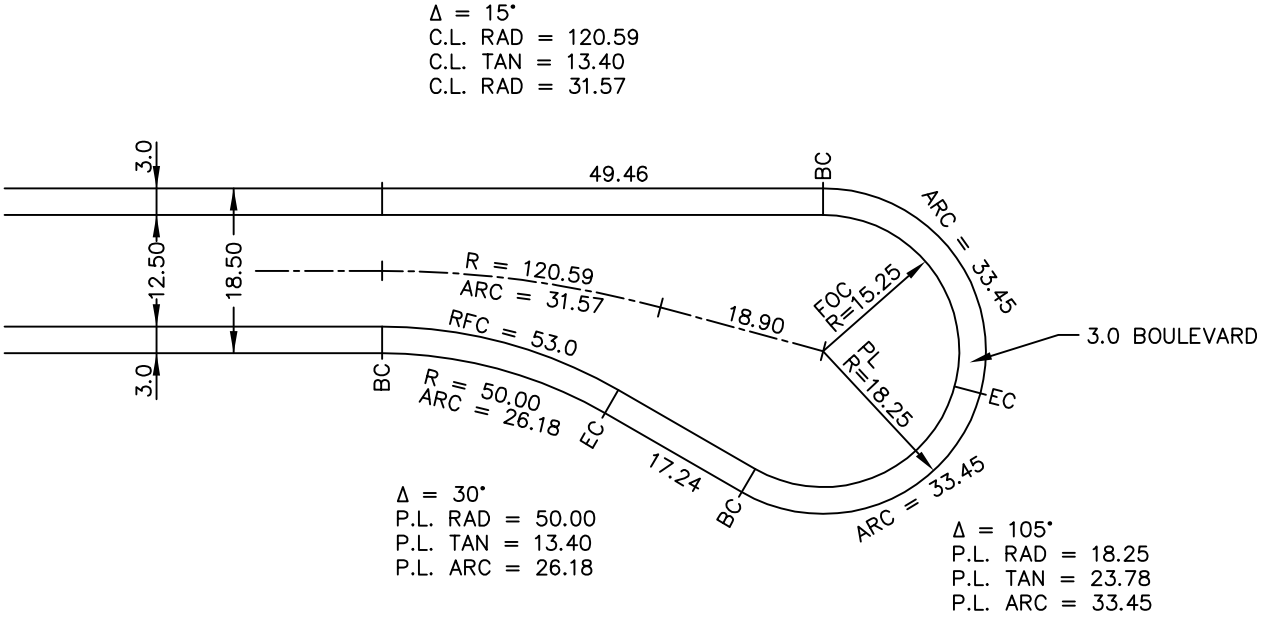




LOCAL RESIDENTIAL CUL-DE-SAC CURB AND GUTTER

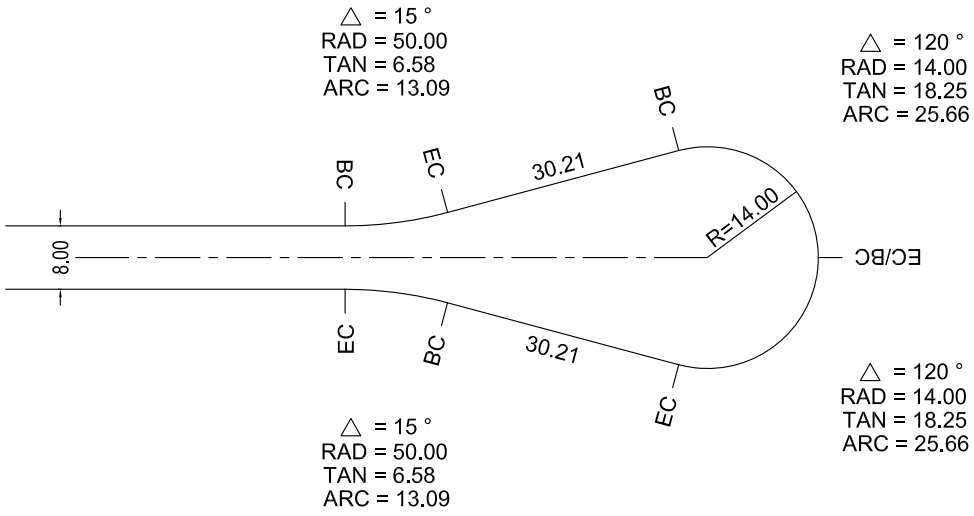
Project No.	4006035
Scale	N.T.S.
Date	JUNE 2009
Standard Detail No.	9.1

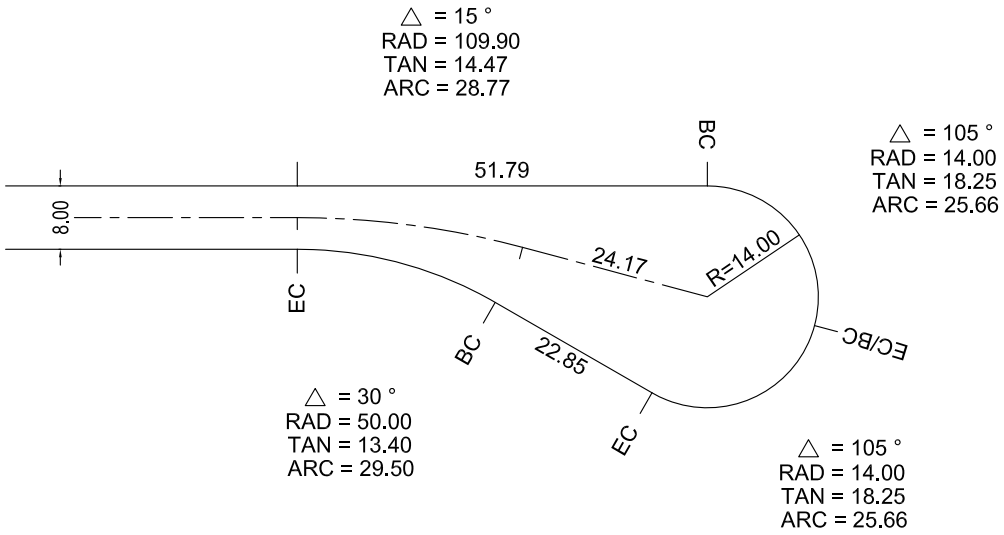




LOCAL INDUSTRIAL/COMMERCIAL
CUL – DE – SAC
CURB AND GUTTER

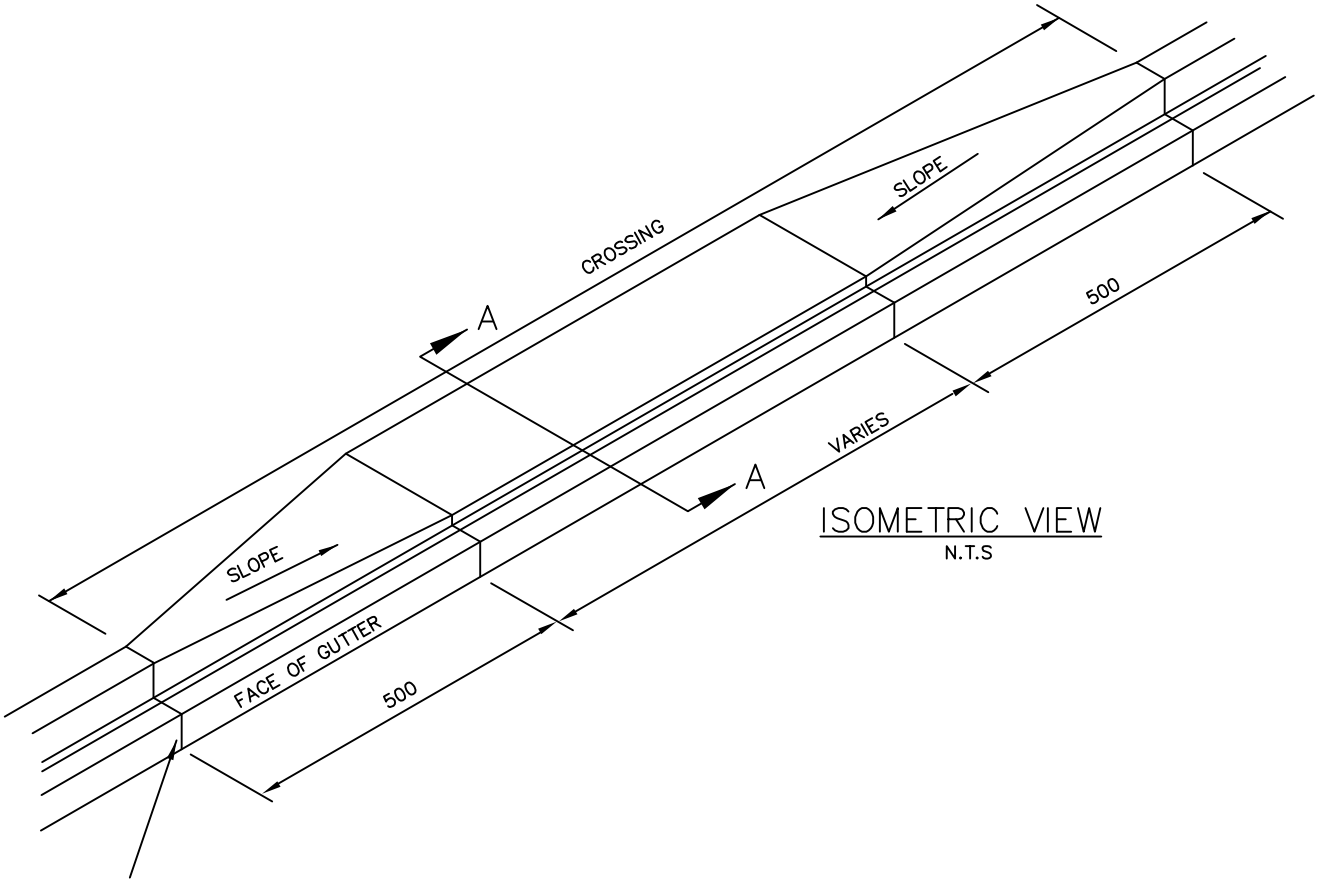
Project No.	4006035
Scale	N.T.S
Date	MAY 2007
Standard Detail No.	9.2



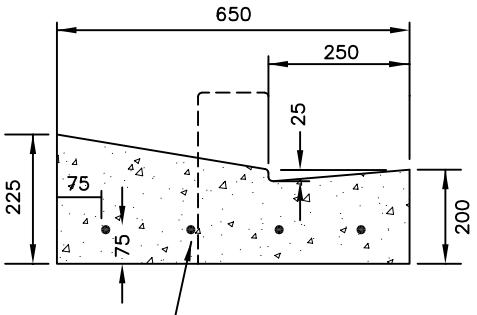


RURAL CUL-DE-SAC DETAILS

Project No.	4006035
Scale	N.T.S.
Date	JUNE 2009
Standard Detail No.	9.2A



ISOMETRIC VIEW
N.T.S



SECTION A – A

NOTES:

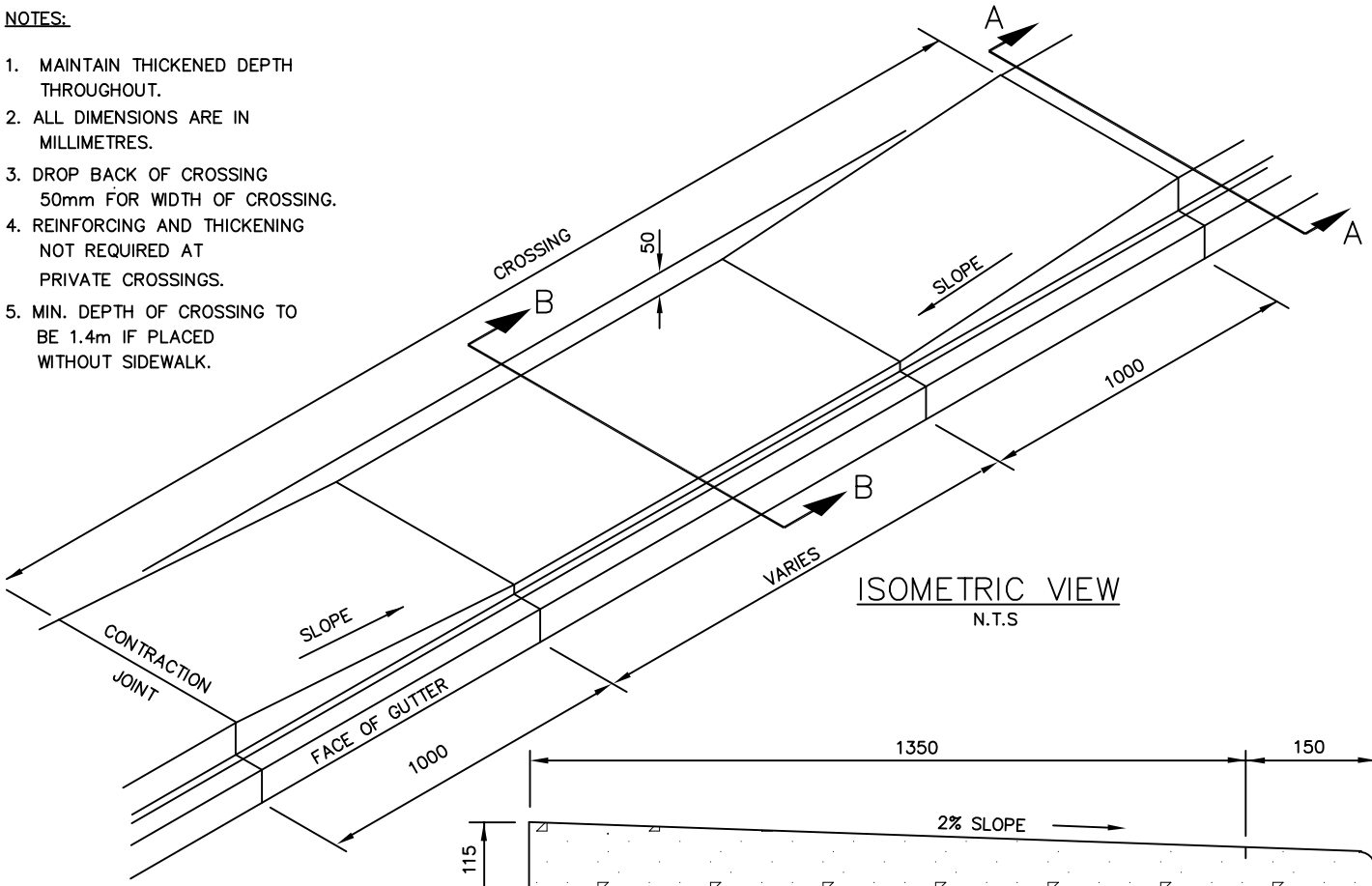
1. MAINTAIN THICKENED DEPTH THROUGHOUT.
2. ALL DIMENSIONS ARE IN MILLIMETRES

INDUSTRIAL / COMMERCIAL CURB & GUTTER CROSSING

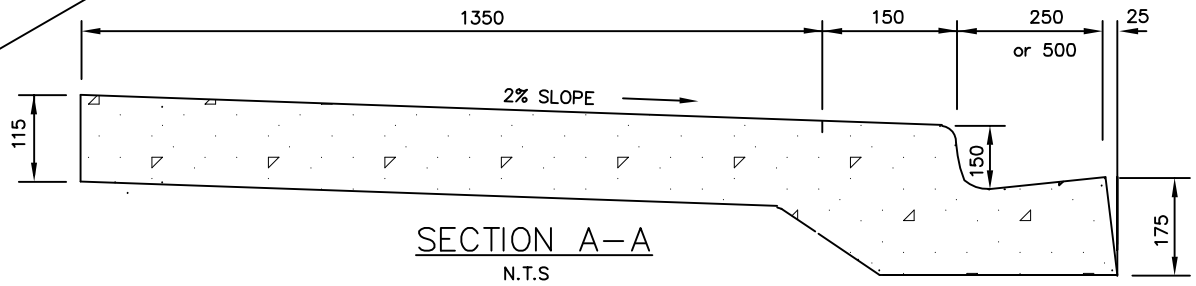
Project No.	4006035
Scale	N.T.S
Date	MAY 2007
Standard Detail No.	9.3

NOTES:

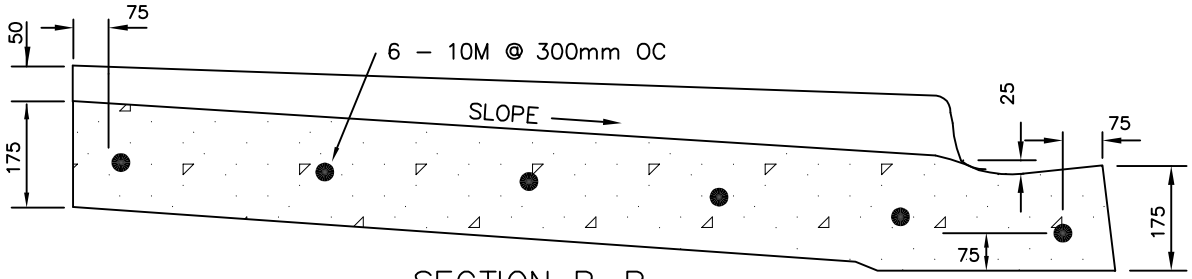
1. MAINTAIN THICKENED DEPTH THROUGHOUT.
2. ALL DIMENSIONS ARE IN MILLIMETRES.
3. DROP BACK OF CROSSING 50mm FOR WIDTH OF CROSSING.
4. REINFORCING AND THICKENING NOT REQUIRED AT PRIVATE CROSSINGS.
5. MIN. DEPTH OF CROSSING TO BE 1.4m IF PLACED WITHOUT SIDEWALK.



ISOMETRIC VIEW
N.T.S



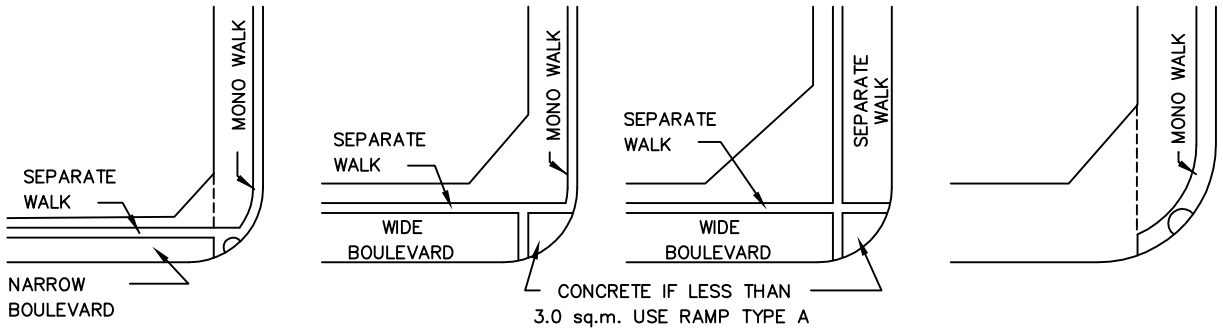
SECTION A–A
N.T.S



SECTION B–B
N.T.S

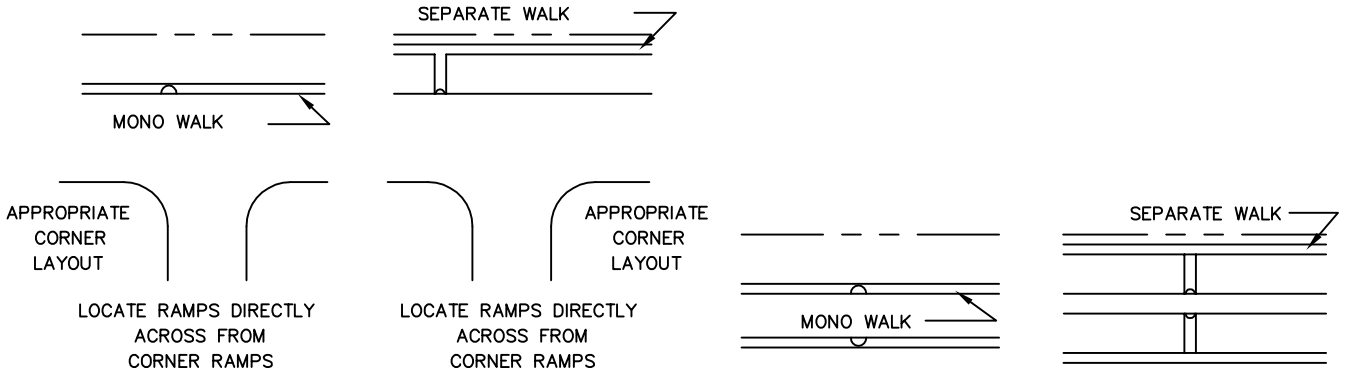
TYPICAL MONOLITHIC LANE AND DRIVEWAY CROSSING

Project No.	4006035
Scale	N.T.S
Date	MAY 2007
Standard Detail No.	9.4



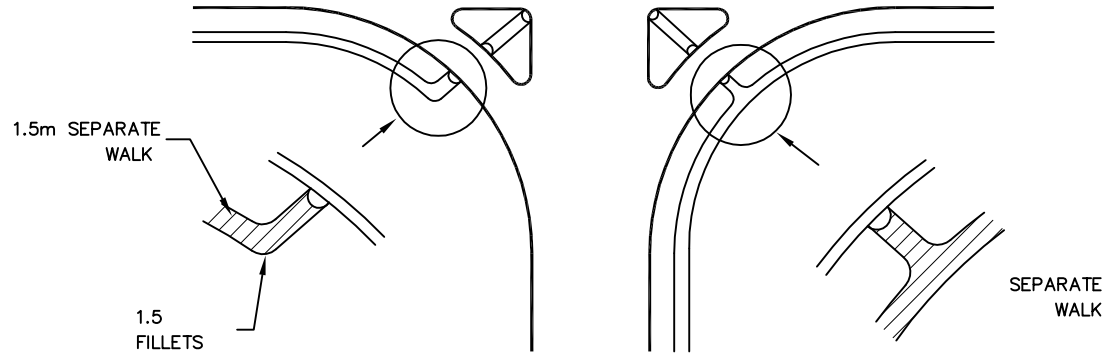
RAMP TYPE A | RAMP TYPE B | RAMP TYPE B | RAMP TYPE A

CORNER LAYOUT



RAMP TYPE C | RAMP TYPE D | RAMP TYPE C | RAMP TYPE D

TANGENT LAYOUT



RAMP TYPE D

INTERSECTION LAYOUT

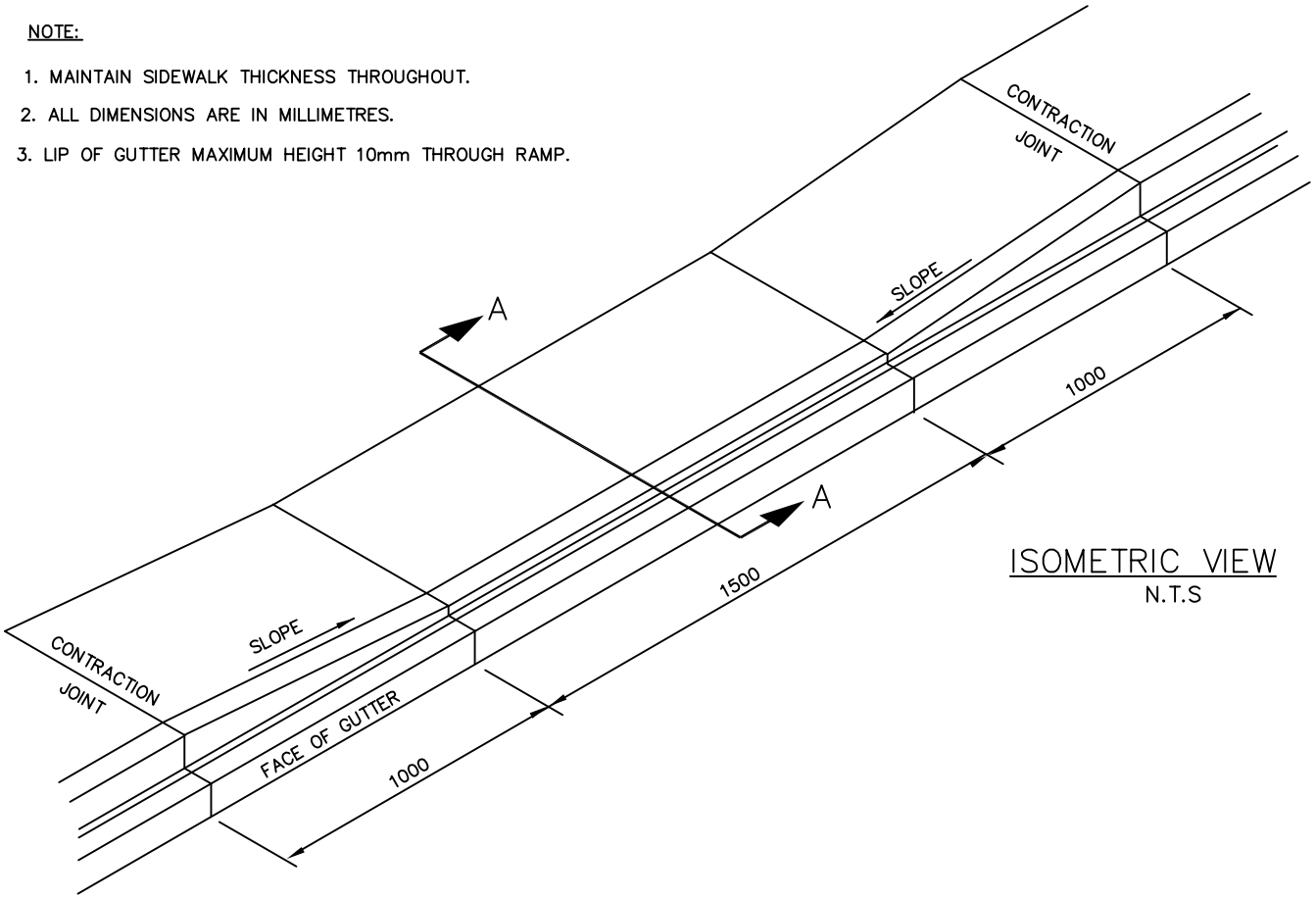
N.T.S.

WHEELCHAIR / BIKE RAMP LOCATIONS

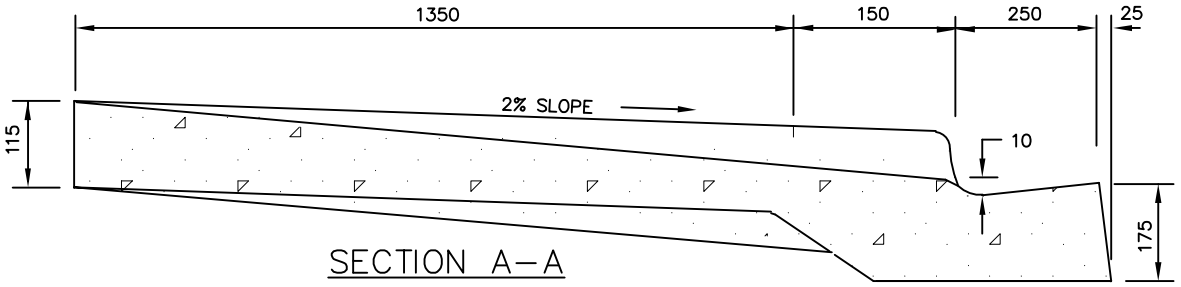
Project No.	4006035
Scale	N.T.S
Date	MAY 2007
Standard Detail No.	9.5

NOTE:

1. MAINTAIN SIDEWALK THICKNESS THROUGHOUT.
2. ALL DIMENSIONS ARE IN MILLIMETRES.
3. LIP OF GUTTER MAXIMUM HEIGHT 10mm THROUGH RAMP.



ISOMETRIC VIEW
N.T.S

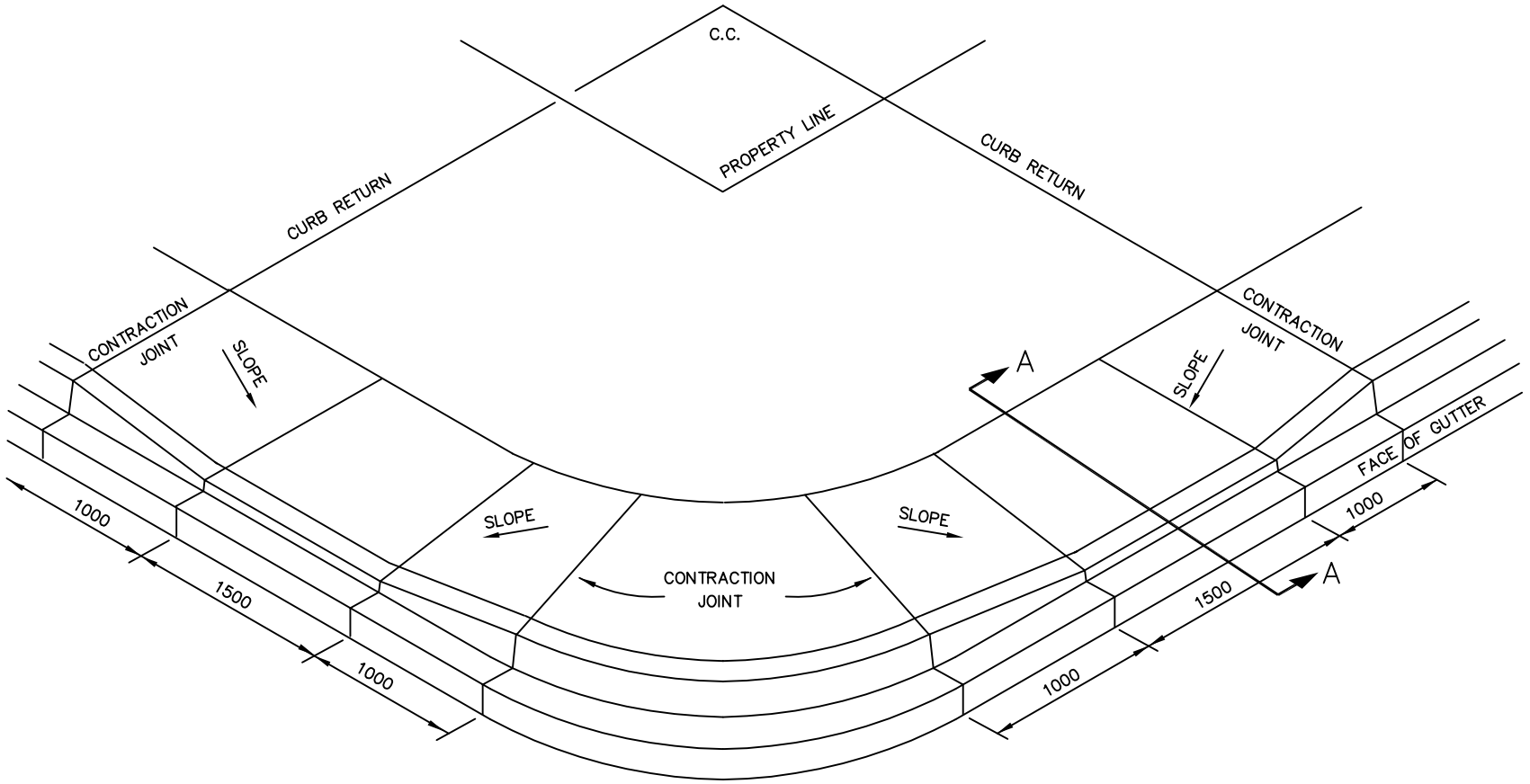


SECTION A–A
N.T.S

PARAPLEGIC RAMP
DETAILS ON TANGENT

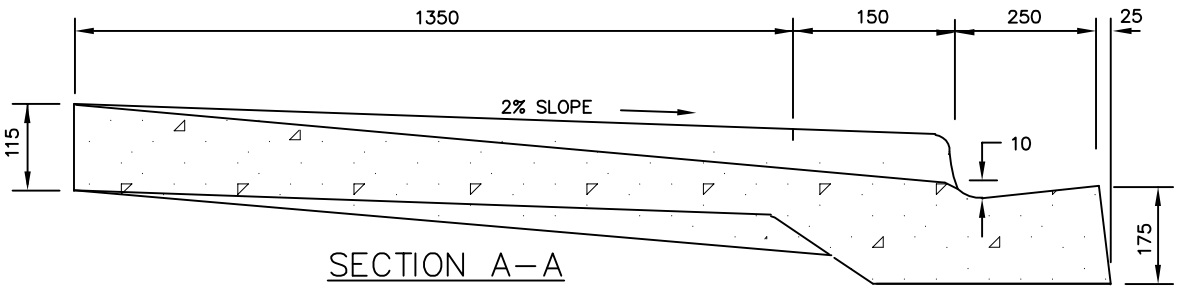
Project No.	4006035
Scale	N.T.S
Date	MAY 2007
Standard Detail No.	9.6

PARAPLEGIC RAMP DETAILS AT BOTH CURB RETURNS



ISOMETRIC VIEW

N.T.S



SECTION A–A

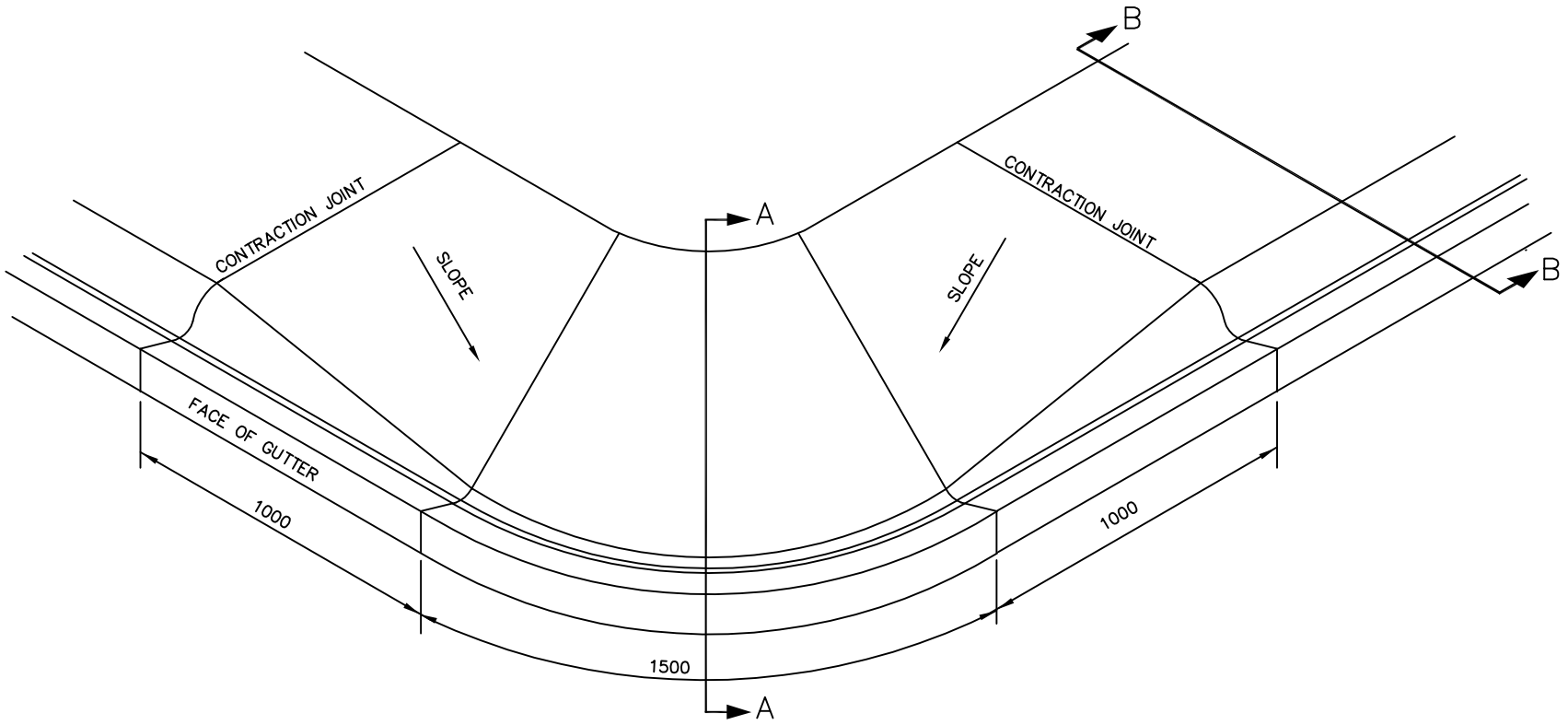
N.T.S

NOTES:

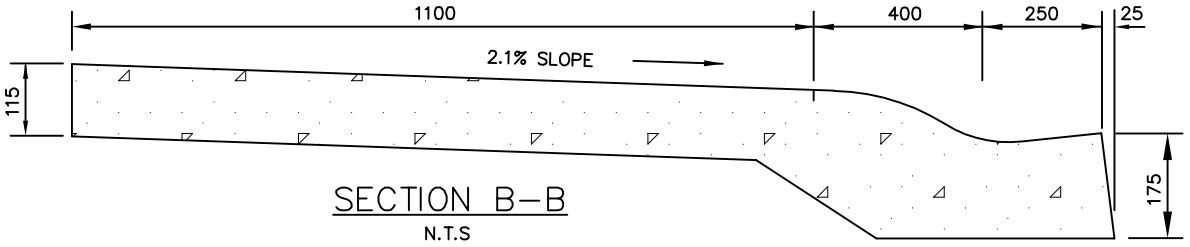
1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE STATED.
2. MAINTAIN SIDEWALK DEPTH THROUGHOUT.
3. LIP OF GUTTER MAXIMUM HEIGHT 10mm THROUGH RAMP.

Project No.	4006035
Scale	N.T.S
Date	MAY 2007
Standard Detail No.	9.7

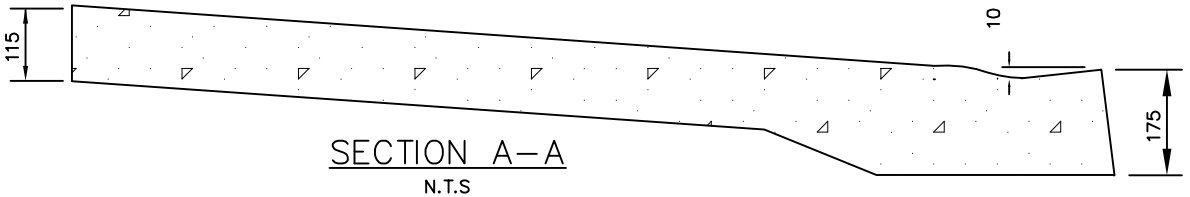
PARAPLEGIC RAMP DETAILS AT CENTER OF CURB RETURN ROLLED CURB



ISOMETRIC VIEW
N.T.S



SECTION B–B
N.T.S

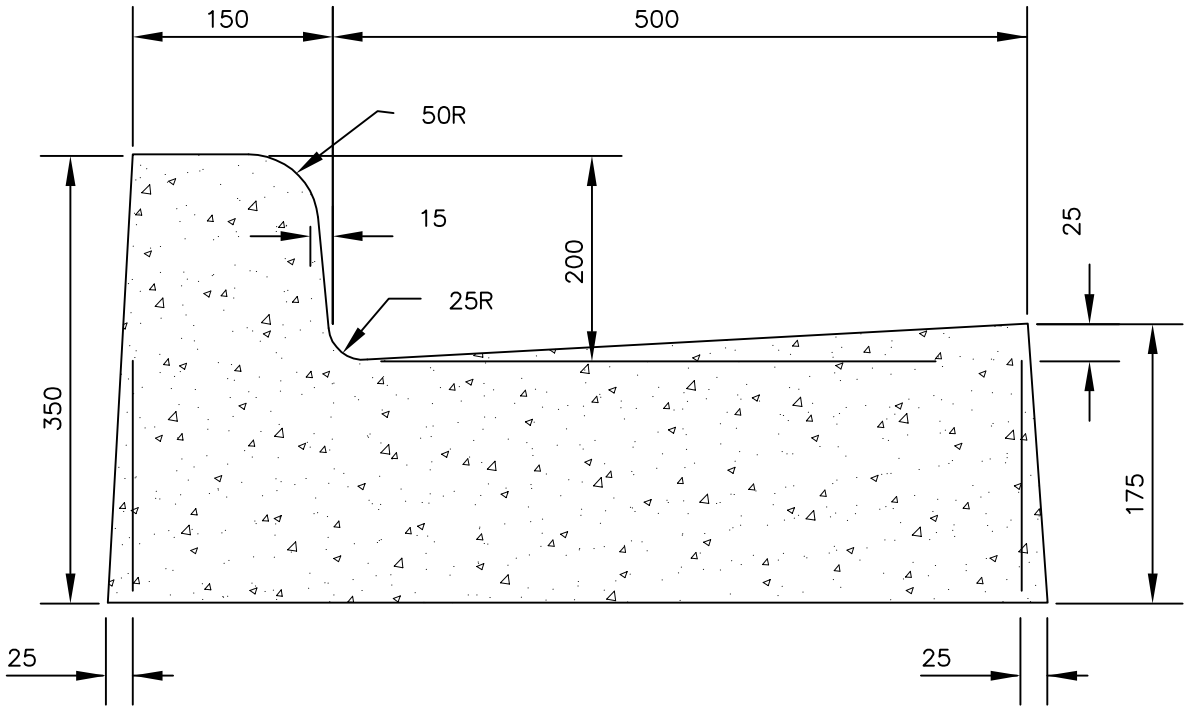


SECTION A–A
N.T.S

NOTES:

1. MAINTAIN SIDEWALK DEPTH THROUGHOUT.
2. ALL DIMENSIONS ARE IN MILLIMETRES.
3. LIP OF GUTTER MAXIMUM HEIGHT 10mm THROUGH LIP.

Project No.	4006035
Scale	N.T.S
Date	MAY 2007
Standard Detail No.	9.8

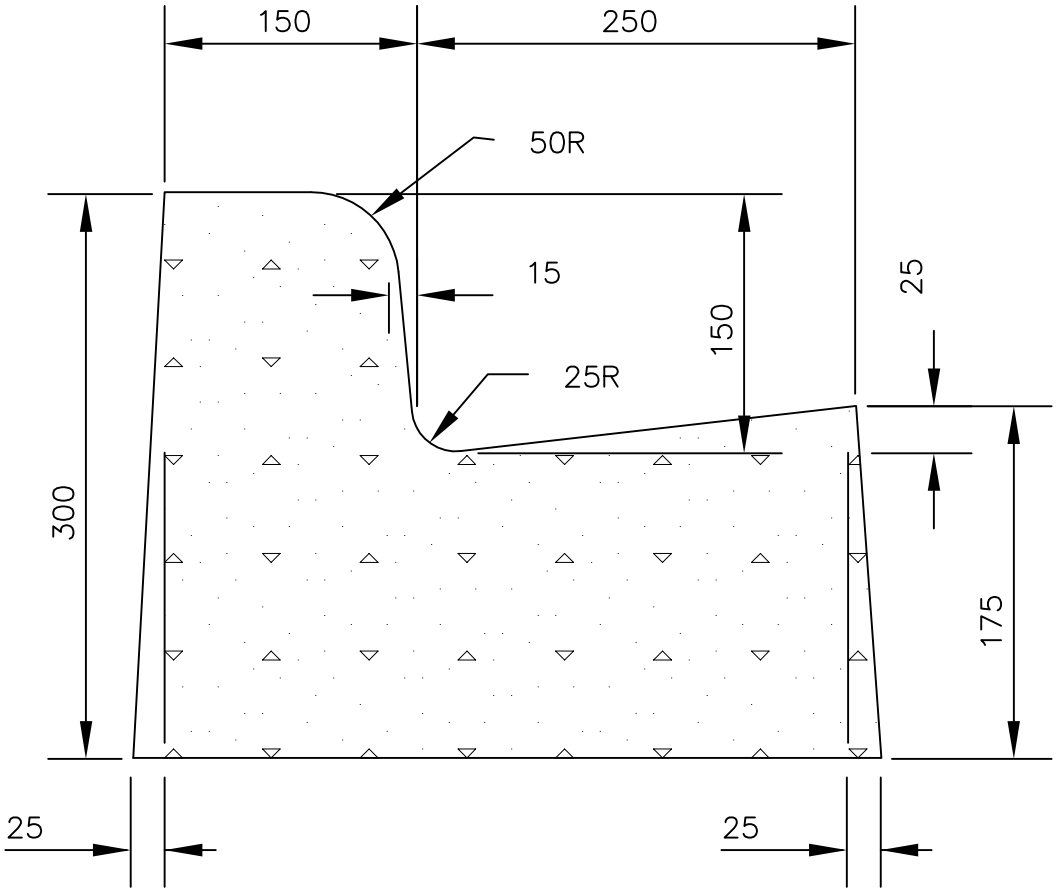


NOTES:

1. 25 mm BATTER NOT REQUIRED FOR HANDFORMED.
2. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE STATED.

500mm CURB & GUTTER FOR ARTERIAL ROADWAYS

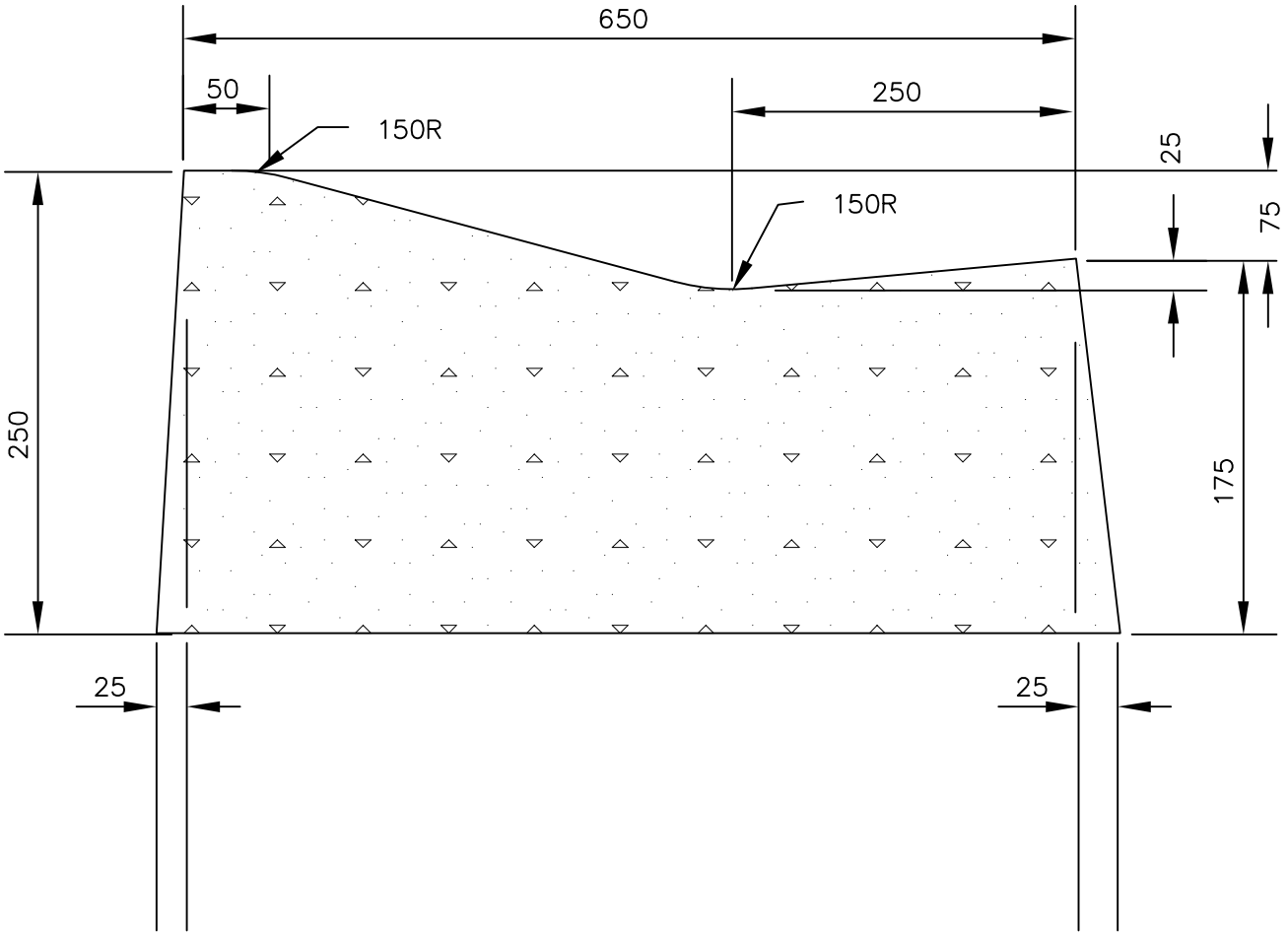
Project No.	4006035
Scale	N.T.S
Date	MAY 2007
Standard Detail No.	9.9



NOTES:

1. 25 mm BATTER NOT REQUIRED FOR HANDFORMED.
2. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE STATED.

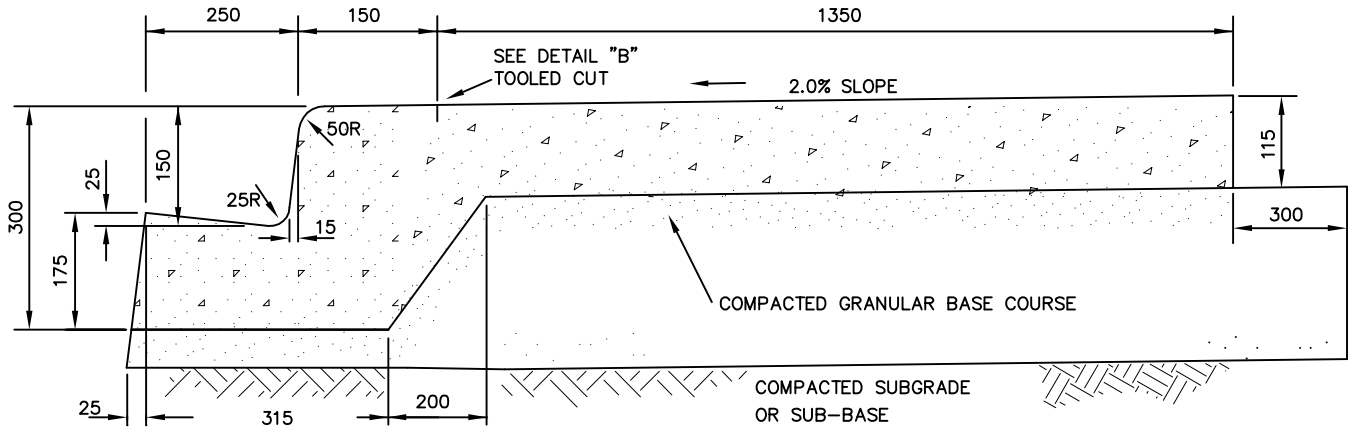
	250mm STANDARD CURB & GUTTER	Project No. 4006035 Scale N.T.S | Date MAY 2007 Standard Detail No. 9.10

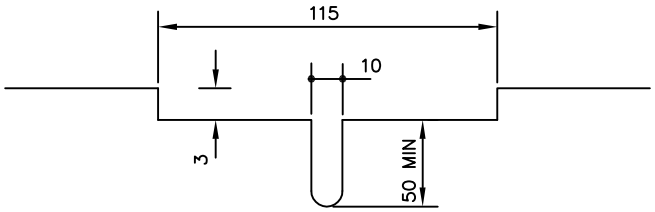


NOTES:

1. 25 mm BATTER NOT REQUIRED FOR HANDFORMED.
2. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE STATED.

	250mm ROLLED CURB AND GUTTER	Project No. 4006035 Scale N.T.S / Date MAY 2007 Standard Detail No. 9.11





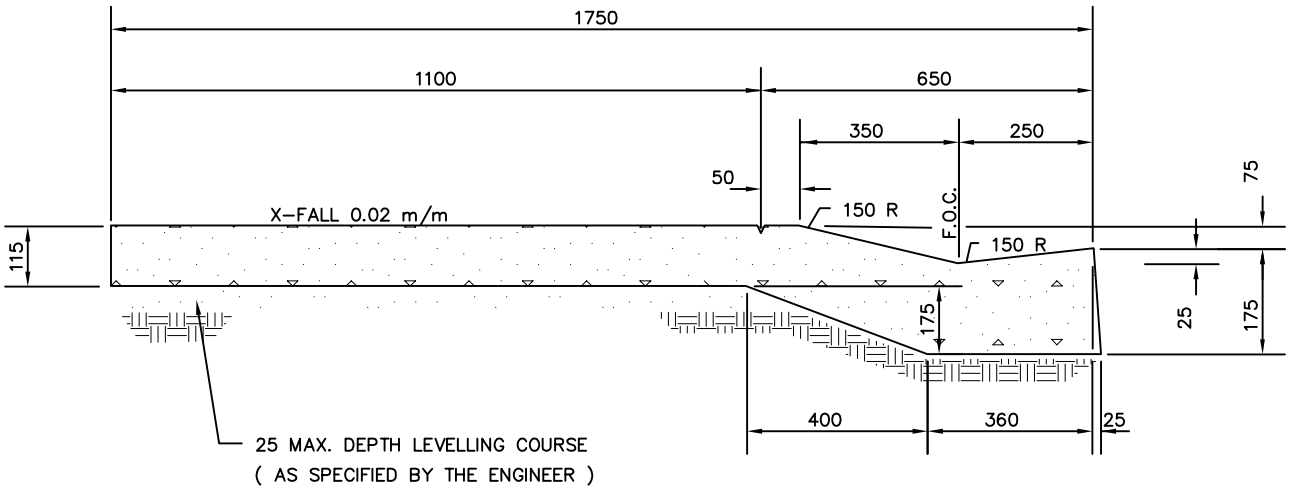
DETAIL "B"

NOTE:

1. ALL DIMENSIONS ARE IN MILLIMETRES.

1.50m STANDARD MONOLITHIC SIDEWALK

Project No.	4006035
Scale	N.T.S
Date	MAY 2007
Standard Detail No.	9.12

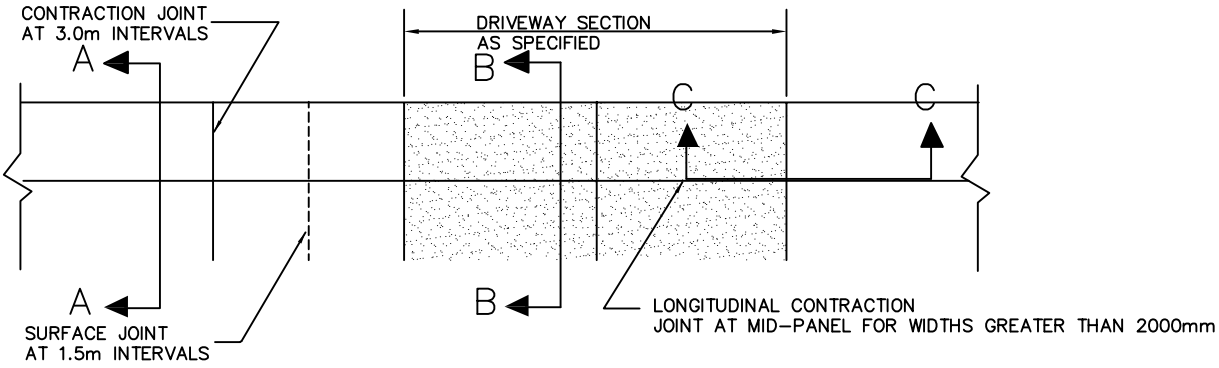


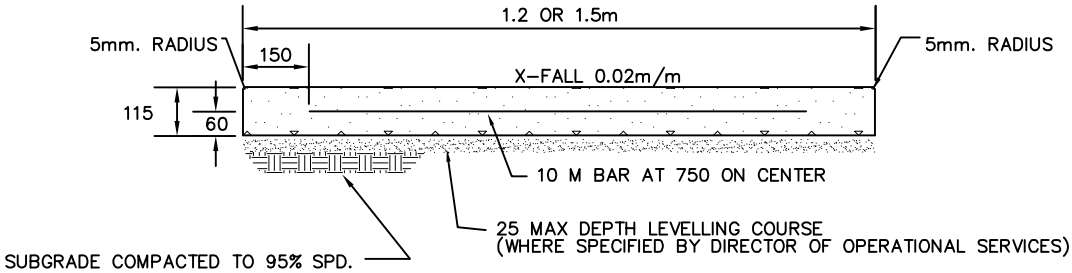
NOTES:

1. 25 mm BATTER NOT REQUIRED FOR HANDFORMED
2. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE STATED.

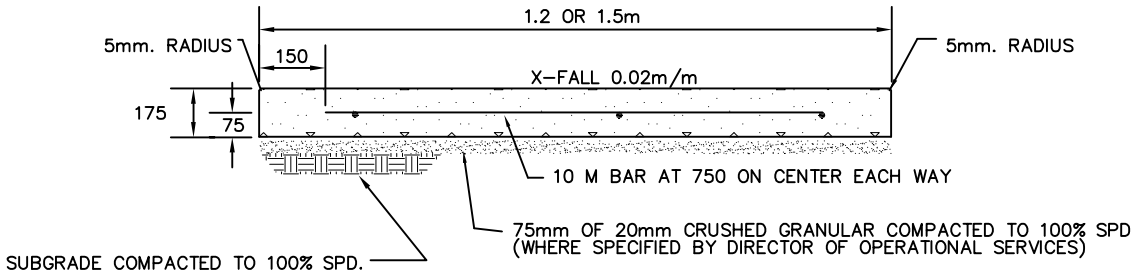
1.50m ROLLED MONOLITHIC SIDEWALK

Project No.	4006035
Scale	N.T.S
Date	MAY 2007
Standard Detail No.	9.13

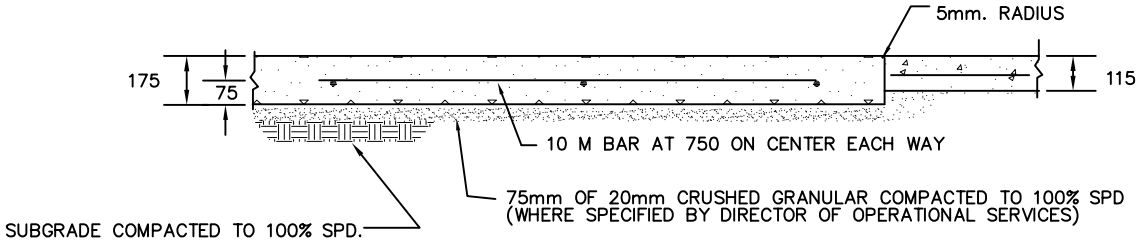




SECTION A-A...STANDARD SIDEWALK



SECTION B-B...DRIVEWAY SECTION

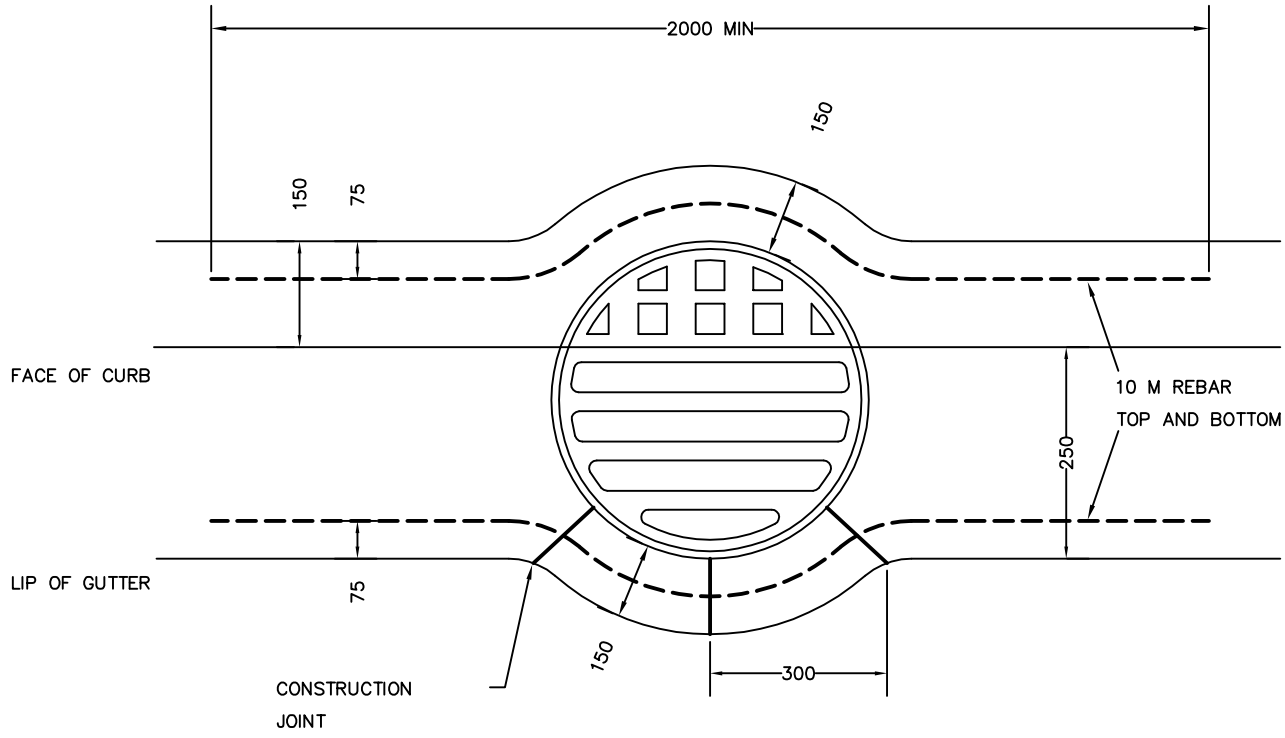


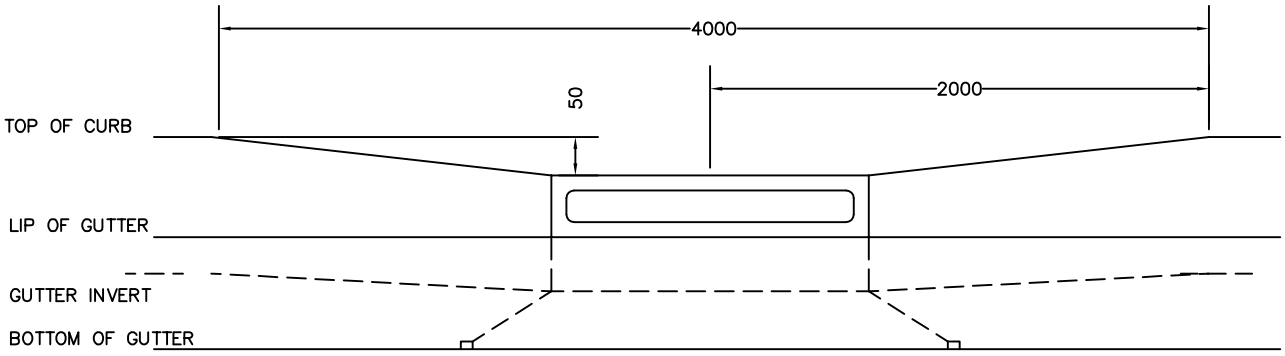
SECTION C-C...TRANSITION

NOTE:

1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE STATED.

	1.20m OR 1.50m SEPARATE SIDEWALK	Project No. 4006035 Scale N.T.S | Date MAY 2007 Standard Detail No. 9.14





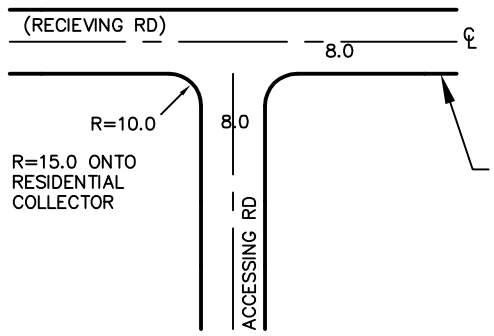
NOTES:

1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE STATED.

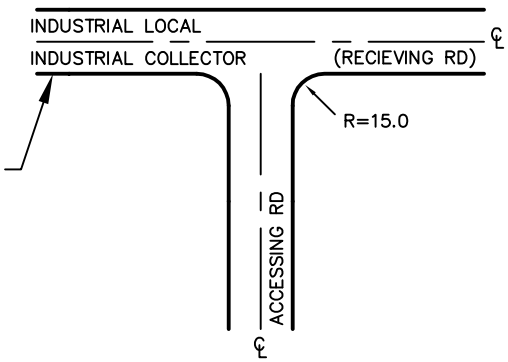
TYPICAL CATCH BASSIN INSTALLATION 150 CURB & 250 GUTTER

Project No.	4006035
Scale	N.T.S
Date	MAY 2007
Standard Detail No.	9.15

RESIDENTIAL ACCESS
RESIDENTIAL LOCAL
RESIDENTIAL COLLECTOR

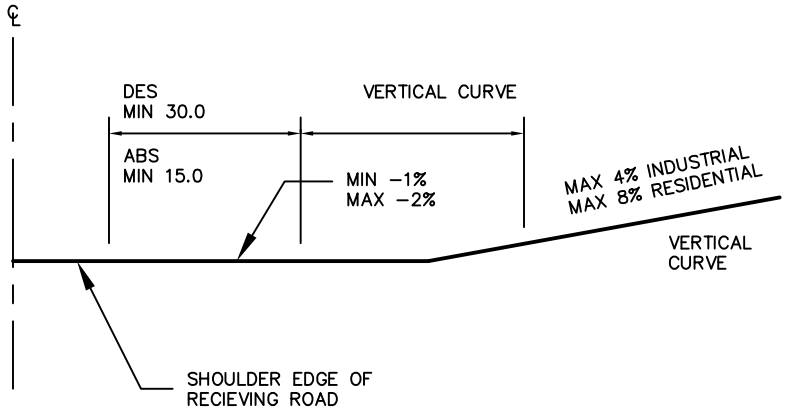


RESIDENTIAL ACCESS
RESIDENTIAL LOCAL

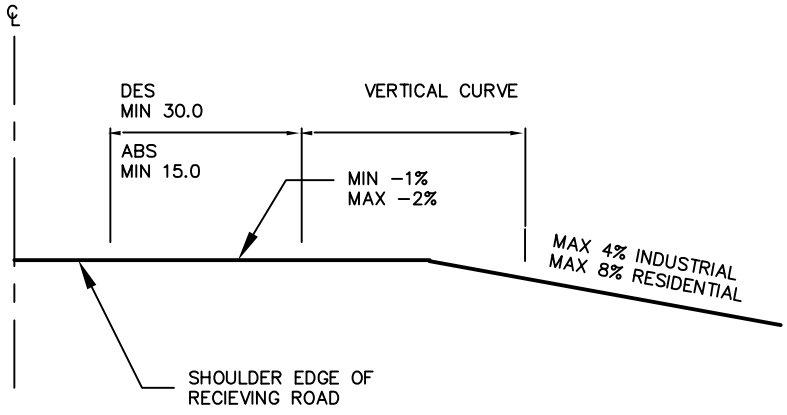


INDUSTRIAL LOCAL
INDUSTRIAL COLLECTOR

ROAD SHOULDER



PROFILE – ACCESSING ROAD IN CUT

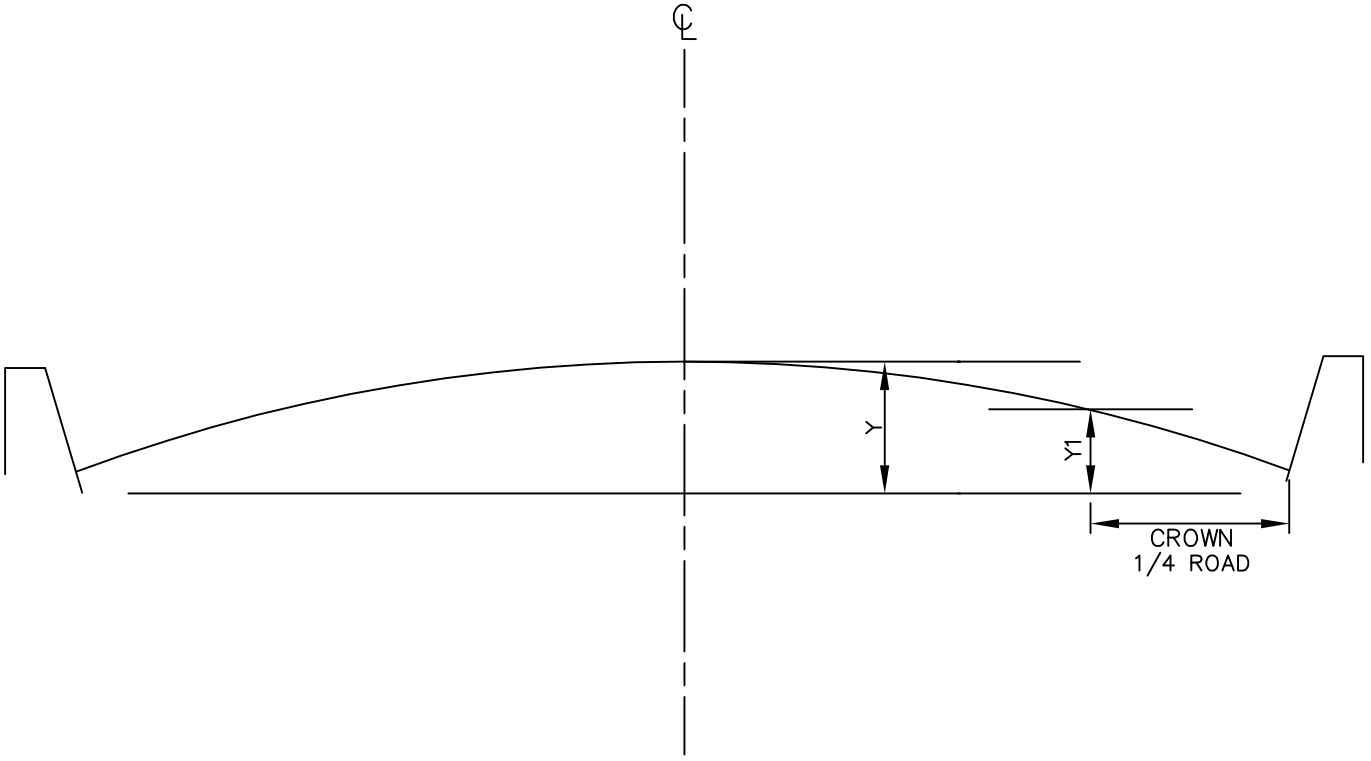


PROFILE – ACCESSING ROAD IN FILL

NOTES:
1. LENGTH OF VERTICAL CURVE SHALL BE ACCORDING TO T A C MANUAL
2. ALL DIMENSIONS ARE IN METERS

TYPICAL ROAD INTERSECTIONS

Project No.	4006035
Scale	N.T.S
Date	MAY 2007
Standard Detail No.	10.1



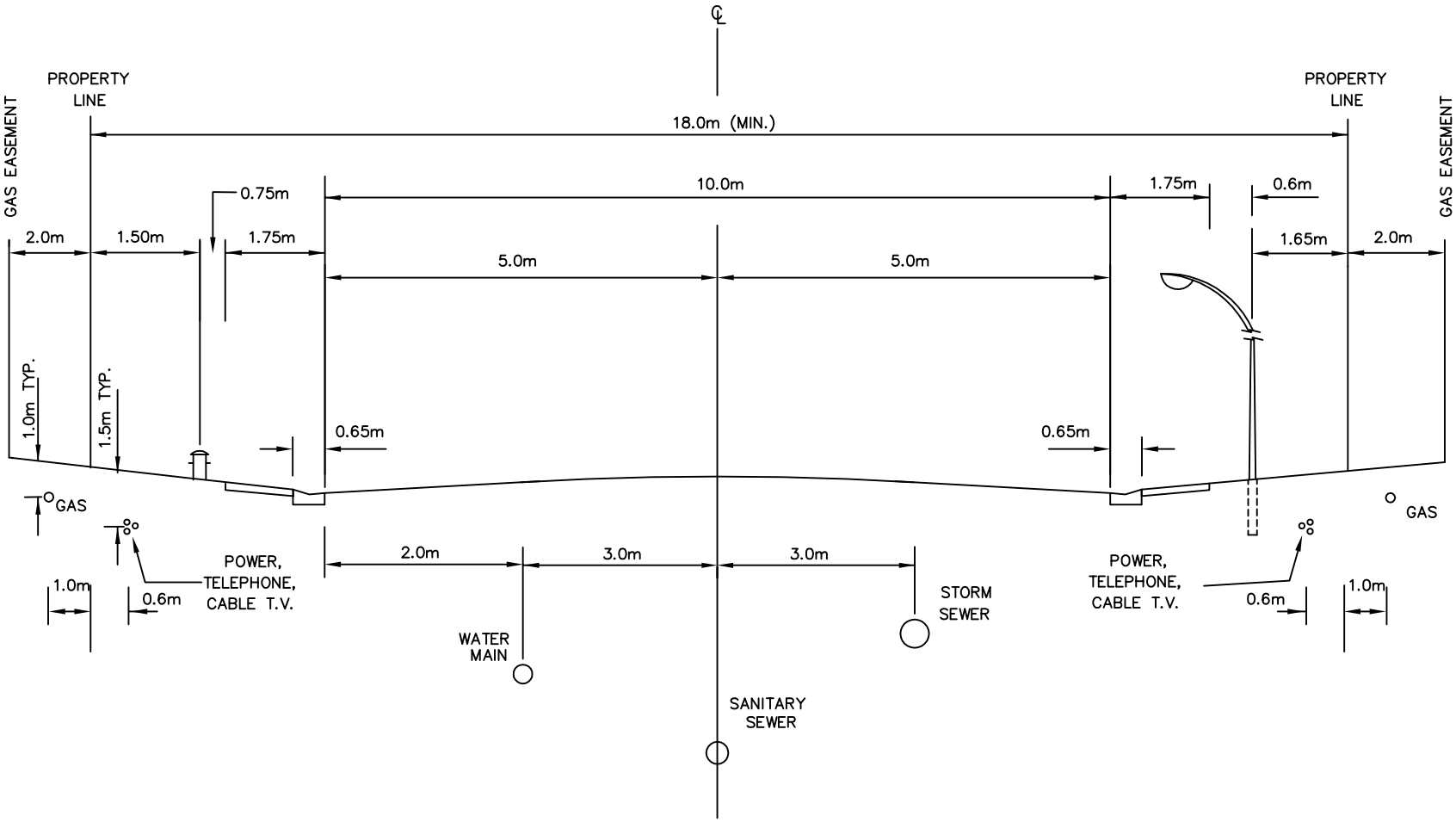
INTERMEDIATE PAVEMENT TYPE (% CROWN 1/4"–1/2")

(0.63cm–1.27cm)

ROAD WIDTH	9.7m	11.0m	12.0m	13.4m	14.5m
CROWN HT. "Y"	150	170	190	210	230
1/4 ROAD WIDTH HT. "Y1"	103	114	130	143	155

PAVEMENT CROWN FOR VARIOUS ROAD WIDTHS

Project No.	4006035
Scale	N.T.S
Date	MAY 2007
Standard Detail No.	10.2



SECTION

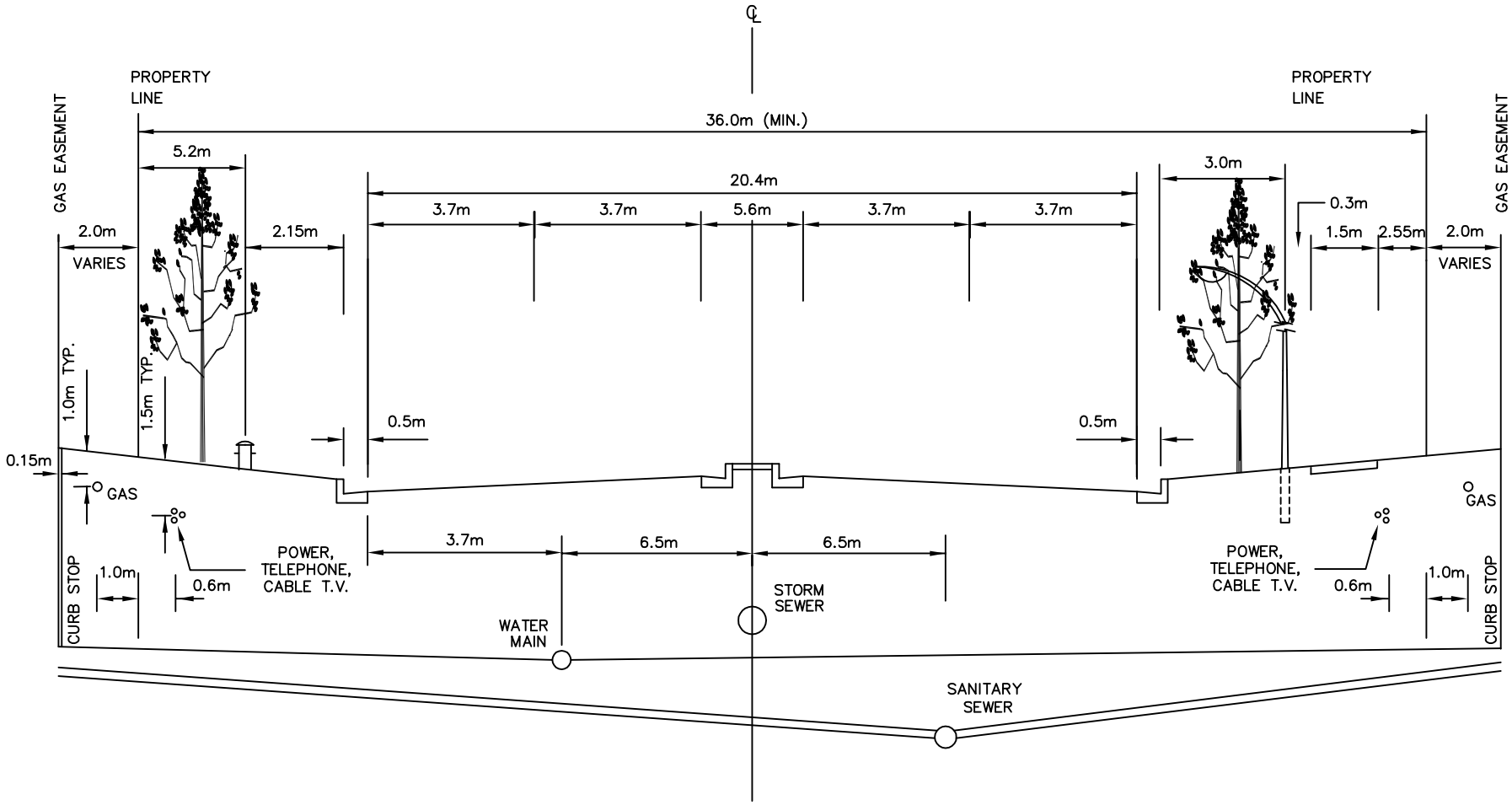
N.T.S.

NOTES:

1. IF NO GAS EASEMENT, CURB STOP TO BE INSTALLED 0.15m INSIDE ROAD RIGHT-OF-WAY.

LOCAL RESIDENTIAL (URBAN)

Project No.	4006035
Scale	N.T.S
Date	MAY 2007
Standard Detail No.	10.3



SECTION

N.T.S

NOTES:

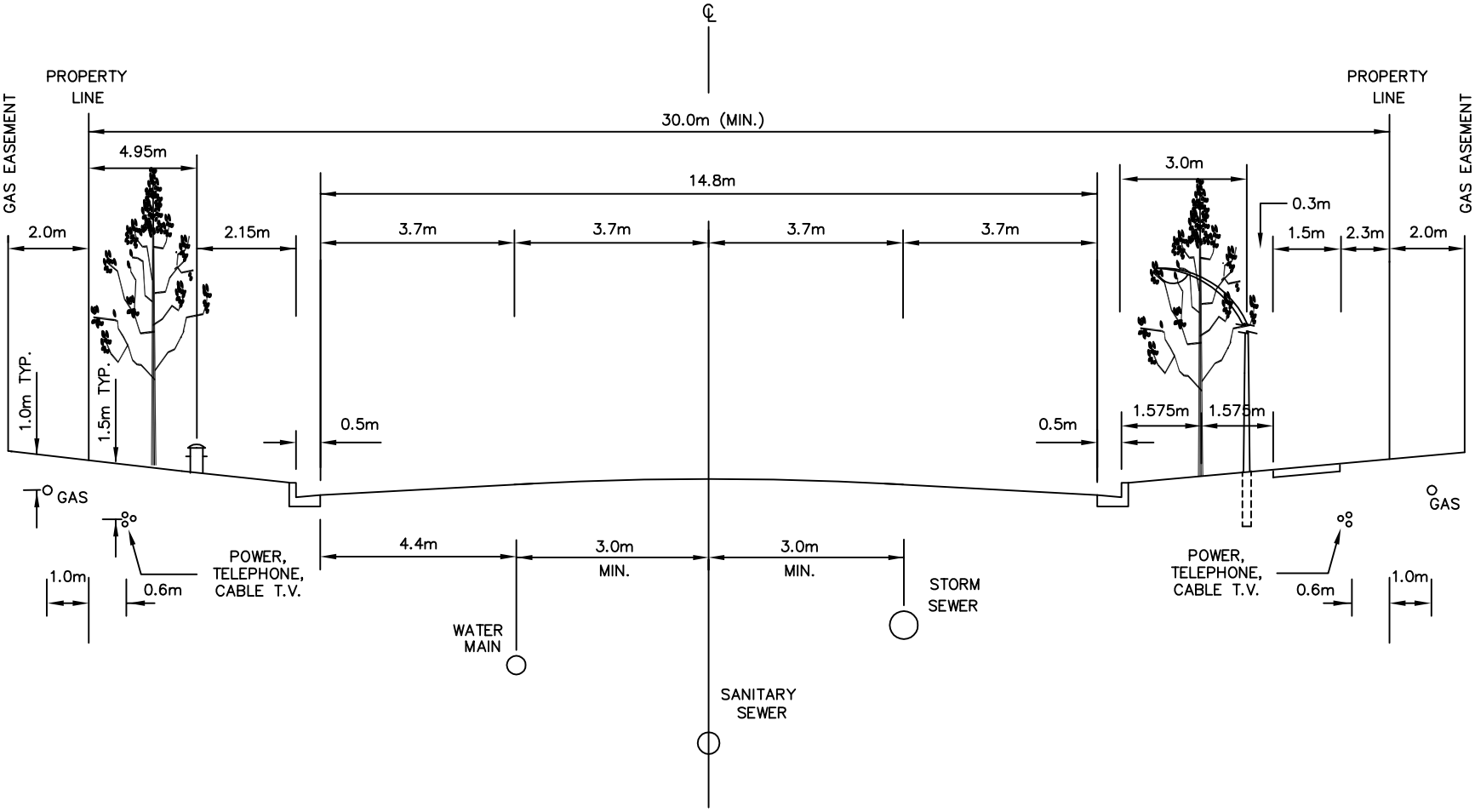
1. SIDEWALK MAY BE EITHER SEPERATE OR MONOLITHIC AS REQUIRED BY THE COUNTY.

2. IF NO GAS EASEMENT, CURB STOP TO BE INSTALLED 0.15m INSIDE ROAD RIGHT-OF-WAY.

DIVIDED ARTERIAL

Project No.	4006035
Scale	N.T.S
Date	MAY 2007
Standard Detail No.	10.4

M:\2006\4006035 - Lesser Slave River Spec\DRAWINGS\Standard Detail Drawings\10.4.DWG Tue, Aug 14 2007 16:57 - brunon



SECTION

N.T.S

NOTES:

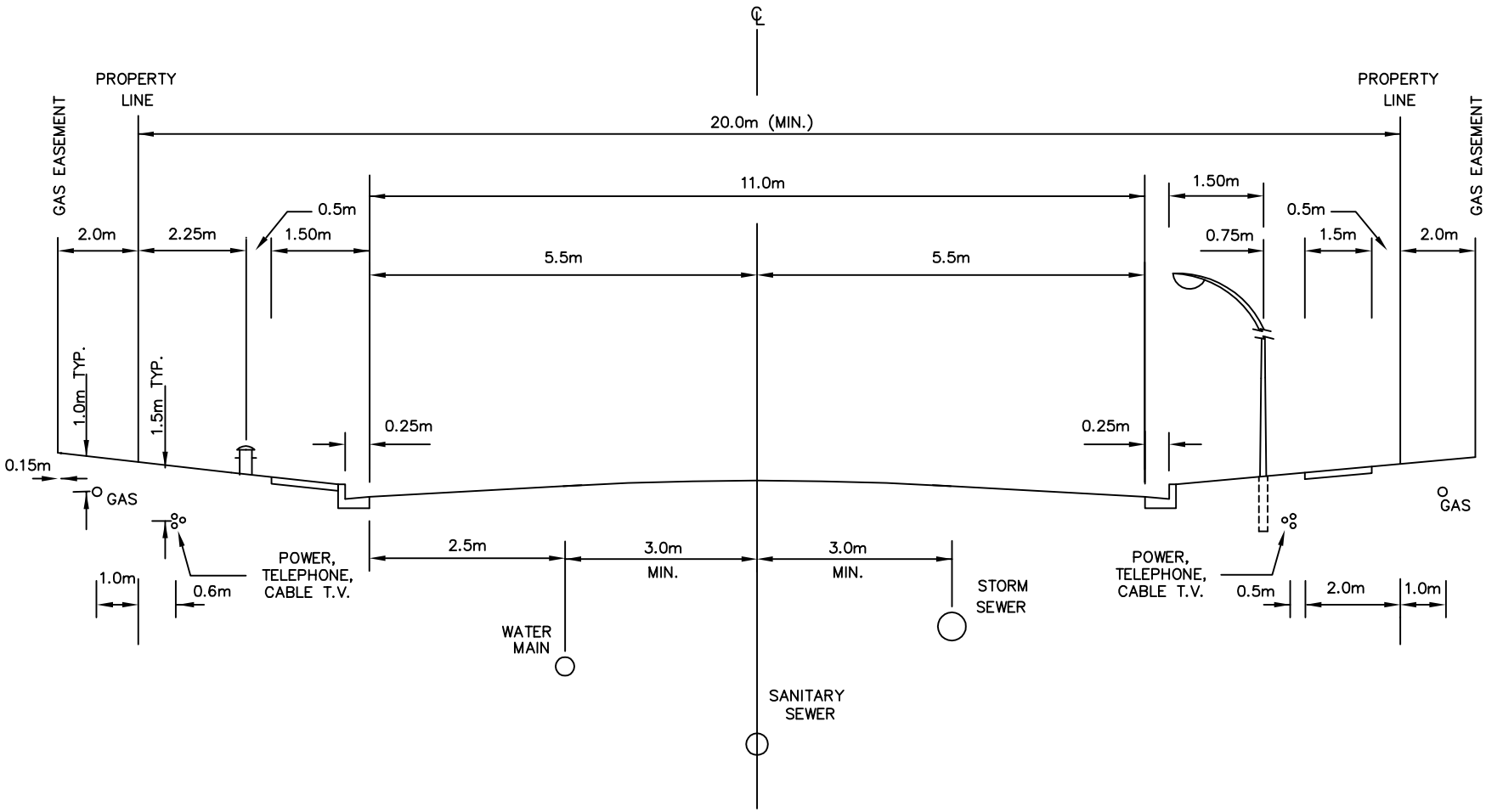
1. SIDEWALK MAY BE EITHER SEPERATE OR MONOLITHIC AS REQUIRED BY COUNTY.

2. IF NO GAS EASEMENT, CURB STOP TO BE INSTALLED 0.15m INSIDE ROAD RIGHT-OF-WAY.

UNDIVIDED ARTERIAL (URBAN)

Project No.	4006035
Scale	N.T.S
Date	MAY 2007
Standard Detail No.	10.5

M:\2006\4006035 - Lesser Slave River Spec\DRAWINGS\Standard Detail Drawings\10.5.DWG Tue, Aug 14 2007 16:58 - brunon



SECTION

N.T.S

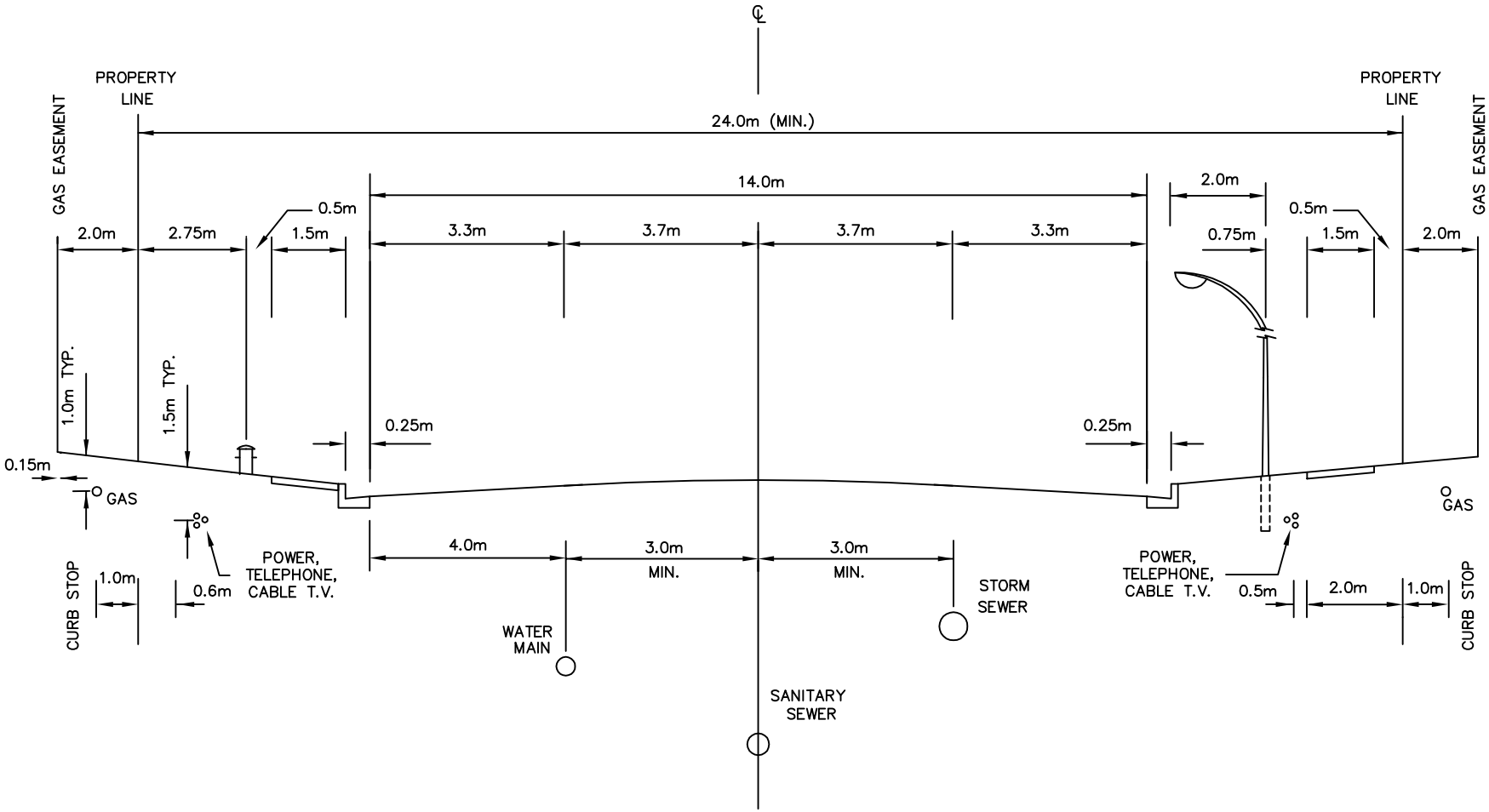
NOTES:

1. SIDEWALK MAY BE EITHER SEPERATE OR MONOLITHIC AS REQUIRED BY COUNTY.

2. IF NO GAS EASEMENT, CURB STOP TO BE INSTALLED 0.15m INSIDE ROAD RIGHT-OF-WAY.

MINOR RESIDENTIAL COLLECTOR (URBAN)

Project No.	4006035
Scale	N.T.S
Date	MAY 2007
Standard Detail No.	10.6



SECTION

N.T.S

NOTES:

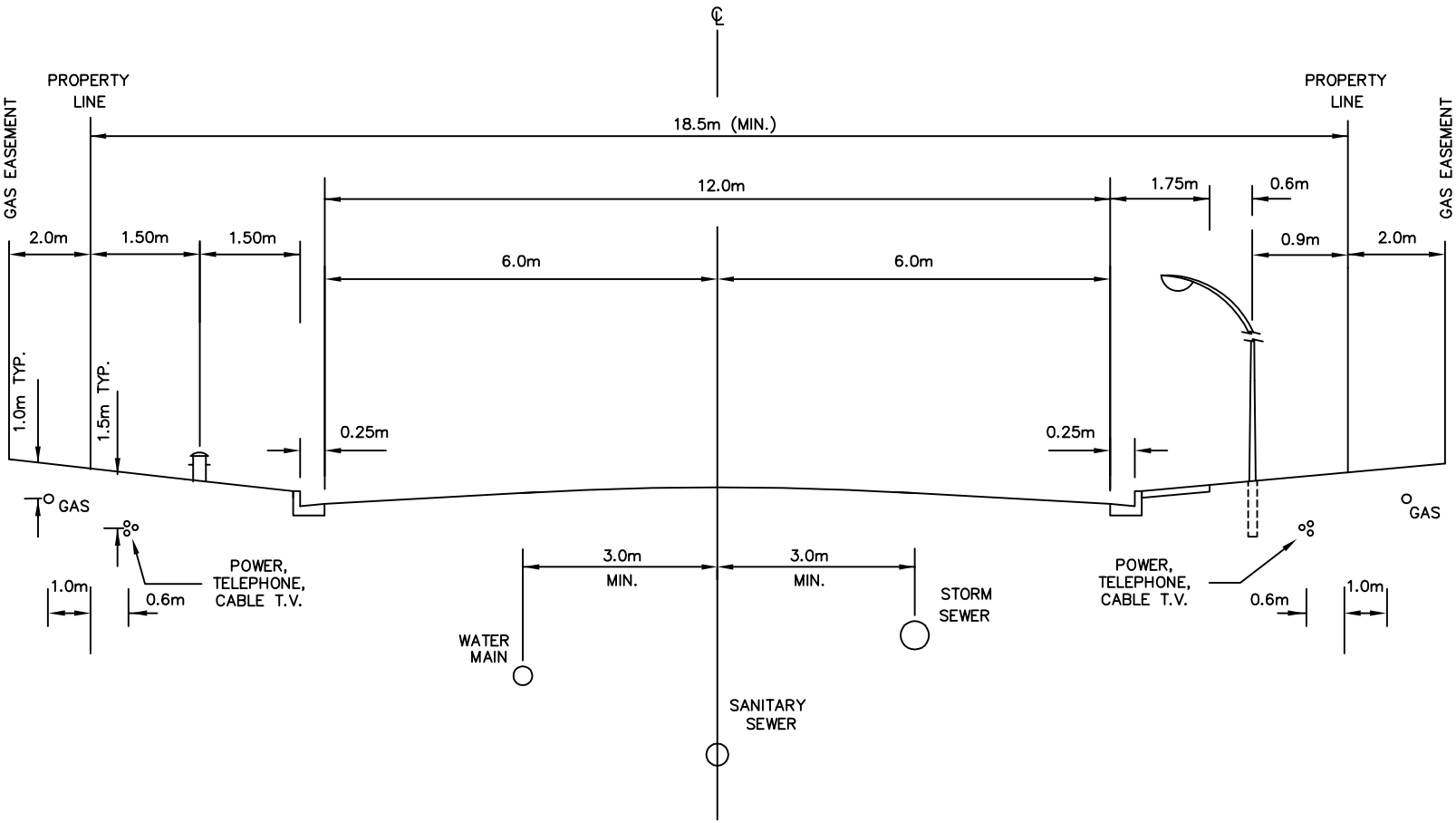
1. SIDEWALK MAY BE EITHER SEPERATE OR MONOLITHIC AS REQUIRED BY COUNTY.

2. IF NO GAS EASEMENT, CURB STOP TO BE INSTALLED 0.15m INSIDE ROAD RIGHT-OF-WAY.

DATE:

MAJOR RESIDENTIAL COLLECTOR (URBAN)

Project No.	4006035
Scale	N.T.S
Date	MAY 2007
Standard Detail No.	10.7



SECTION

N.T.S

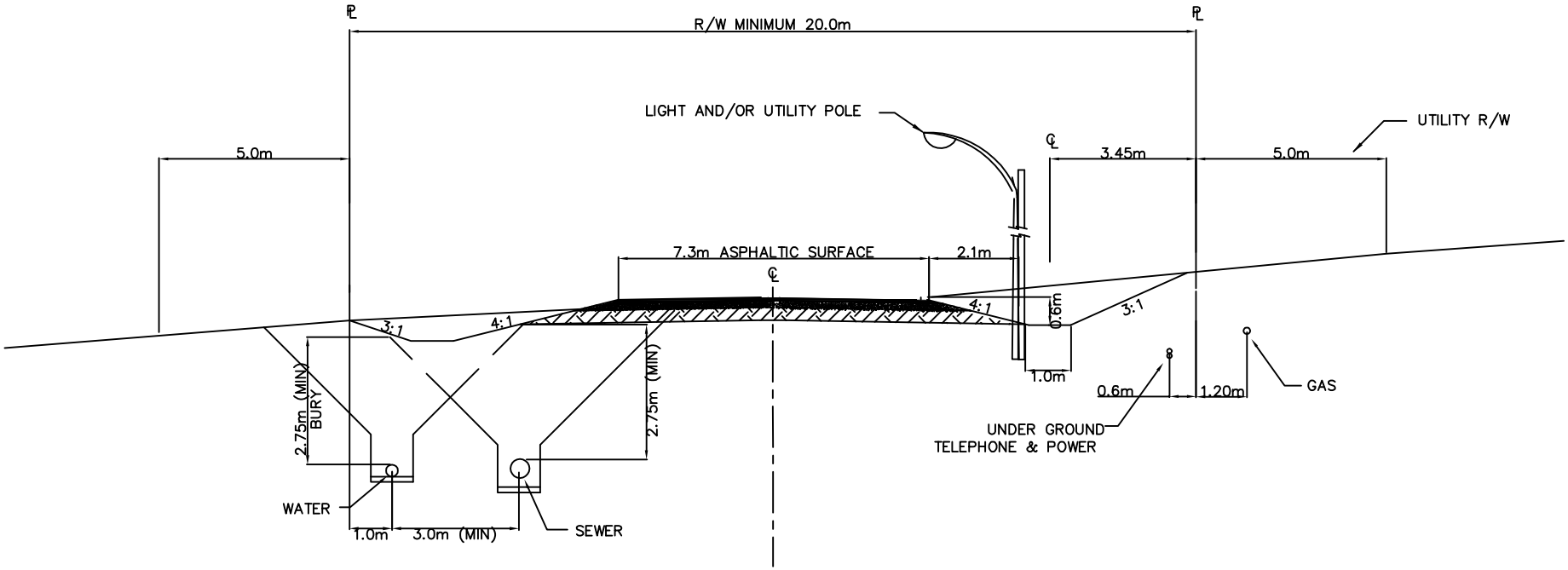
NOTES:

1. SIDEWALK MAY BE EITHER SEPERATE OR MONOLITHIC AS REQUIRED BY COUNTY.

2. IF NO GAS EASEMENT, CURB STOP TO BE INSTALLED 0.15m INSIDE ROAD RIGHT-OF-WAY.

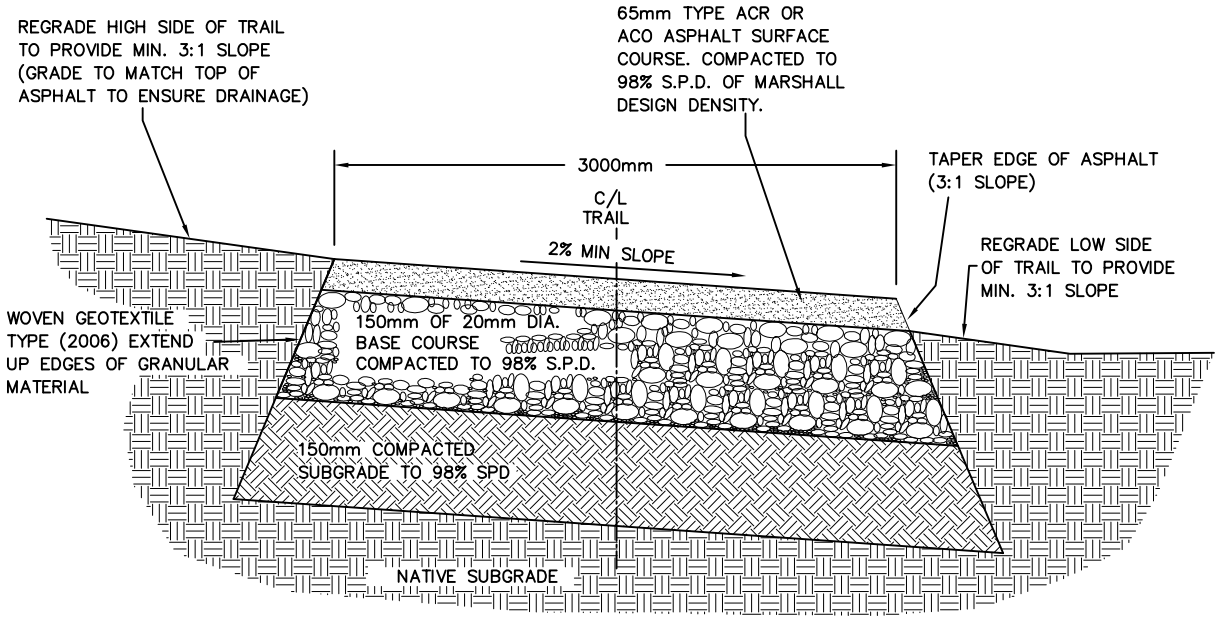
LOCAL INDUSTRIAL (URBAN)

Project No.	4006035
Scale	N.T.S
Date	MAY 2007
Standard Detail No.	10.8



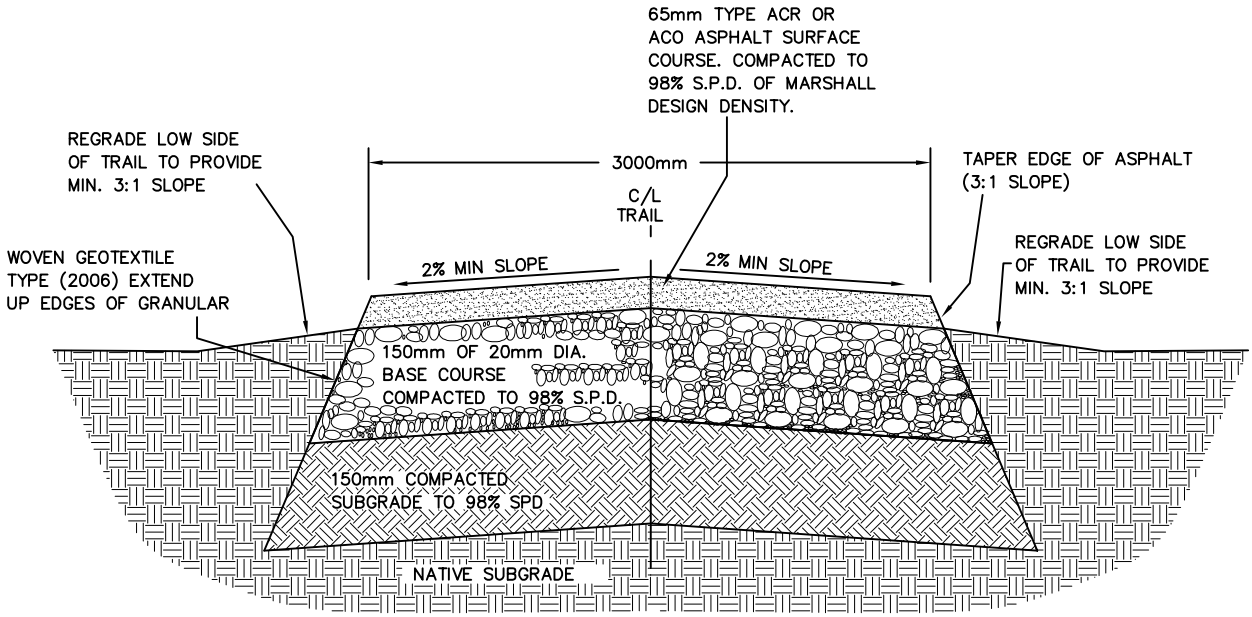
RURAL RESIDENTIAL SUBDIVISION
WITH UTILITIES
STANDARD CROSS–SECTION

Project No.	4006035
Scale	N.T.S
Date	MAY 2007
Standard Detail No.	10.10



TYPICAL TRAIL SECTION – CROSSFALL

NTS



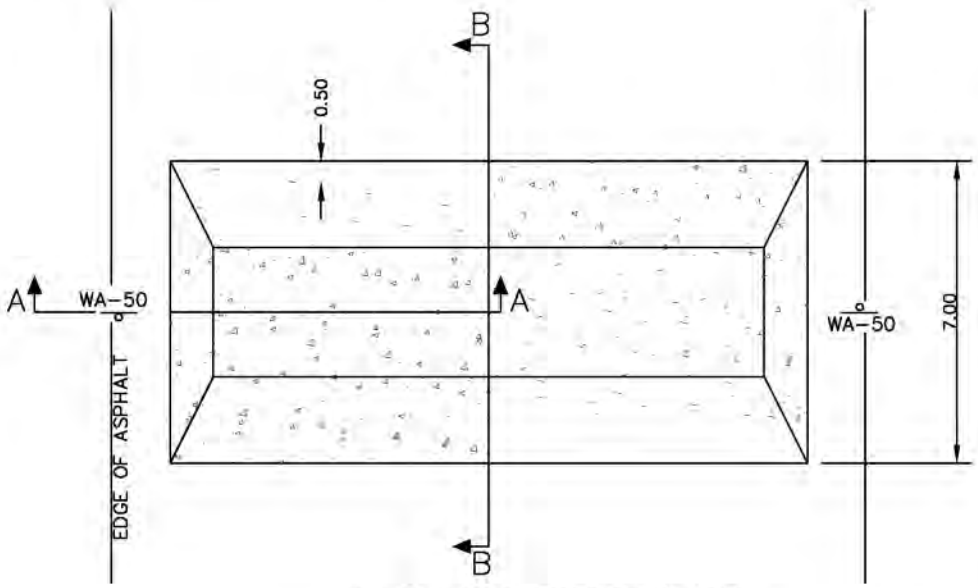
TYPICAL TRAIL SECTION – CROWN

NTS

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES
2. MAKE ALL JOINTS WITH EXISTING VEGETATION SMOOTH AND CONTINUOUS, WHERE NECESSARY TRIM BACK ROOTS AND CLEAR DEBRIS
3. WHERE M.D. CHOOSES TO DELETE ASPHALT, INCREASE GRAVEL THICKNESS ACCORDINGLY. MAINTAIN GRADE AS SHOWN.

	TYPICAL TRAIL CROSS–SECTIONS	Project No. 4006035 Scale N.T.S | Date MAY 2007 Standard Detail No. 10.11

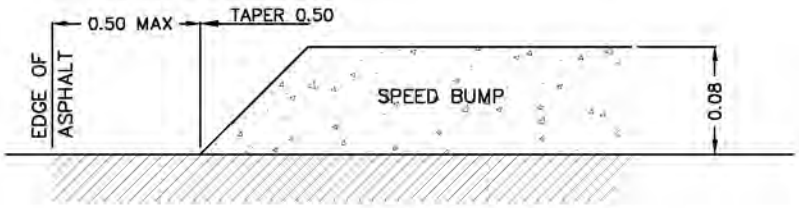


TWO WAY STREET/LANE
N.T.S.

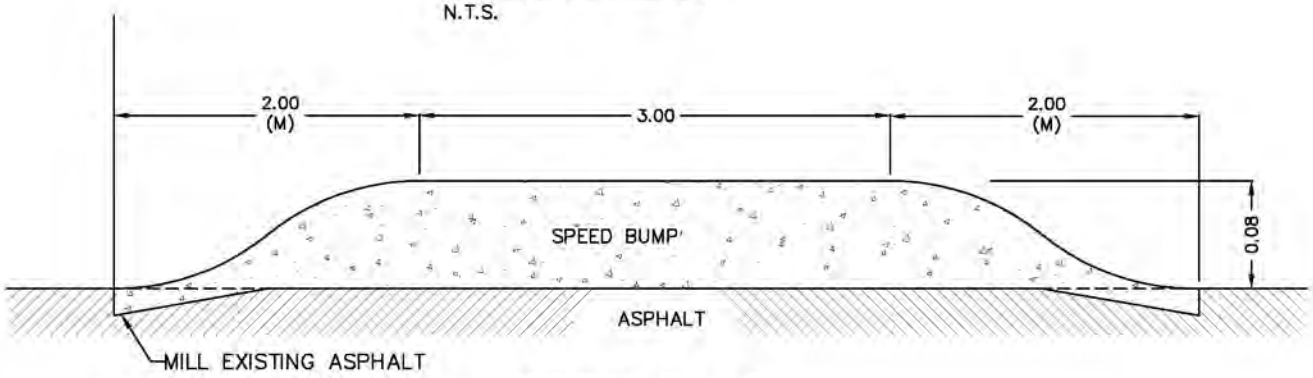
WA-50
450mm X 450mm
SPEED BUMP

NOTES:

1. PAINT 1.0 m WIDE YELLOW LINE ACROSS BOTH FACES OF BUMP.
2. PAINT 0.6 m WIDE CHEVRON PATTERN ON ENTIRE SURFACE.



SECTION A – A
N.T.S.



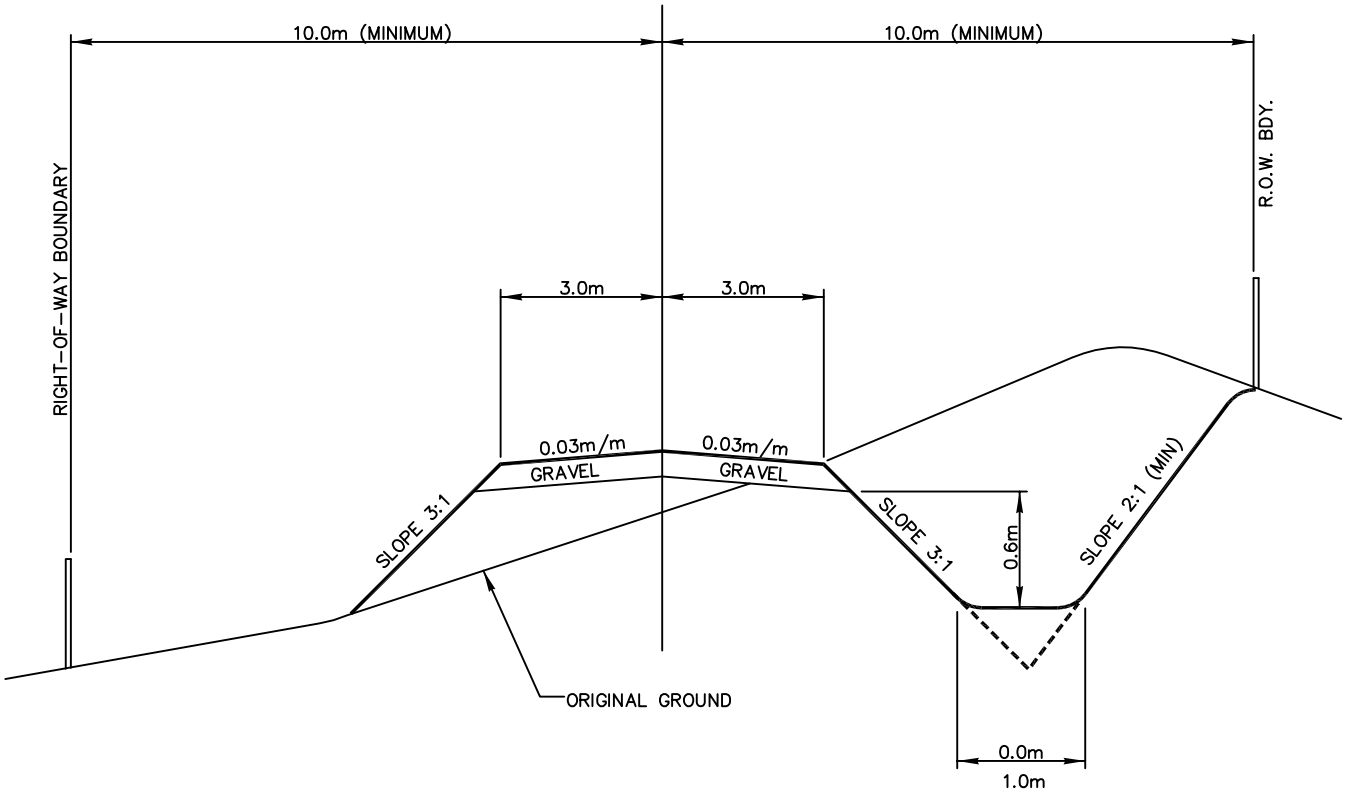
SECTION B – B
N.T.S.

SINUSOIDAL SPEED BUMP DEVELOPMENT:

DISTANCE (M)	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875	1.000	1.125	1.250	1.375	1.500	1.625	1.750	1.875	2.000
FINISHED HEIGHT(mm)	0	1	3	7	12	18	26	32	40	48	55	62	68	73	77	79	80

ASPHALT SPEED BUMP DETAILS

Project No.	4006035
Scale	N.T.S
Date	MAY 2007
Standard Detail No.	10.12



SURFACE WIDTH (m)	R.O.W. REQUIRED (m)	NORMAL SIDE SLOPE	MAXIMUM SIDE SLOPE	NORMAL BACK SLOPE	MAXIMUM BACK SLOPE	MINIMUM CURVE RADIUS (m)	MAXIMUM SUPER ELEVATION (m/m)	MAXIMUM GRADIENT (%)
6.0	20.0	3:1	3:1	3:1	2:1	50	0.08	11.0

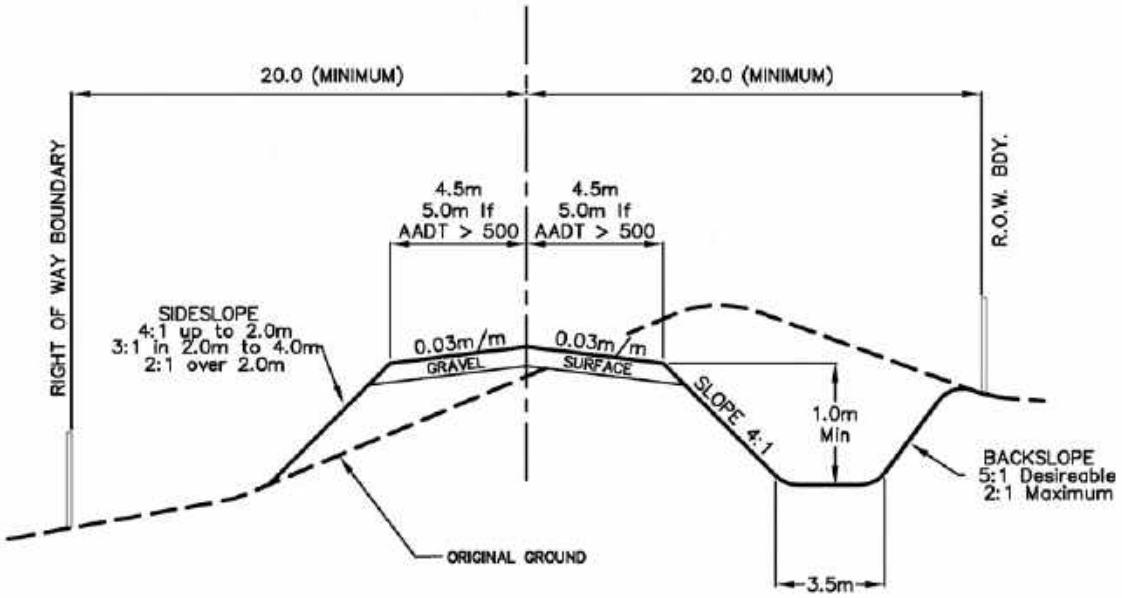
NOTES:

1. TYPICALLY THIS ROADWAY IS USED WHERE LESS THAN 3 RESIDENCES ARE SERVED.

LIMITED ACCESS ROAD STANDARD CROSS-SECTION

Project No.	4006035
Scale	N.T.S
Date	MAY 2007
Standard Detail No.	10.16

INDUSTRIAL ROAD
(CLASS 1)



GRAVEL REQUIREMENTS (4–20 SPECIFICATION)
NEW CONSTRUCTION –330m³ /km (MINIMUM 9.0m ROAD TOP)
–400m³ /km (MINIMUM 10.0m ROAD TOP)
MAINTENANCE –125m³ /km (MINIMUM)

SURFACE WIDTH (m)	R.O.W. REQUIRED (m)	NORMAL SIDE SLOPE	MAXIMUM SIDE SLOPE	NORMAL BACK SLOPE	MAXIMUM BACK SLOPE	MINIMUM CURVE RADIUS (m)	MAXIMUM SUPER ELEVATION (m/m)	MAXIMUM GRADIENT (%)
9.0/10.0	40.0	4:1	2:1	5:1	2:1	600	0.06	7.0

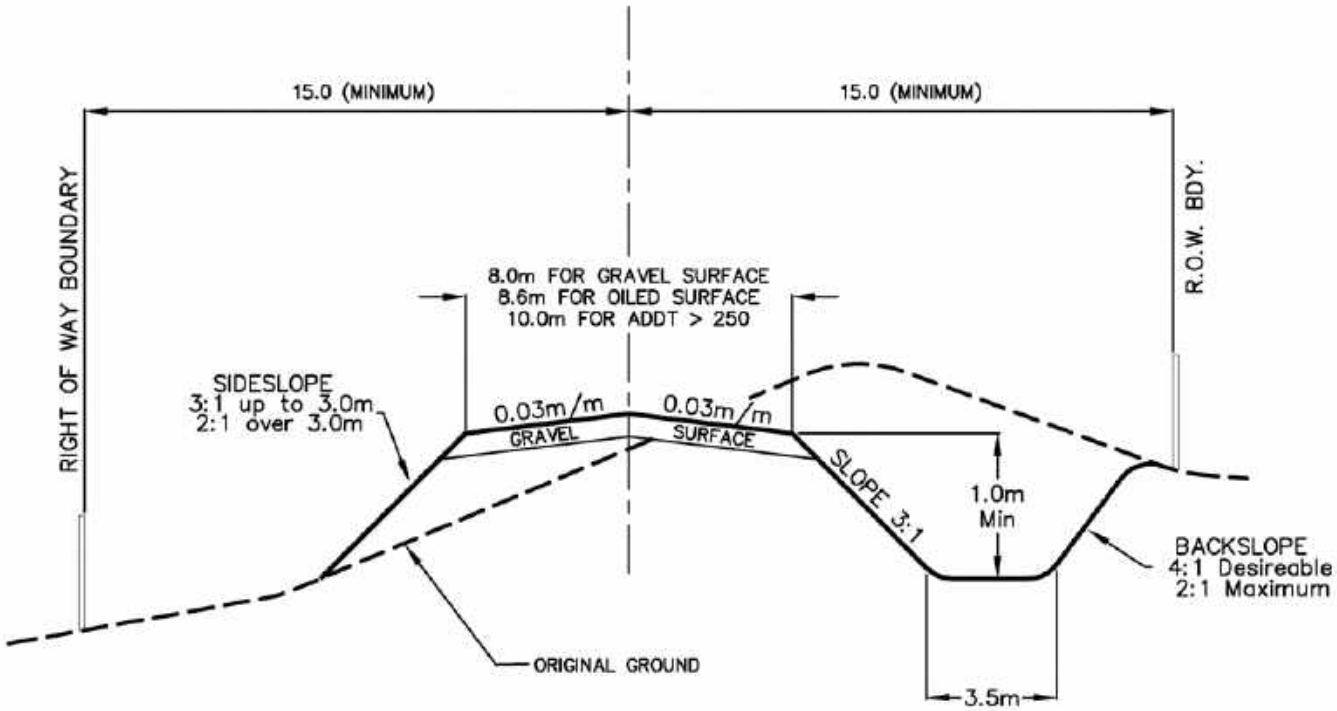
NOTES:

1. ALL DIMENSIONS IN METRES UNLESS OTHERWISE STATED.
2. IF ADDITIONAL RIGHT–OF–WAY IS REQUIRED, TRY TO OBTAIN BY BACKSLOPING AGREEMENT OTHERWISE PURCHASE.

INDUSTRIAL ROAD
STANDARD CROSS–SECTION

Project No.	4006035
Scale	N.T.S
Date	MAY 2007
Standard Detail No.	10.18

MAJOR COLLECTOR (GRAVELLED) (CLASS 2)



GRAVEL REQUIREMENTS (4–20 SPECIFICATION)
NEW CONSTRUCTION –280m³ /km (MINIMUM)
MAINTENANCE –125m³ /km (MINIMUM)

SURFACE WIDTH (m)	R.O.W. REQUIRED (m)	NORMAL SIDE SLOPE	MAXIMUM SIDE SLOPE	NORMAL BACK SLOPE	MAXIMUM BACK SLOPE	MINIMUM CURVE RADIUS (m)	MAXIMUM SUPER ELEVATION (m/m)	MAXIMUM GRADIENT (%)
8.0 8.6 10.0	30.0	3:1	2:1	4:1	2:1	600	0.06	7.0

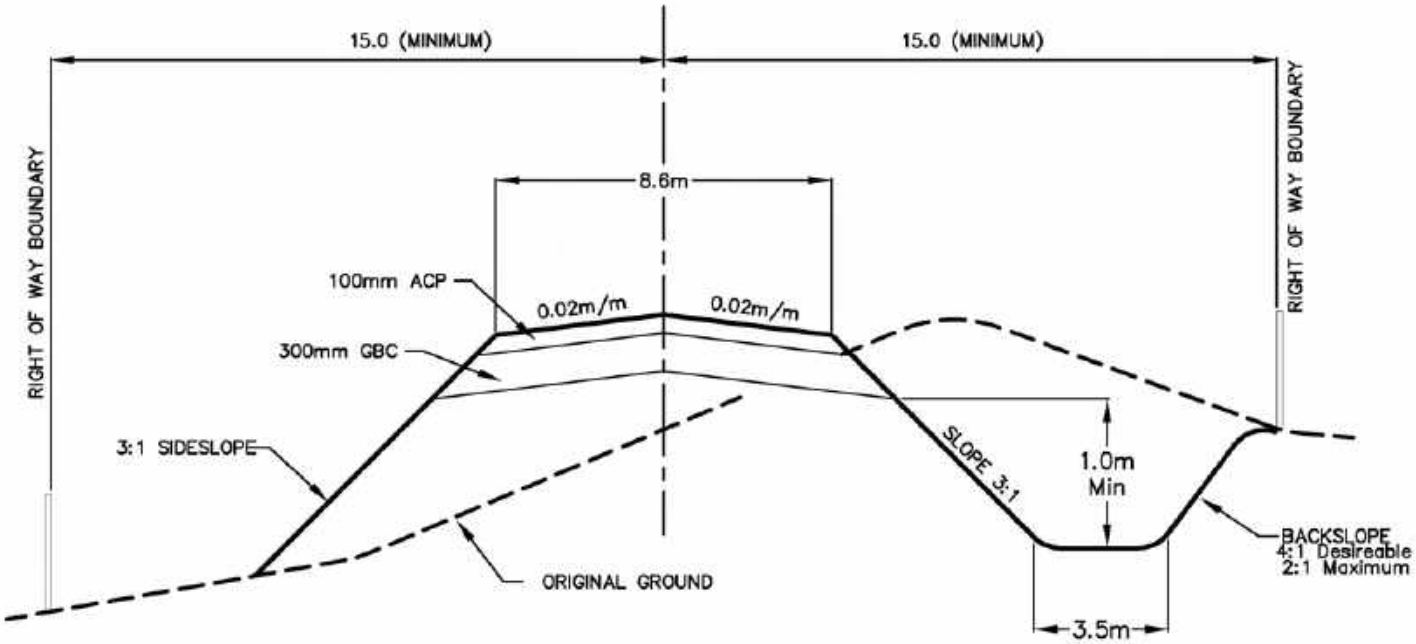
NOTES:

1. ALL DIMENSIONS IN METRES UNLESS OTHERWISE STATED.
2. IF ADDITIONAL RIGHT–OF–WAY IS REQUIRED, TRY TO OBTAIN BY BACKSLOPING AGREEMENT OTHERWISE PURCHASE.

MAJOR COLLECTOR
STANDARD CROSS–SECTION

Project No.	4006035
Scale	N.T.S
Date	MAY 2007
Standard Detail No.	10.19

MAJOR COLLECTOR (PAVED)
(CLASS 2)



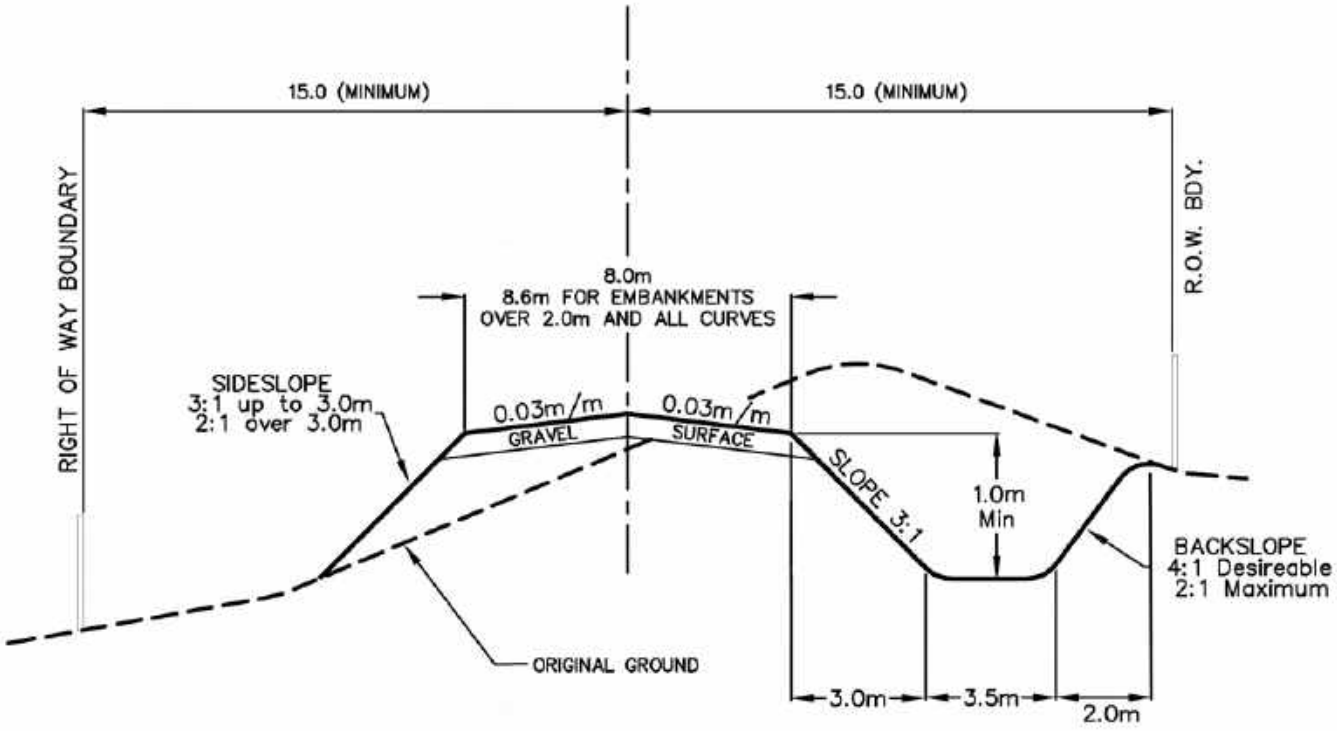
SURFACE WIDTH (m)	R.O.W. REQUIRED (m)	NORMAL SIDE SLOPE	MAXIMUM SIDE SLOPE	NORMAL BACK SLOPE	MAXIMUM BACK SLOPE	MINIMUM CURVE RADIUS (m)	MAXIMUM SUPER ELEVATION (m/m)	MAXIMUM GRADIENT (%)
8.6	30.0	3:1	3:1	4:1	2:1	600	0.06	7.0

NOTES:

1. ALL DIMENSIONS IN METRES UNLESS OTHERWISE STATED.
2. IF ADDITIONAL RIGHT-OF-WAY IS REQUIRED, TRY TO OBTAIN BY BACKSLOPING AGREEMENT OTHERWISE PURCHASE.

	MAJOR COLLECTOR PAVED ROAD STANDARD CROSS-SECTION	Project No. 4006035 Scale N.T.S Date MAY 2007 Standard Detail No. 10.20

COLLECTOR
(CLASS 3)



GRAVEL REQUIREMENTS (4–20 SPECIFICATION)
NEW CONSTRUCTION –230m³ /km (MINIMUM)
MAINTENANCE –125m³ /km (MINIMUM)

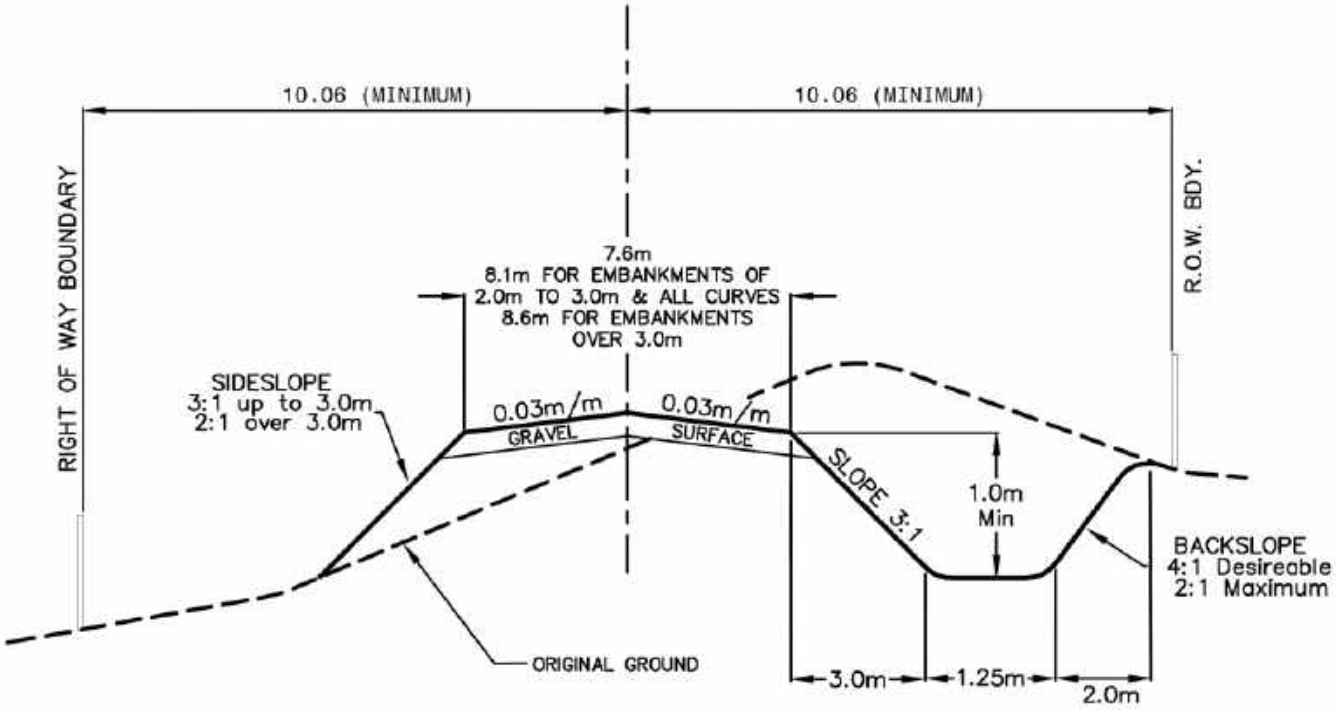
SURFACE WIDTH (m)	R.O.W. REQUIRED (m)	NORMAL SIDE SLOPE	MAXIMUM SIDE SLOPE	NORMAL BACK SLOPE	MAXIMUM BACK SLOPE	MINIMUM CURVE RADIUS (m)	MAXIMUM SUPER ELEVATION (m/m)	MAXIMUM GRADIENT (%)
8.0 8.6	30.0	3:1	2:1	4:1	2:1	600	0.06	7.0

NOTES:

1. ALL DIMENSIONS IN METRES UNLESS OTHERWISE STATED.
2. IF ADDITIONAL RIGHT–OF–WAY IS REQUIRED, TRY TO OBTAIN BY BACKSLOPING AGREEMENT OTHERWISE PURCHASE.

	COLLECTOR STANDARD CROSS–SECTION	Project No. 4006035 Scale N.T.S | Date MAY 2007 Standard Detail No. 10.21

MINOR COLLECTOR
(CLASS 4)



GRAVEL REQUIREMENTS (4–20 SPECIFICATION)
NEW CONSTRUCTION –230m³ /km (MINIMUM)
MAINTENANCE –125m³ /km (MINIMUM)

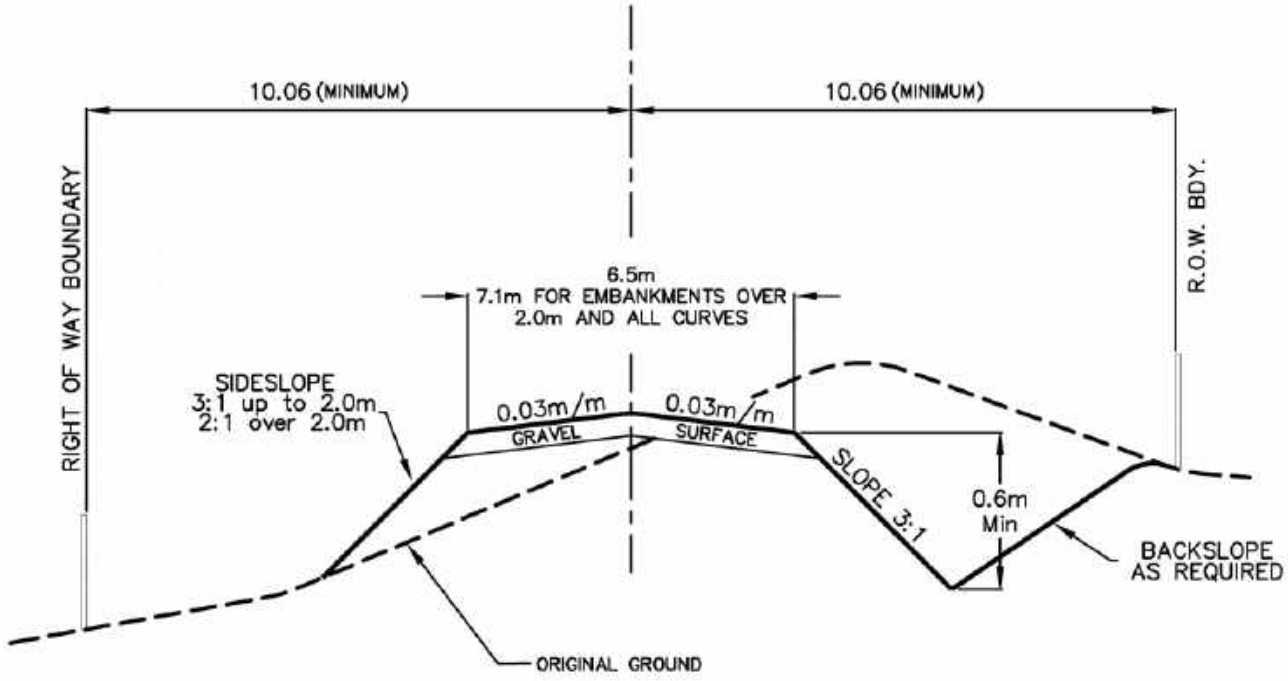
SURFACE WIDTH (m)	R.O.W. REQUIRED (m)	NORMAL SIDE SLOPE	MAXIMUM SIDE SLOPE	NORMAL BACK SLOPE	MAXIMUM BACK SLOPE	MINIMUM CURVE RADIUS (m)	MAXIMUM SUPER ELEVATION (m/m)	MAXIMUM GRADIENT (%)
7.6 8.1 8.6	20.12	3:1	2:1	4:1	2:1	600	0.06	8.0

NOTES:

1. ALL DIMENSIONS IN METRES UNLESS OTHERWISE STATED.
2. IF ADDITIONAL RIGHT–OF–WAY IS REQUIRED, TRY TO OBTAIN BY BACKSLOPING AGREEMENT OTHERWISE PURCHASE.

	MINOR COLLECTOR STANDARD CROSS–SECTION	Project No. 4006035 Scale N.T.S | Date MAY 2007 Standard Detail No. 10.22

FARM MACHINARY ROAD
(CLASS 5)

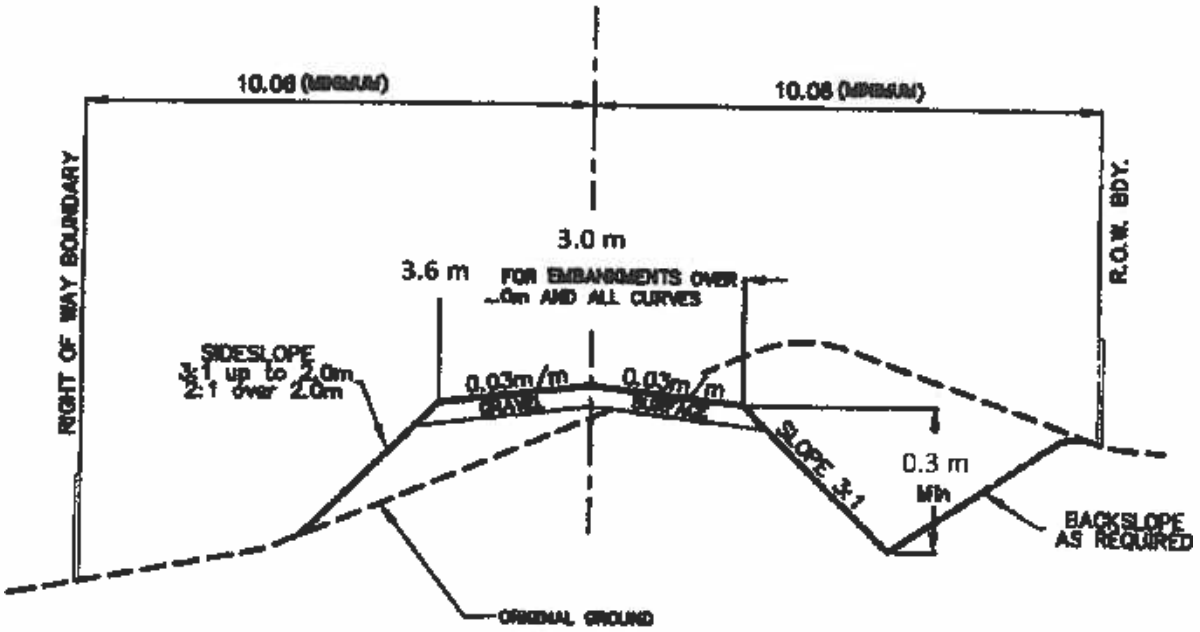


GRAVEL REQUIREMENTS (4–20 SPECIFICATION)
NEW CONSTRUCTION –AS REQUIRED
MAINTENANCE –AS REQUIRED

SURFACE WIDTH (m)	R.O.W. REQUIRED (m)	NORMAL SIDE SLOPE	MAXIMUM SIDE SLOPE	NORMAL BACK SLOPE	MAXIMUM BACK SLOPE	MINIMUM CURVE RADIUS (m)	MAXIMUM SUPER ELEVATION (m/m)	MAXIMUM GRADIENT (%)
6.5 7.1	20.12	3:1	2:1	AS REQUIRED		300	0.06	9.0

	FARM MACHINARY ROAD STANDARD CROSS–SECTION	Project No. 4006035 Scale N.T.S | Date MAY 2007 Standard Detail No. 10.23

RECREATIONAL LANDS ACCESS ROAD
NON KEY LOCAL ROAD
(CLASS 6)



GRAVEL REQUIREMENTS (4–20 SPECIFICATION)
NEW CONSTRUCTION –AS REQUIRED
MAINTENANCE –AS REQUIRED

SURFACE WIDTH (m)	R.O.W. REQUIRED (m)	NORMAL SIDE SLOPE	MAXIMUM SIDE SLOPE	NORMAL BACK SLOPE	MAXIMUM BACK SLOPE	MINIMUM CURVE RADIUS (m)	MAXIMUM SUPER ELEVATION (m/m)	MAXIMUM GRADIENT (%)
3.0 m	20.12	3:1	2:1	AS REQUIRED			0.06	9.0
3.6 m								

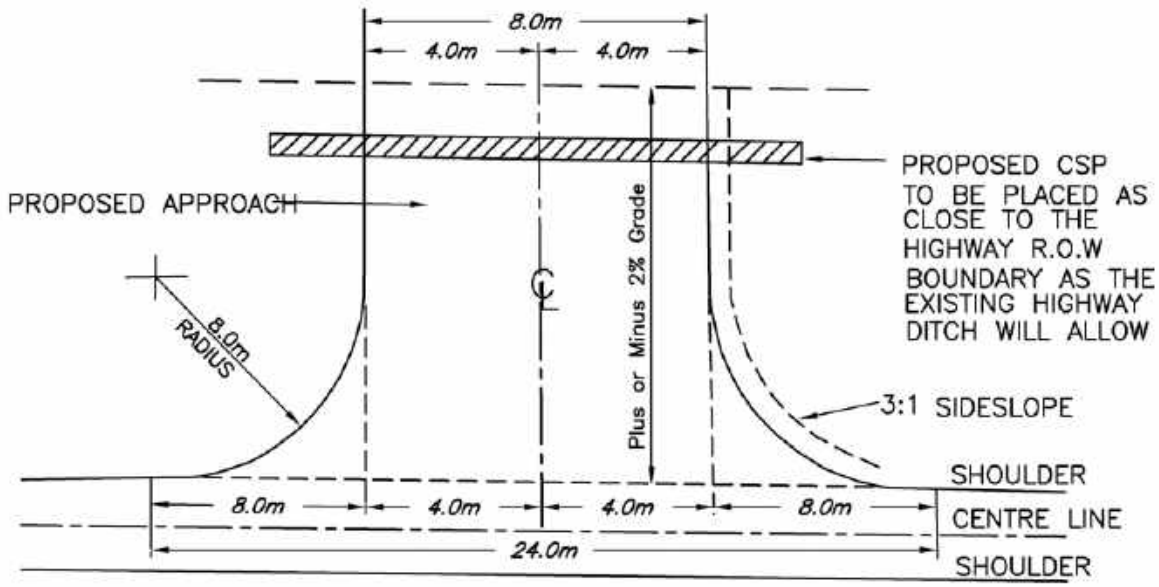
RECREATIONAL LANDS ROAD

STANDARD CROSS–SECTION

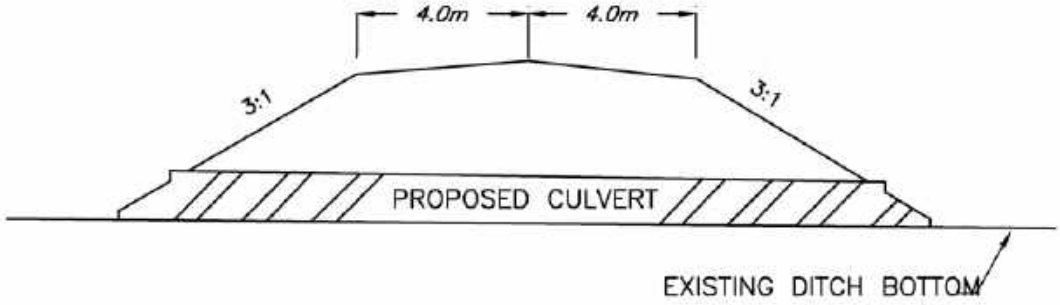
Project No.
Scale
Standard
JUNE 2014
10.23(A)

3012.00/Rec Lands Road
Detail Drawing

TYPICAL PRIVATE APPROACH



APPROACH CROSS SECTION



APPROACHES

1– APPROACHES SHALL BE CONSTRUCTED SO AS TO CONFORM TO ALBERTA TRANSPORTATION SPECIFICATIONS AS DETAILED
2– ONLY SUITABLE, COMPACTABLE MATERIAL IS TO BE USED
3– ALL DISTURBED AREAS IN THE ROAD RIGHT OF WAY SHALL BE LANDSCAPED AND SEEDED
4– MINIMUM 500MM CULVERT SHALL BE INSTALLED IF REQUIRED
5– SIGHT DISTANCE MUST BE 300M OR MORE FROM THE APPROACH IN EACH DIRECTION
6– NO BRUSH OR DEBRIS SHALL BE LEFT OR DISPOSED OF WITHIN THE RIGHT OF WAY

TABLE FOR DETERMINATION OF ROADWAY WIDTH		
USE	ROADWAY WIDTH W (m)	
	SINGLE	JOINT
RESIDENTIAL	6.0	8.0
AGRICULTURAL	8.0	10.0

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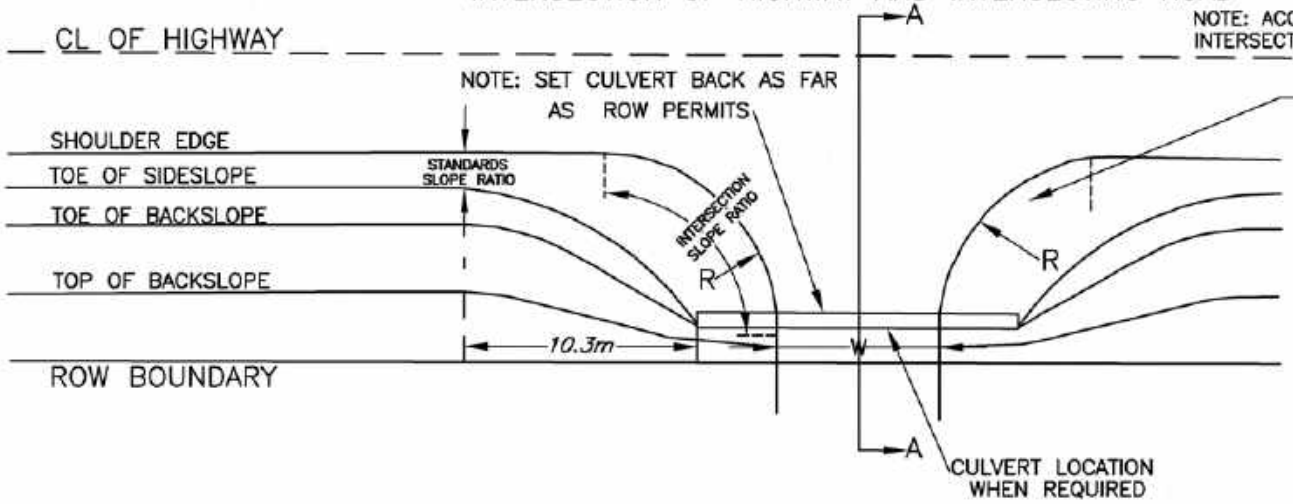
MINIMUM APPROACH STANDARDS

Project No.	4006035
Scale	N.T.S
Date	MAY 2007
Standard Detail No.	10.24

INTERSECTION OF HIGHWAY AND INTERSECTING ROAD

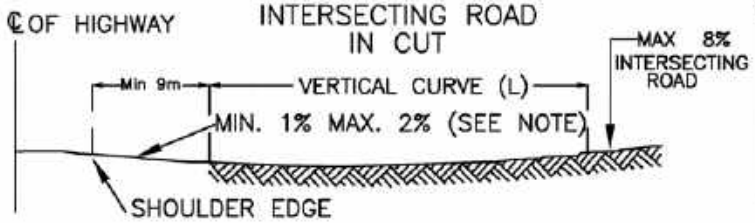


HEIGHT OF FILL(m)	INTERSECTION SLOPE RATIO
0–4.0	7:1
OVER 4.0	5:1 (MAX) ⚠

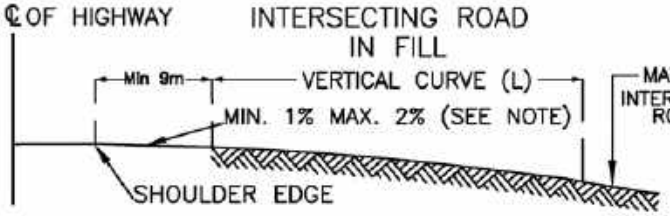
SLOPE ROAD OF 5:1 AT CULVERT AND CONTINUE USE OF 5c 1 SLOPE TO ROW BOUNDARY

⚠ NOTE:
COURTESY OF ALBERTA TRANSPORTATION AND UTILITIES DRAWING No. CB6–2.3M5

SECTION A–A INTERSECTING ROAD IN CUT



SECTION A–A INTERSECTING ROAD IN FILL



⚠ NOTE:
DESIRABLE MINIMUM 1% IS TO PREVENT PONDING AND SUBSEQUENT ICING AT THE INTERSECTION

DESIRABLE MAXIMUM 2% IS FOR EASE OF OPERATION IN ALL WEATHER CONDITIONS

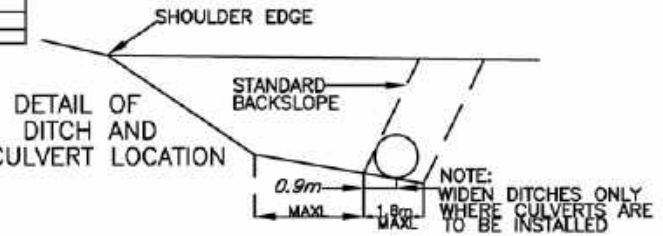
APPROACH GRADES BETWEEN 0.5% AND 3% ABSOLUTE MAXIMUM 6% ARE CONSIDERED ACCEPTABLE APPROACH ROAD GRADES UP TO 1% SLOPING DOWN TOWARD THE HIGHWAY MAY BE USED TO MATCH SUPERELEVATION ON THE MAIN ROAD IF DESIRABLE FOR ENGINEERING REASONS

⚠ NOTE:
WHERE THE MINOR INTERSECTING ROADWAY HAS A LARGE NUMBER OF WB–15 VEHICULES TURNING, THE APPROACH TREATMENT SHOWN IN FIGURE D–3.3a OF HIGHWAY GEOMETRIC DESIGN GUIDE SHOULD BE USED

TABLE FOR DETERMINATION OF ROADWAY WIDTH			RADIUS OF INTERSECTION EDGE AND SHOULDER (R)
USE	ROADWAY WIDTH W (m)		
	JWALE	JOINT	JWALE OR JOINT ACCESS
RESIDENTIAL	8	10	10
AGRICULTURAL	10	10.5	15
UTILITY MAINTENANCE	8		15
PUBLIC ROAD ALLOWANCE	8		15

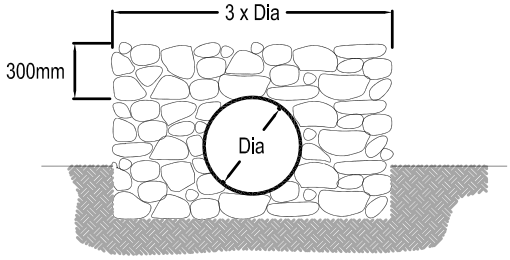
MAXIMUM LENGTH OF VERTICAL CURVE		
ALGEBRAIC DIFFERENCE IN GRADIENT (%)	LENGTH L (M)	
	CREST	SAG
1	6	8
2	12	15
3	18	23
4	24	30
5	30	34
6	37	46
7		46
8		46
9		

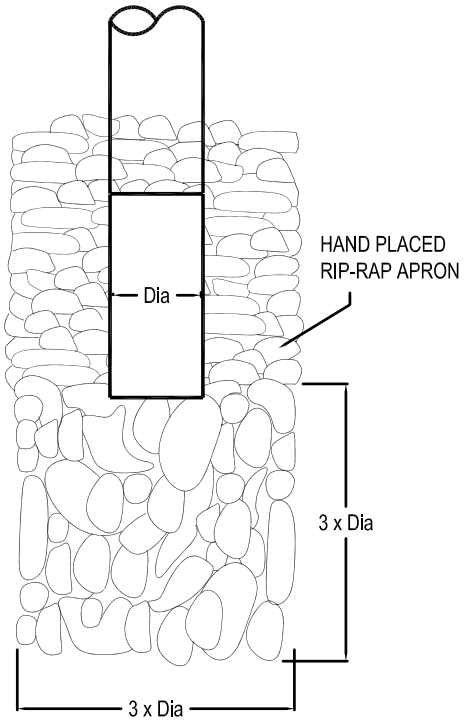
DETAIL OF DITCH AND CULVERT LOCATION

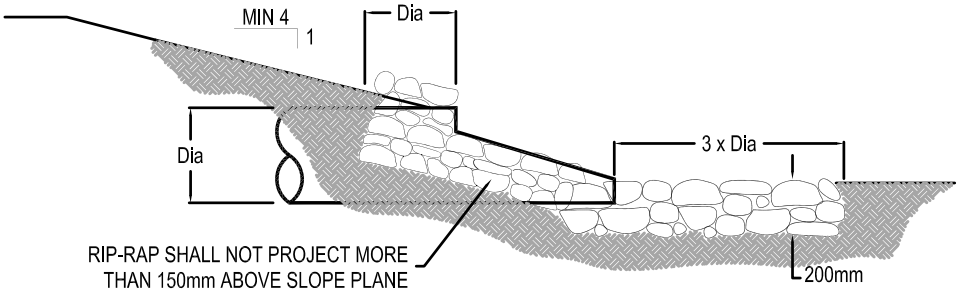


APPROACH TREATMENT FOR MINOR INTERSECTING ROADWAY

Project No.	4006035
Scale	N.T.S
Date	MAY 2007
Standard Detail No.	10.25







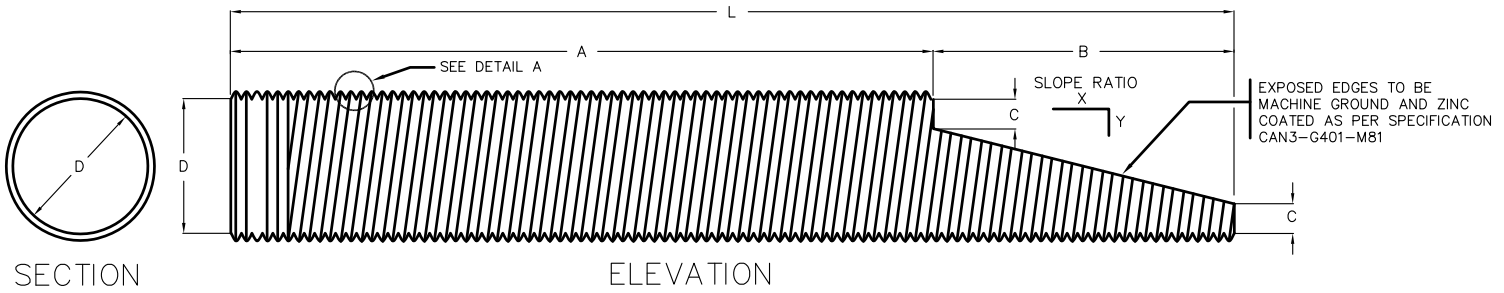
NOTES:

1. CULVERTS TO BE BURIED 1/4 DIAMETER BELOW DITCH INVERT.
2. CULVERTS TO HAVE 3:1 SLOPE END TREATMENTS, SEE DRAWING "B-14 RURAL" FOR DETAILS.
3. ROCK SIZE SHALL BE MINIMUM 200mm AND MAXIMUM 450mm.

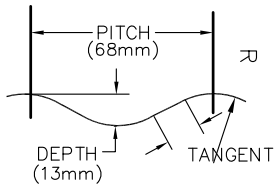
HAND LAID RIPRAP DETAILS

Project No.	4006035
Scale	N.T.S.
Date	JUNE 2009
Standard Detail No.	10.26

DETAILS OF STANDARD SLOPED END SECTIONS FOR C.S.P. ROUND CULVERTS



INSIDE DIAMETER "D" mm	SLOPE RATIO X:Y	"C" mm	"A" m	"B" m	INVERT LENGTH OF SLOPED END SECTION "L" m
400	3:1	100	5.40	0.60	6.0
500	3:1	125	5.25	0.75	6.0
600	3:1	125	4.95	1.05	6.0
700	3:1	150	4.80	1.20	6.0
800	3:1	175	4.65	1.35	6.0
900	3:1	200	4.50	1.50	6.0
1000	3:1	225	4.35	1.65	6.0
1200	3:1 4:1	225 275	3.75 3.40	2.25 2.60	6.0 6.0
1400	3:1 4:1	250 300	3.30 2.80	2.70 3.20	6.0 6.0



DETAIL A

NOTES:
THE HELICALLY CORRUGATED PIPE IS TO HAVE THE PIPE ENDS RECORRUGATED TO PROVIDE ANNULAR CORRUGATIONS FOR COUPLING PURPOSES (AS SHOWN). THE MINIMUM LENGTH WITH ANNULAR CORRUGATIONS SHALL BE 300mm FOR DIAMETERS OF 900mm OR LESS AND 600mm FOR A DIAMETER OF GREATER THAN 900mm. THE COUPLER SHALL BE AN ANNULAR CORRUGATED BAND TYPE. THERE SHALL BE A MINIMUM OF 3 BOLTS PER COUPLER FOR DIAMETERS OF 800mm OR GREATER.

FOR DURABILITY THE MINIMUM STRATHCONA COUNTY WALL THICKNESS REQUIREMENT IS 2.8mm.

THICKNESS OF CORRUGATED STEEL PIPE-TABLE A

DIA. IN mm	AREA IN m^2	*HEIGHT OF COVER ABOVE TOP OF CULVERT IN m
400	0.126	1-30: 2.0 | 2.8
500	0.196	1-15: 1.6 | 16-30: 2.0 | 2.8
600	0.283	1-5: 1.6 | 6-15: 2.0 | 2.8 | 3.5
700	0.385	1-5: 2.0 | 6-15: 2.8 | 3.5 | 4.2
800	0.503	1-5: 2.0 | 6-15: 2.8 | 3.5 | 4.2
900	0.636	1-5: 2.0 | 6-15: 2.8 | 3.5 | 4.2
1000	0.786	1-5: 2.8 | 6-15: 3.5 | 4.2
1200	1.131	1-5: 2.8 | 6-15: 3.5 | 4.2 | FOR FILLS OVER 11m-USE TABLE B
1400	1.540	1-5: 3.5 | 6-15: 4.2 | FOR FILLS OVER 9m-USE TABLE B

DISCRETIONARY 2.0mm OR 2.8mm BY STRATHCONA COUNTY

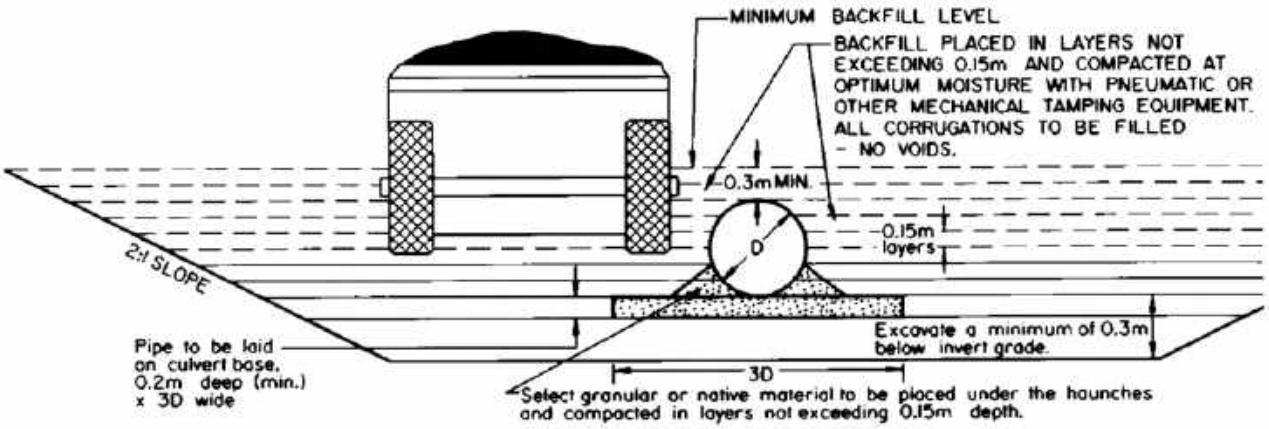
*THE IMPERFECT TRENCH CONDITION METHOD OF INSTALLATION IS TO BE USED WHEN HEIGHT OF COVER OVER AN 800mm DIA. C.S.P. EXCEEDS 21m AND WHEN HEIGHT OF COVER OVER A 900mm DIA. C.S.P. EXCEEDS 19m.

METRIC 5% VERTICALLY ELONGATED C.S.P.-TABLE B

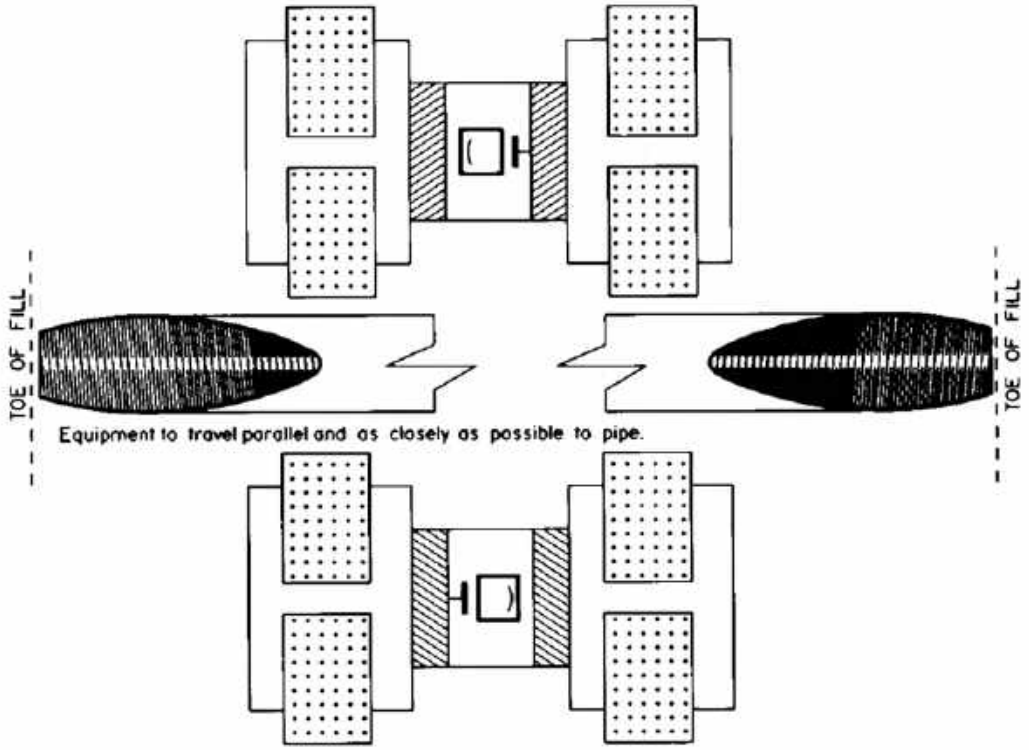
DIA. IN mm	AREA IN m^2	*HEIGHT OF COVER ABOVE TOP OF CULVERT IN m
1200	1.131	1-5: 2.8 | 6-22: 3.5 | 23-30: 4.2
1400	1.540	1-5: 3.5 | 6-22: 4.2 | 23-30:

CULVERT MATERIAL DETAILS

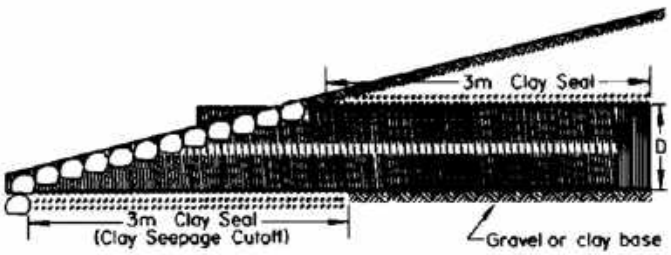
Project No. 4006035
Scale N.T.S.
Date JUNE 2009
Standard Detail No. 10.27



EXCAVATION, CULVERT BASE AND BACKFILLING



COMPACTION (PLAN VIEW)



Clay seal for seepage to be placed at both ends, for a length of 3m. and to the top of the pipe.

CLAY SEAL DETAIL

CORRUGATED METAL PIPE CULVERT INSTALLATION

Project No.	4006035
Scale N.T.S.	JUNE 2009
Standard Detail No.	10.28

LESSER SLAVE RIVER, ST. NAME
Font: Hwy 'C'
Letter Height: 6"

106X22 cm

116x22cm

	STREET NAME SIGN LAYOUT	Project No. 4006035 Scale N.T.S. Date JULY 2009 Standard Detail No. 10.29

LESSER SLAVE RIVER 100X20 RURAL

M.D. of Lesser Slave River

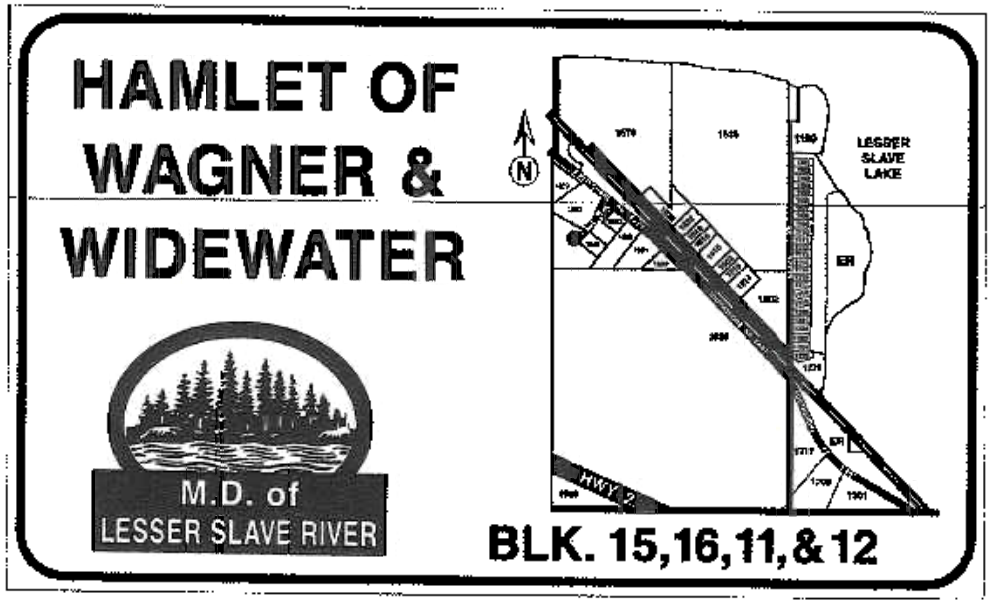
Rural Address 100 x 20 cm

4" HIGHWAY FONT

	RURAL ADDRESS SIGN LAYOUT	Project No. 4006035 Scale N.T.S. Date JULY 2009 Standard Detail No. 10.30

SUBDIVISION SIGN LAYOUT

10' X 6' Lettering - 6"



8' x 4' Lettering - 6"

Project No.	4006035
Scale	N.T.S.
Date	JULY 2009
Standard Detail No.	10.31